

INSECTS AS A GLOBAL FOOD RESOURCE: THE HISTORY OF TALKING ABOUT IT AT THE UNIVERSITY OF WISCONSIN

Gene R. DeFoliart

Preface

It suddenly occurred to me on the morning of May 25th, 2000 that this book had to be written. I had arrived in Fairbanks, Alaska, the night before to spend 12 days visiting my youngest daughter, Linda, and her husband, Dave. The stimulus for this sudden awakening may have occurred a few days earlier, however, when I had stumbled across an old file in my campus office that detailed what became verbal warfare back in 1988 with a subcommittee of the Curriculum Committee of the UW College of Agricultural and Life Sciences, when I had tried to get approval for a 1-credit course on insects as a food resource. I had forgotten how much hard work it was. Talking about insects as food was definitely swimming against the current of prevailing public opinion in the United States even though insects have been historically important as food in most of the rest of the world. I began to remember that almost everything about this project had been hard work. But, at the same time, it has also been great fun. And, sometimes, doors have opened so unexpectedly that I became convinced that this project has a green light somewhere in the realms of the powers that be. My objective here is to take you, the reader, with me on this journey, trying to get Americans and Europeans to thinking of insects as perfectly respectable food.

Portions of the first two chapters may seem a bit redundant, but it helps establish a baseline against which future progress in changing the American attitude can be discerned. The bias against insects as food has not been eliminated, but it has been reduced over the 25 years covered in this report.

Chapter 1. The Symposium, The Associated Press Release, The Beginning

Quite a few people have asked, over the years, how I became interested in insects as food. The phone rang one afternoon in the fall of 1974 in the chairperson's office, Department of Entomology, University of Wisconsin at Madison. I picked it up. On the other end of the line was Robert P. Hanson, a professor of virology in the Department of Veterinary Science. We knew each other well, having collaborated for several years in research on mosquito-borne arboviruses. These include among others the mosquito-carried viruses that can result in encephalitis. Bob told me that there was an effort underway by he and several other faculty members to organize what they were calling "A Symposium on Unconventional Sources of Protein." It would be held on the Madison campus and would involve professors who had conducted research appropriate to the subject. In addition, however, the organizers thought that edible insects should certainly be included in the symposium.

Bob asked if there was anyone in the Department of Entomology who might like to take on the assignment. I suggested the names of a couple of people who might be willing, and I agreed to contact them. In each case, however, when I broached the subject, the prof suddenly remembered that he had to be in Europe or somewhere on the date of the symposium. So I called Hanson and told him I couldn't find anyone in Entomology with the time and inclination to accept the assignment. Then I left the office and went home to have the flu for the rest of the week.

For the next several years, friends not infrequently suggested that I must have become delirious after I got home. The more I thought about the possible implications of insects as a food resource, the more fascinated I became with the subject. On Friday, a little before 5:00 pm, I got out of bed, pushed my fevered body to the phone, dialed Professor Hanson's number and told him that if the insect slot on the symposium program was still open I would do it myself.

That's how, not long afterward, I found myself listed on a pretty impressive-looking program, scheduled to speak on a subject I knew nothing about. The Workshop was scheduled to be held April 22, 1975 on the College of Agricultural and Life Sciences campus. Except for an opening speaker invited over from Michigan State, the participants were all from UW departments and UW-affiliated government labs. The line-up of subjects, speakers and speaker affiliations was as follows:

- Perspectives and Prospects on Food and Protein. S.H. Wittwer, Dir., Agricultural Experiment Station, Michigan State University
- Carbohydrates from Forest and Forest Industry Residues as Substrates for Protein Production. J.N. McGovern, Department of Forestry, and A.J. Baker, Forest Products Laboratory, UW-Madison
- Farm Wastes as Feedstuffs for Animals. M.L. Sunde, Department of Poultry Science
- Leaf Protein. Mark A. Stahmann, Department of Biochemistry
- Fungal Protein. Lung-chi Wu and M.A. Stahmann, Department of Biochemistry
- Cellulose Transformers. Dale M. Norris, Department of Entomology
- Thermophiles as Producers of Microbial Protein. Elizabeth McCoy, Department of Bacteriology
- Insects as a Source of Protein. G.R. DeFoliart, Department of Entomology

- Evaluation of Green Plant Protein Concentrates as Animal Feeds. N.A. Jorgensen, Department of Dairy Science
- Utilization of Novel Proteins in Human Foods. T. Richardson, Department of Food Science
- Food For Thought. R. Najem, Director of Humanities Institute

Luckily, the Ag library, Steenbock, was (and still is) right next door to my building, Russell Laboratories. I started going over there a lot, trying to find relevant information, especially research results of any kind. In the end I wound up with a presentation based on 25 references cited. I thought I had a pretty good, dramatic, opening paragraph, as follows (DeFoliart 1975a, b):

C.F. Hodge (1911) calculated that a pair of house flies beginning operations in April could produce enough flies, if all survived, to cover the earth 47 feet deep by August. This, of course, is an ecological absurdity but it does convey some idea of the tremendous reproductive potential of some insects. If one can reverse for a moment the usual focus on insects as enemies of man, Hodge's layer of flies represents an impressive pile of animal protein.

My closing paragraph was as follows:

Insect protein literally abounds all around us. It has been established that it is of high quality. The need now is for those who are familiar with the biology of specific insect species to become acquainted with the kinds and quantities of wastes available and to do some exploratory research to determine the true economic feasibility of harvesting this protein and of utilizing insects in recycling wastes for the production of protein.

In between those two paragraphs, I made the point that pre-industrial cultures make wide use of insects as food, but in our culture the main immediate potential would appear to lie in their "recycling of waste materials into protein-rich feeds for other animals that are more acceptable as human food – such as poultry, fish, and livestock." Among other things, I discussed recent research aimed at using house fly larvae to biodegrade poultry manure into high-protein poultry feed, the high protein content of grasshoppers and African termites and the very high calorific value of the latter.

I thought the paper was good enough, frankly, that it should be published even though it contained no original research. It was a subject that needed to be brought to the attention of entomologists. The *Bulletin of the Entomological Society of America*, which is peer-reviewed but not restricted to research, was the appropriate journal I thought. Before submitting the manuscript, though, considering the uncertain status of the subject matter, I thought I would give it the acid test by asking Professor Stanley Beck and Professor Fumio Matsumura, two of the most highly respected scholars not only in our department but on the UW campus, to take a look at it. That got me into an interesting predicament that is best seen by looking at the pertinent correspondence. Under date of May 23, 1975, I wrote to Dr. James S. Packer, Managing Editor, Entomological Society of America (ESA), College Park, Maryland:

Dear Dr. Packer:

The enclosed manuscript "Insects as a Source of Protein" is the text of a paper I presented at a recent symposium here at the University of Wisconsin on "Unconventional Sources of Protein." Although the Proceedings of the Symposium will probably be published, they will accept the ms as "reprinted" from another journal and it has been my intention to submit it for consideration in the *Bulletin of the ESA* where it would receive much wider readership among entomologists – who I hope would be stirred to some exploratory research on the subject.

I suddenly have a problem, however. Two reviewers in this Department, S.D. Beck and F. Matsumura, both urged that I send the ms to *Science* where it would have a more interdisciplinary audience.

I realize it is highly unorthodox to submit a manuscript to two journals simultaneously and I hope that I am not presuming too much upon your good graces, but in reference to "reprinting" in the Symposium proceedings I will need to know soon what to cite as the location of original publication. There will simply not be enough time to await the result of a second review process if that should become necessary.

The subject of the paper, I believe, is truly ripe for consideration by entomologists and other biologists, and represents a potentially very positive new aspect of our discipline. I would like to see entomologists get some credit for opening it up. It is certainly a subject that titillates the public interest. Since a press release on the Symposium about a month ago, I have been bombarded for follow-up interviews by wire services, newspapers and radio talk shows literally from coast to coast.

Again, I apologize for the circumstances under which I am asking you to consider publication in the *Bulletin*. I will say that, with the necessity for a quick decision, the copy sent to *Science* was not revised to *Science* format and as a result they may not even consider it.

The response to my letter came from Wallace P. Murdoch, Executive Secretary of ESA, dated June 4, 1975:

Dear Gene:

In reference to your letter of May 23 and accompanying manuscript entitled, "Insects as a Source of Protein," I believe like S.D. Beck and F. Matsumura that it should be published in *Science*. My reason is that if published in *Science* it would receive much wider recognition as a source of protein and possible research support than if published in the BULLETIN and received only by entomologists. Unfortunately, few entomologists are in the position to provide the funds necessary to conduct research of this nature.

In event your article is not accepted by *Science* I think it should be published, and am willing to publish it in the BULLETIN providing appropriate page charges of \$90.00 per page can be met. I would estimate it can be printed in

2-1/2 pages. It could be published in the December issue. I hope this arrangement is agreeable with you.

My best personal regards.

I responded to Dr. Murdoch's letter on June 11:

Dear Wally:

Thanks for your letter of June 4 regarding the manuscript "Insects as a Source of Protein." John Ringle's [Editor of *Science*] preliminary assessment was that chances were slim for acceptance by *Science* because of a tremendous backlog of articles on hand, so rather than hassle further with them, I am glad to accept your offer to publish it in the December issue of the *Bulletin*. The *Bulletin* is really where I wanted it in the first place. The \$90/page charge will be no problem.

In glancing at the manuscript the other day, it seemed to me that it would be better to reverse the order of the present paragraphs 2 and 3 on page 1. If you agree, would you please make that change.

With best regards,

Actually, publication came off in September, still in 1975. But, back to the Symposium. The local media were well represented at the Symposium. Appearing on the morning of April 22 in the *Wisconsin State Journal* was a preview article by staff writer William R. Wineke titled, "Today's Waste to be Tomorrow's Food?" Considering how much each speaker knew about the subject he/she was addressing (most had done relevant research), guess who got more than his/her fair share of ink? The guy talking about insects, of course. Wineke's article follows:

A unique conference on "unconventional sources of protein" will be held today at the University of Wisconsin to explore such ideas as the creation of protein from paper mill wastes and from grinding up insects.

Emeritus Prof. Elizabeth McCoy has isolated a "thermophilic bacteria" (which grows only at high temperatures) which can digest waste wood fibers from paper processing.

The bacteria, she says, contain as much as 65 per cent protein and feed on the 17 million tons of waste material now left over from wood processing.

Prof. Gene DeFoliart, a UW entomologist, will report on recent studies describing how insects can either convert waste material to protein or can be processed themselves to produce a high-quality protein.

"Strange as it may sound, if the housefly can convert manure into protein, then it definitely has a use in producing food," he said in an interview Monday.

The participants in the conference all stressed that today's sessions will be "speculative."

"We know that insects constitute a high-quality protein," DeFoliart said. "What we don't know is whether it will be economically feasible to recover it."

Prof. McCoy said the main benefit of thermophilic bacteria in digesting wood wastes is that those wastes now are a source of pollution, one which costs the wood industry a great deal to dispose of.

She said that by feeding the bacteria into the wood wastes, researchers have found the bacteria convert the wastes into a protein form and, at the same time, produce their own heat which “just about pasteurizes the product.”

She said she has tasted the product and found it “bland, but perfectly suitable as a human food source.”

Prof. DeFoliart, on the other hand, concedes that “any suggestion that insects be used directly as human food in this country would be met with repugnance.

“The main potential is in their ability to recycle waste materials and to convert them into protein that can then be used in feeds for animals that are more acceptable as human food.”

He added that about half the dry weight of an insect is protein, protein of better quality than soybean meal and equivalent to fish and bone meals.

Also speaking today will be poultry scientist Milt Sunde, who has helped develop ways to turn poultry litter into an animal food “very high in protein – as much as 31 per cent.”

A university biochemist, Lung-Chi Wu, has developed a method to use unwanted agricultural waste materials and scrub oak trees to produce a “tasty, nutritious mushroom.”

He and Prof. Mark Stahmann have taken liquid waste from canneries, mixed them into small wooden plugs, driven the plugs into scrub oak trees, and grown mushrooms from them.

Stahmann and Neal Jorgensen, a UW dairy scientist, also have discovered that an acre of alfalfa can produce three to four times as much protein as an acre of soybeans.

The problem, they say, is how to turn that protein into a form in which most animals can digest it.

They have developed a harvesting method through which the crop is put into a machine that separates the juice from the fiber. The concentrate can then be sold as a high-protein feed.

As in the other discoveries, Jorgensen stressed that the project is still being researched.

But the match of ideas is what today’s conference is about, and participants hope that, eventually, some of these “far-out” concepts will end up producing food for a hungry world.

During the week after the Symposium, I received a copy of something called “Broadcast News,” which was labeled, “For Release: Monday, April 28, 1975.” There were two reports with the titles, “USDA Herd Report” and “Researchers Say Insects Contain Much Usable Food Protein.” The first report had a little over ½ page of text, the second nearly 1½ pages. The announcer starts by saying it’s time for the daily roundup of agribusiness news. “This service is brought to you in cooperation with the United States Department of Agriculture, the College of Agricultural and Life Sciences, UW-Madison, and the

University of Wisconsin-Extension.” I don’t know who wrote this piece on the insects, and, 25 years later, I don’t remember whether I was interviewed or not, but the writer obviously had access to the Symposium document. The writer talks only about insects and therefore has room to provide greater detail than was available in Wineke’s report. And like Wineke’s column, this UW news release was a calm unvarnished summary of the points I had emphasized at the Symposium:

There are more than one million species of insects in the world, and while we often find them a bother, they might provide us in the future with a way to get rid of unwanted waste by-products and serve as a source of protein.

Professor Gene DeFoliart (de FALL ee ard) [actually, we call it more like de Fall yert], University of Wisconsin entomologist, says any suggestion that insects be used directly as human food in this country would be met with strong dislike. The main potential is in their ability to recycle waste materials and to convert them into protein that can then be used in feeds for animals that are more acceptable as human food, such as poultry and fish.

DeFoliart says that protein is the scarcest food item in the world’s food supply, but he notes that insects yield a very high quality protein and in large amounts. About half the dry weight of an insect is protein. He says it’s probably a better quality protein than soybean meal and equivalent to fish and bone meals. These materials are usually used as supplements in livestock and poultry feeds.

DeFoliart says that U.S. Department of Agriculture researchers and researchers in Colorado have substituted housefly pupae for the soybean oil meal in chick rations. They found no detectable difference in the growth rate of the chicks, in feed consumption, or in the feed conversion ratio.

A side benefit is that fly pupae can be reared in poultry litter. The pupae reduce the bulk of the material by about one-half, and the odor nearly disappears. What’s left is a dry, flaky material that can serve as an excellent soil conditioner.

According to researchers in Ohio, insects may be used in the future to harvest protein from sewage lagoons. While there has been little research yet on this, DeFoliart notes that the use of sewage lagoons increased for disposing sewage from smaller towns and for large livestock and poultry operations. The bio-mass from these operations contains about 20 percent protein.

DeFoliart says there’s probably no substance of plant origin, living or dead, that’s not susceptible to breakdown by one or more of the insect species. He says, “We’ll need a lot more research to determine the economic potential of insects.”

There was a new media go-around May 13 to 15 when an article appeared in at least 11 Wisconsin newspapers. It stated that, in interviews, UW scientists had expanded on the ideas presented at the recent conference on unconventional sources of protein. I don’t remember the interviewing, but it must have occurred because I was quoted in the second sentence as saying, “Wouldn’t it be a great way to get rid of mosquitoes? Actually, mosquitoes would be poor candidates as human food. They are all wings, legs, proboscids (the mouthparts that pierce and draw blood) and water. (Believe it or not, though, there is an annual mosquito pie contest at a state park in Arkansas.) I hadn’t yet

learned that there is a great difference in being interviewed about possible use of insects as food and being interviewed about mosquitoes and encephalitis viruses. In the case of the former, you don't want to toss out in front of a journalist any small talk or off-hand comment intended to be ridiculous or funny unless you wouldn't mind seeing it in print. It could even get into the title they give your interview. It took me awhile to learn that, and you will see that my frivolous statement led three of the newspapers to publish titles that made it sound like the big goal was to convert mosquitoes to human food. The distribution of this particular article appeared to be limited to Wisconsin, appearing in the following newspapers (with titles in parentheses): Eau Claire Leader Telegram (Unusual protein sources studied), Fond du Lac Commonwealth Reporter (Eating them – well-prepared, of course – seems good way of eliminating insects), Janesville Gazette (UW Researchers Seek Protein), La Crosse Leader-Tribune (Insects, Wastes Are Viewed As Protein Sources), Manitowoc Herald-Times (Mosquito Meal Would Add Protein), Marinette Eagle Star (How about an insect sandwich?), Marshfield News Herald (Converting Mosquitoes Into Protein Proposed), Racine Journal Times (Food from bugs and wastes is UW aim), Sheboygan Press (Could Be We'll Someday Be Eating Mosquitoes), Wausau Record Herald (Researchers want to turn insects into edible protein) and West Bend News (UW researchers study turning bugs into protein).

On May 22, 1975, one month to the day after the Symposium, an article titled "Bugs May Avert Food Crisis" appeared in the Wisconsin State Journal. The author was Timothy Harper of the Associated Press; the subtitle was "High in Protein, UW Scientist Says." The article is reprinted below:

A possible food source that has more protein than meat, fewer calories than vegetables, and is cheaper than both may drive you a little bit buggy.

University of Wisconsin entomology Prof. Gene De Foliart is studying how insects might one day be used to avert a world food crisis.

His studies, on all types of bugs from termites to houseflies, show that there's really nothing wrong with eating most insects.

"There is no doubt about the quality of insects as food," he said, "but the subject has hardly been considered. A lot of insects are used for food in more primitive cultures, but not in the more civilized parts of the world."

The problem, he said, is that most people just can't stomach the idea of sitting down to a crisp green salad of creepy crawlers or a spider loaf sandwich.

"Many people have a natural revulsion to the idea of eating insects," De Foliart said.

He said Americans eventually may eat insects directly, but certainly not until the public is gradually persuaded that a bug burger is as good as a hamburger.

"I don't know if we'll ever get people to eat insects directly," he said. "It might come to that, but not right away in this country."

In the meantime, De Foliart is conducting various experiments to determine the nutritional and economic advantages of insects as food.

"Termites, for instance, have higher protein content than beef or fish," he said. "And housefly pupae – that's the stage between the larvae and the adult –

have the equivalent of fish and bone meal and are actually of better quality than soybean oil meal.”

DeFoliart is developing indirect means of using insects to fortify and improve supplies.

In one experiment, he fed manure to housefly larvae and then fed the larvae to chickens. The birds prospered and laid healthy high grade eggs.

But his students wouldn't eat them.

DeFoliart admits that basically he doesn't practice what he preaches when it comes to eating bugs.

“My experience has been limited to a silkworm pupae about 10 years ago,” he said ruefully. “It tasted like a museum specimen. It really wasn't very good.”

But he added he would like to try a few other delicacies.

“Maybe some fried termites or roasted grasshoppers,” he said.

“With the wings removed, of course.”

Harper's article obviously went a long way toward ruining my day, judging from the notice I hung up on the bulletin board in the Entomology Department office the very morning (May 22) that his article was published:

TO: Entomology Faculty and Students
FROM: G. R. DeFoliart
SUBJECT: A really bad newspaper article

Many of you probably saw the article “Bugs May Avert Food Crisis” in this morning's Wisconsin State Journal. The article is full of nonsensical statements, most of them attributed to me. I find the article very embarrassing and am taking such steps as possible to refute it, at least locally. Unfortunately, it went all over the country as an Associated Press release.

The newspaper article stems from a presentation “Insects as a Source of Protein” which I made at the “Symposium on Unconventional Sources of Protein” held a few weeks ago here on campus. At that time, my topic, and the symposium in general were well reported in the State Journal in an article by William Wineke. Copies of both articles are posted in the Conference Room.

I didn't stop there, though, and looking back now I think I kind of regret being so thin-skinned about it all. I wrote a letter to the Editor of the State Journal. It was published May 30, 1975, and given the title “Insects Into Food” by the Journal Editor:

The Associated Press article “Bugs May Avert Food Crisis,” published in The Wisconsin State Journal, generally missed the main points that I have made on this subject. In addition, a number of statements attributed to me were inaccurate or embarrassing.

Although insects can be used as human food and are used as such by many pre-industrial societies, I have not proposed switching to “bugburgers” or “creepy-crawler” salads. No such re-education project is necessary. The main

immediate potential of insects lies in their ability to recycle waste materials into protein-rich feed for other animals that are more acceptable as food for humans – such as poultry, fish and livestock. A chicken suffers no cultural shock in downing a maggot. The maggot can be reared in the chicken excreta and is loaded with protein. The chicken will taste fine.

This is only one of many possible systems that might be devised. This particular one has been researched at Colorado State University by the U.S. Dept. of Agriculture. There are a million species of insects and it is probably safe to say that there is no substance of plant or animal origin, waste or otherwise, from cellulose to feathers, that is not utilizable as food by one or more of them.

Insects do not provide, contrary to the statement by AP, fewer calories than vegetables, and no one should go on an insect diet expecting to lose weight. In addition to protein, insects contain a substantial amount of fat, which means that they have a very high calorie value. In fact they are among the richest sources of calories. The source of confusion on this point may have resulted from the fact that some insect fat, in its degree of unsaturation, bears a resemblance to vegetable oils.

Finally I have done no experimental research on this subject. As one result my students did not refuse to eat eggs from chickens fed fly larvae; they were never offered any. My field of research is mosquito-borne virus diseases, but at a recent “Symposium on Unconventional Sources of Protein” on the UW campus, I did review research by others on chemical analyses of insects and suggested that insects deserve more attention than they have received in the search for new sources of protein. The problem will be how to wed insect mass-production technology to recycling of wastes, and a great deal of research will be required to determine the true biological and economic potential of specific insect-waste conversion systems. – G. R. DeFoliart, professor and chairman, Dept. of Entomology, University of Wisconsin-Madison.

The AP article went far and wide. My phone started ringing. Calls were coming from everywhere. Everyone was wanting an interview. It kept on for weeks – for two or three months, in fact. I was hearing from old friends, too. The first person I heard from, in fact, was Laine Eschle, formerly the wife of Jim Eschle, one of my former graduate students. She was again living in Lubbock, Texas. Her letter was dated May 21, 1975:

Dear Gene:

Saw your article on insects as a future protein source, in the Lubbock paper this morning. Can hardly wait to try fried creepy crawlies and sautéed cockroaches (without the wings of course)! Keep up the good work. Say Hi to Lou for me.

That was the first of what became a load of letters received. The “Lou” that Laine referred to was my wife, Louise, or Lou, as everybody called her. I replied to Laine under date of August 5th (I don’t know what held me up so long in answering):

It was very nice hearing from you. As a matter of fact, I heard from a number of old friends after that AP release, and it's not surprising – it was really crazy. The original paper from which this whole episode stemmed will be published in the September issue of the Bulletin of the Entomological Society of America, and I will send you a reprint. In the meantime, don't you believe I said all those things.

It did stir up a lot of public response and some funny happenings. The night it was on the Johnny Carson show I was asleep in front of the TV but Lou was watching and she began yelling for me to wake up and for Linda (our youngest daughter) to come upstairs. By the time the confusion was over all we heard was the last joke or two. And so it went, or I should say goes, because I'm still getting one or two calls a day, mostly from radio talk shows around the country Well, let us know if you run across any good insect recipes. I hope we'll have a chance to visit again one of these days.

The only thing I can still remember Carson saying was something like: "Can't you just see it. While you're eating your termite soup, the termites are eating your bowl." I still remember clearly, though, how Lou was pounding on my back trying to get me to wake up. Within five minutes after it was over, my sister, Jessa Dean DeFoliart Scott, was calling from Arkansas. She said she couldn't believe her ears when she realized that the Wisconsin professor Carson was talking about was her brother, but she said Johnny sure murdered the pronouncing of my name.

From among old friends, I even heard from the only university president that I'd known personally up to that time, and one of only two I've known personally up to this time. Dr. Hilton Briggs was Dean of the College of Agriculture at the University of Wyoming when I was there during most of the decade of the 1950s. He left to become President of South Dakota State University, in Brookings, a post which he held for 17 years. He wrote under date of May 27, 1975:

Dear Gene,

The other night I was reading in The Argus Leader the AP release concerning work you have been doing on potentials of increasing food production. It was very interesting. It did point out very clearly that while you were indicating potentials that as yet you are not "feasting" on all those potentials. We are happy to see you getting the recognition that forward-looking research should bring.

It's been ages since we've seen you folks. . . . I thought it was quite a coincidence that I was visiting with Mrs. Robert DeZonia [The DeZonias lived in the same neighborhood as we did in Madison, and Bob was [find out]] one night, and she was telling about unusual names and combinations of names. She was telling us about their daughter that had the unusual name of DeZonia having a close friend by the name of DeFoliart [our daughter Sharon]. My ears immediately picked it up, and I asked if that could possibly be you folks; and here it was. In education circles, it truly is a small world. We send our very best personal regards to you and your family, and we trust that it will not be too long before we will have a chance to review old times and re-establish acquaintance.

Sincerely,

I was still defensive about the AP article when I replied to President Briggs, July 8th:

Dear Hilton [first time I ever called him Hilton]:

It was very nice to hear from you. I heard from quite a few old friends after that AP story was released. It was quite garbled and contained many inaccuracies as you probably suspected when you read it. In fact, the AP writer became so enthused in coining terms like “bugburger” and “spider loaf” that he all but missed the main points. The ensuing two weeks were interesting, though; I had some 30 contacts from newspapers, radio and TV around the country, even including BBC, for follow-up interviews. . . . We heard via Cathy DeZonia about the conversation you had with her folks. It is indeed a small world.

Sincerely,

Revised August 5, 2001

Chapter 2. Correspondence, the Media and Educational Progress in the 1970s and Early and Mid-1980s

Not all of the mail we received after Harper's article was cheery and upbeat, for example the following from an anonymous letter-writer in California, postmarked May 22, 1975:

Dear Sir;

Regarding the enclosed clipping, this is to inform you that some students will visit your office and provide you with a shit sandwich. It will be interesting to see how you will enjoy it.

Another anonymous letter came from some school kids:

Our Sixth Grade class wishes to let you know that we have been studying insects and arachnids and we think that you or the reporter got mixed up. We have marked the place. A lot of little kids might read this and think that spiders are insects. Our teacher taught us better.

I can thank Harper for this. The place they had marked was the reference to "spider loaf sandwich" in his article. Even though, in Harper's article, I was supposed to have used the term, I had never heard it before. Also, I will say in reference to this that teaching little kids to criticize anonymously can make you wonder about the teacher.

Another letter, this one not anonymous, postmarked August 2, 1975, basically suggested that I should try my idea first on the EPA and on Henry Kissinger and a lot of other government bureaucrats who were selling us down the river to the Communists and environmentalists. He explained in great detail exactly why he thought we should try it first on them; following are a few selected portions from his one solid page of single-spaced highly redundant letter:

. . . . Now, let's get back to your insects for food; perhaps we should force those environmentalists and ecology experts to try out your-insects-for-food-plan because they are ruining our right to harvest our own products from our own land. In the south the insects are, because of our stupid "experts", eating away at the growing crops; the fireants have killed animals needed for food, and the fertilizer needed for farming (especially phosphate) has been sent to Russia to make the enemy strong so he can devour us quicker than even he thought possible - it's called détente - but it has brought to us shortages, high prices and one crisis after another - and if it wasn't planned that way, why did it happen since we got all these kicks after Kissinger took over the affairs of our government. . . . He has made Russia strong Never have we had such a stupid government as we have had for too long a time and it is time we woke up.

. . . . When the government bureaucrats get into anything they wreck it - the Post Office is a perfect example - and when they can come in and take our properties, plan our lives as the EPA is now doing, then we will have fewer harvests and higher prices and finally we are subdued - which is just what the government under these socialists are trying to do to us. Why don't you ask the

EPA bureaucrats to eat your insects and let us go on about our business and we will eat the food that God intended for us to eat. Or, has God been thrown out of everything these days? Why don't you offer those OSHA men, those EPA inspectors, those fools trying to plan our lives for us, some of those bug burgers that you are talking about?

. . . . we think your idea on insects for food should be first tried on these EPA kooks because they are the people dictating to us how we should get along without insecticides proven capable of taking care of our insect problems. . . .

We have been sold out to the communist world under the Kissinger plans, and even the food has been taken off our tables to be handed to the dictators in communist countries - while we pay the taxes and do the dying in no-win wars against communism so that communism can win even on the battlefield. How long must we see our nation die for lack of honesty and honor? Anyone care?

Once Harper's AP article was out there, you can imagine how quickly the media jumped on a subject like this. Even though the articles will seem somewhat repetitious in content, I have reprinted several of them here in order to set a baseline from which future progress in reducing the American bias will hopefully be discernable. Harper's article appeared in most newspapers around the country on May 21 or May 22, 1975. The first three articles feeding off Harper, that I saw, ranged from pure sarcasm to sarcasm mixed with discussion of possible benefits to being free of sarcasm or nearly so. All authors, however, did what any of us do when we think we have a chance to be funny. Make the most of it. The first of these articles that anyone sent to me, appeared on May 22 in the Boca Raton News Editorials column. It was titled "This one could bug ya":

"Get a bucket of roaches . . . have a barrel of fun."

"Two all-spider patties special sauce lettuce cheese pickles onion on a sesame seed bun."

"Hold the pickles, hold the houseflies, special orders don't upset us - have it your way!"

Don't laugh. That roach you squashed this morning on the kitchen floor could have been a fine instant breakfast. In the future you may take the family out to "Bugs Unlimited" or "Chigger Haven" for a tasty "Thing in a Basket" with a side order of deep-fried termites to go.

"There is no doubt about the quality of insects as food," says Gene De Foliart, University of Wisconsin entomologist (bug expert). "Termites, for instance, have a higher protein content than beef or fish."

The professor is suggesting we eat more insects, but admits "many people have a natural revulsion to the idea of eating insects." No argument there, professor. And we don't much like the prospect of trapping our dinner as it makes a mad rush for safety under the refrigerator, only steps ahead of us and the cat.

De Foliart reports he once ate a silkworm pupae and that it tasted "like a museum piece," though we can't tell if that means it tasted more like Indian artifacts or a suit of armor. Suffice to say, the professor's definition of "edible" ranges wider than ours.

De Foliart has one strong argument – price. What with the very large supply (just look around you) and a less-than-brisk demand, the price is, as they say, affordable. All you really need is a yellow light and some Insect Helper.

Still, De Foliart doesn't think bug cuisine will catch on quickly in America, though he does say "it might come to that." (If it comes to THAT we don't want to be around to see it.)

"A lot of insects are used as food in more primitive cultures but not in the more civilized parts of the world," the professor says.

The man obviously never served in the U.S. Army.

Well, the editors are right about one thing. I was never in the Army. It was the Navy, naval aviation to be exact. About all I can say to the Boca Raton editors is "Sorry about your cockroach problem." Most people call in an exterminator for that. It's too bad though, that when they hear about insects as food, the only thing the B.R. editors can think about is the last cockroach they saw scurrying under their refrigerator. In that regard, they are, unfortunately, like too many other Americans. But, it would be like me saying to one of them, "You eat vertebrate animals? Yuk! How could you? I could never eat a skunk! How do you like yours prepared?" Domestic cockroaches are the skunks of the insect world. They are not only very unsanitary in their habits but they are allergenic to humans.

The B.R. editors, unfortunately, quoted from Harper the statement I presumably had made about insects being "used as food in more primitive cultures but not in the more civilized parts of the world." Maybe I said this, I don't know, but the statement is offensive, and I regret saying it if I did. In an interview, one does not always come up with the best choice of words in every instance. I still remember vividly some thoughts I had about the word "civilized" four years later in Lucknow, India, where I was spending a few days as part of a nine-member U.S. delegation to the First Indo-U.S. Workshop on Biodegradable Pesticides. After getting out of bed that first morning in Lucknow, from my hotel window I looked down on a very broad thoroughfare with phalanx after phalanx of bicyclers on their way to work. Only a few cars, all of them small, could be seen among those thousands of bicyclers. I couldn't help but think about all of the gas guzzlers and other extremes of consumption back home, and I was almost audibly asking myself, "And who is supposed to be civilized?" Being "affluent" is not by a long shot synonymous with being "civilized" in my mind.

The next spin-off from Harper's article that I saw was sent by Dr. Les Lyons of the Forest Research Laboratory in Sault Ste. Marie, Ontario, with the note: "Gene, Something for your scrapbook!" It was a column, called "Across the News Desk," by someone named Homer Foster, in The Sault Daily Star of May 26, 1975. As I said, newspaper journalists are no different than the rest of us when it comes to looking for, and welcoming, any opportunity to be humorous. And where would they find a more gold-plated opportunity than when someone pops up with the statement that people should be eating insects? You will notice, though, that Foster works in his witticisms while dishing out much less sarcasm than the B.R. editors:

How about a nice termite sandwich?

Doesn't appeal to you? Well, how about a grilled bugburger?

Still doesn't whet your appetite? You may be missing out on good wholesome food – food which in some ways may be better for you than what you are eating now.

That, at least, is the opinion of a University of Wisconsin entomology professor who has been studying how insects might be used to provide food for the hungry people of the world.

The thought of eating insects is repulsive to most of us.

Mind you, like a good many others, I enjoy the tasty snail called escargot. But that's about where I draw the line: I can't even think of eating grasshoppers, for instance, which are a great delicacy for many people.

NOTHING WRONG

Despite our revulsion, the university professor, Dr. Gene DeFoliart, says there's really nothing wrong with eating most insects.

You'll notice he says "most". [sic] I suppose even the professor wouldn't advocate munching on Black Widow spiders with the venom still intact.

Lest you get the idea that the professor might be prejudiced against spiders, let me hasten to say that it isn't so: Dr. DeFoliart would see nothing wrong with a sandwich made up from spider loaf [here I'm paying again for Harper's fantacizing].

WE'RE REPULSED

In one of the understatement of all time, the professor concedes that "Many people have a natural revulsion to the idea of eating insects."

As an illustration of the revulsion, cites his own university students. In an experiment, he fed manure to housefly larvae and then fed the larvae to chickens.

The chickens did very well and soon became prime birds, ready for the oven. The problem arose when the students absolutely refused to eat them [another falsehood repeated.]

Dr. DeFoliart thinks it's too bad we feel so strongly about insects.

He claims the food value of insects is indisputable. Termites, for instance, have a higher protein content than either beef or fish, according to the professor.

As another example he says that housefly pupae (the stage between the larvae and the adult fly) are equivalent to fish and bone meal. "They're actually better than soybean oil meal," he says.

All of this probably is true – after all, the professor is a specialist and no doubt knows exactly what he's talking about.

I suspect, though, it will be a frosty Friday before the average North American is persuaded to rush off to his nearest drive-in restaurant for a spider-burger.

NOT SO FUSSY

This is not to say Dr. DeFoliart's work may not be valuable. After all, North Americans make up less than a tenth of the world's population. Many of the remaining nine-tenths aren't so fussy.

Indeed, in some countries, insects are considered good food, often delicacies. And I'm not referring to the Frenchman enjoying his feed of snails and grubs.

THEY EAT LICE

In some South Seas lands, head lice are eaten. I've seen pictures of a woman combing the lice out of the hair of her children and popping the fruits of her labor into her mouth.

Yes, again it's repulsive – to us.

Remember, though, that eating pork is repulsive to many other peoples . . . that eating frog legs is disgusting to many of our own people. . . and that some people can't even abide the thought of eating lobster.

I'm not suggesting we ought to start frying up cockroaches for breakfast. But maybe we shouldn't sneer at the idea that insects may be part of the answer to the problem of feeding the increasing billions of the world's people.

The third spin-off that I saw was right here in Madison, in the Wisconsin State Journal of July 11, 1975. It was on the editorial page, a column by staff writer James D. Selk, titled "Hungry? Have a Nice Termite." Selk was essentially free of sarcasm – maybe because the originating university was so nearby, right here in Madison.

It probably won't ever come to this, but the worldwide food shortage has interested the scientific community in the possibility of eating bugs.

Insect eating, of course, is nothing new. Entomophagy (the official name for it) has been practiced in many places of the world for centuries.

Locusts are considered delicacies in the Middle East. W.S. Bristowe, a British entomologist in Southeast Asia who looked into the local cuisine several years ago, wrote:

"A toasted dung beetle or soft-bodied spider has a nice, crisp exterior and a soft interior of soufflé consistency which is by no means unpleasant."

Prof. Gene DeFoliart a University of Wisconsin entomologist, also had been studying the subject.

"There is no doubt about the quality of insects as food," he said, "but the subject has hardly been considered. A lot of insects are used for food in more primitive cultures, but not in the more civilized parts of the world."

DeFoliart said, however, that mail he has received since his remarks were circulated by the wire services isn't all that hostile to the idea.

The professor said he doesn't want people to get the notion he's advocating "bug burgers" or anything like that but that it makes sense to raise protein-rich insects as food for livestock.

The theory is that once the bugs are channeled through a cow they don't have the stigma.

When you stop and think of it, however, the stigma is really pretty silly.

Pound for pound, or ounce for ounce, termites have more protein than fish, less fat than prime beef and about 160 calories per ounce.

And let's face it, we accept without question a lot of things at mealtime which when one really thinks about them are pretty awful.

The guy who ate the first oyster, for example, must have been very hungry indeed and look what oysters are going for at your friendly neighborhood gourmet restaurant.

And don't think too much about that chicken egg for breakfast or it could ruin your whole day.

As I see it, the major problem with entomophagy is that if it ever catches on, with free enterprise being what it is, sooner or later we are going to have huge insect farms springing up all over the place.

And the guys who run them are going to figure out ways to produce more, bigger, healthier insects. There will be zillions of insects in insect farms waiting to be eaten.

And some day, just as sure as you're born, some idiot is going to forget to close the door when he leaves for the day.

In the meantime, the phones were ringing, media people and some free-lancers, but mostly media, wanting interviews. Unfortunately, I kept very poor records of these, very hit-and-miss. For requests from radio stations, for example, I rarely caught the call letters and knew only from which city the call came. Some radio stations heard from in the first two or three months after the AP release, or cities in which they were located, were (alphabetically by city): Anderson, Ind.; Boston; Chicago (WBBM); Cincinnati; Cleveland; Crawfordsville, Ind.; Detroit (WADX); Detroit (another station); Indianapolis; Jackson, Miss.; Lethbridge, Alberta, Canada; Los Angeles; Madison (WHA Radio); Miami Beach; Milwaukee (2 stations); New Orleans (WWL); Philadelphia (CBS Radio); Reedsburg, Wis.; St. Louis (KSLQ); St. Louis (another station); Salt Lake City; San Francisco (KGOB?, date?); Washington (Mutual News). Others heard from in the first few months included the Australian Broadcasting Company, BBC and the Canadian Broadcasting Company. On little slips of paper lying around, I can see that over several years we also heard from Channel 6 Milwaukee, Channel 15 Madison, the Associated Press, a Milwaukee newspaper, the Miami Herald, the Network News in Washington DC (which is not associated with TV, but distributes items to about 40 newspapers), and there were no doubt many others for which no record survives at all. The radio station interviews, particularly the live call-in shows, were especially fun except that you frequently had to be ready to go early in the morning.

Mercifully, there was a short cessation in all this activity early in 1976. Actually, there was not a complete cessation, but there was a great reduction because I was not in Madison. I had been successful with an application to the Knapp Bequest Committee for expenses to cover four months to be spent at the University of Hawaii in Honolulu. The Knapp Committee considers proposals for the improvement of teaching at the University of Wisconsin. The course I wanted to improve was Entomology 371, Medical Entomology, a 3-credit course with laboratory taught in alternate years, and cross-listed by the Departments of Zoology and Veterinary Science. The following paragraph of the proposal, written December 31, 1974, is probably the most concise summary of motivation for wanting a break:

. . . . The potential of the course if well taught, set as it is against the backdrop of such preventable human tragedies as malaria, typhus, plague, encephalitis, etc., for generating excitement and enthusiasm for biology among undergraduate students seems unlimited. Because of the diversity of the subject, however, the press of other duties (a research program and for the last seven years

chairmanship of the Department of Entomology), and no adequate textbook, I have had increasing difficulty meeting the challenge and opportunity presented by the subject.

Later on in the application, I mentioned that I had “not taken or sought an extended leave (one month or longer) from the campus in 24 years of postdoctoral academic life.” Approval by the Dean of the College of Agricultural and Life Sciences, Dean Glenn S. Pound was essential before the application could be forwarded on to the Knapp Committee. I had a telephone call from the Dean a few days after sending the application to his office. He started off something like this: “Gene, I’ve been reading your application for a Knapp grant and was quite impressed with what I was reading. Then I came to the part about you’re wanting to go to Hawaii. Couldn’t you do it just as well at, say, Johns Hopkins?” The Dean must have decided to approve it, anyway, because I wrote to him on February 26, 1975, thanking him for supporting my proposal. I had heard from Professor James Latimer, Chairman, on February 15th that the Knapp Committee would support the proposal to the sum of \$4,400 (I had requested \$4,580) for the period January through April 1976 in Hawaii.

Before returning to the main subject, there is one other little anecdote I want to mention relative to our Hawaii trip because it shows so well how one can suddenly be taken aback very unexpectedly despite the best-laid plans. I thought that with the lush tropical vegetation of Hawaii, our trip there would be the trip of a lifetime for Lou. The house we had rented, out near Hainama Bay, had a view and a swimming pool. Paradise! We had been in Hawaii about four or five weeks maybe; Lou and I were sitting there having a pre-dinner cocktail when, out of the blue, she made a remark I have never since forgotten. She said, “You know, I think I’m going to have to have more to do over here than just skim bugs off the swimming pool.”

Echoes from the UW symposium continued during and after our stay in Hawaii. Early in 1976 I received a communication from Jean Lang, Editor at the UW Institute for Environmental Studies (IES) that began: "I am sending you the enclosed newspaper column for your files. The column, which is a weekly feature sent to about 50 state papers by the Institute for Environmental Studies and the Sea Grant Program, describes some findings of the workshop on unconventional sources of protein." Lang told me that I was not available for comment, but she had checked the story with Professors Sunde and Stahmann. She also mentioned that I would note that she had referred to the fly pupae as fly larvae and added, "I apologize for this inaccuracy, but space was limited and I felt newspaper readers would be more familiar with the term 'larvae.'" The manuscript copy was dated January 30, 1976; the title was "Locusts, Carrot Tops and Yeast." Two paragraphs were devoted to the insect coverage at the workshop:

. . . . For example, a feed supplement composed of fly larvae has been developed for baby chicks. The fly larvae are raised on manure and have a protein content of over 60% after being dried and ground. As for the chickens, they thrive on the larval supplement and don't seem to know the difference. The flavor of their meat and eggs remain unchanged.

The locusts and grasshoppers which stage massive and destructive annual migrations in many parts of the world are another potential protein source. UW

entomologist Gene Defoliart speculates that if the locusts could be harvested in quantity and ground up, the locust meal could be added to livestock feeds or used as a high nitrogen fertilizer. . . .

Lang had a nice closing paragraph:

As problems of production, marketing, and consumer prejudices are conquered, these so-called "unconventional protein sources" are likely to become more and more conventional. Someday, they might even become commonplace items on the feedstore shelf.

A round of articles stemming from a common source appeared in state newspapers datelined from August 31 to September 2, 1982. I don't remember the interview process and I don't know whether it started from a press release or somebody's article. I received clippings from (alphabetically) the Milwaukee Journal, Monroe Evening Times, Sheboygan Press, Superior Evening Telegram and Wausau Daily Herald. The Wausau paper had the most creative title, "Insectinside." Whoever created that deserved any award for which newspaper headline creators may be eligible. The longest was in the Milwaukee Journal, by Steve Hannah, titled "Jiminy Cricket! Bug chow?" and is presumably the most complete version. I want the most complete version here even though, as usual, I'm not particularly proud of every last utterance attributed to me:

Madison, Wis. - Gene DeFoliart says let them - meaning you and me - eat bugs.

Yuk!

No, it's protein, says DeFoliart. Insects, he says, are the great, untapped "add-on source of protein for human beings."

The University of Wisconsin-Madison entomologist insists that those crunchy little creatures taste good, too.

"I haven't had a whole dinner of it or anything," said DeFoliart, sounding like the Julia Childs of the entomology set. "The thing we've whipped up a few times in the lab was Greater Wax Moth larva.

"You drop 'em in the deep-fat fryer. If you leave 'em for about a minute, they have a really nutty flavor. A half minute longer, they taste like bits of bacon."

DeFoliart, 57, who has been on the UW - Madison faculty for 23 years, conceded that it would be awhile before cricket chow became standard fare at dinner tables around the US. The cultural aversion will take awhile to overcome, he said.

Meanwhile, he and his associates have been involved in a serious research project in Costa Rica, where cultural aversion to insects is overshadowed by a severe protein deficiency in both man and livestock. The underlying assumption to their work is that protein derived from a particular species of cricket is cheaper than protein imported in the form of soybean meal.

The project was started in a less developed country because rearing crickets for protein requires cheap labor, DeFoliart said. "We're about a year away from doing what we say we can do," he said.

In the Central American experiment, DeFoliart explained, crickets enter the human food chain via chickens. The insects are raised commercially, dried and crushed, then fed to poultry.

"Chickens love 'em and people love chickens," he said.

One thing that may hamper the completion of DeFoliart's project is funding. He said money to underwrite the research has been tough to come by, in part because it's "kind of the square peg in a round hole" syndrome.

A bit unusual

"It is, after all, a bizarre subject," he added. But he is convinced that it is eminently worthwhile.

Funds over the past four years have come from the UW graduate school as well as federal Hatch Act money filtered through agricultural experiment stations.

DeFoliart said he had also applied for grants from the US Agency for International Development, US Department of Agriculture and the National Institutes of Health. His efforts have met with limited success.

"There just isn't any established field," the UW professor noted. "When this project goes through the National Institutes of Health's nutrition study section, they say it's just not innovative enough."

In any event, DeFoliart said the thought of eating insects might turn a stomach or two here at home, but it had been common practice for ages in other parts of the world. People have been eating termites in Africa for a long time, he pointed out.

"In general, insects taste pretty good," said DeFoliart. "The problem is that they are not available in bulk."

I remember, on a nice sunny afternoon somewhere along the line, being interviewed in my screened-in side porch by Steve Hannah of the Milwaukee Journal. The preceding may have been the result of that interview. The Journal's account was the only one with a byline, and, also, it bore the earliest date, August 31.

Of the thousands of letters I've received since 1975 concerning insects as food, one that stands out in my memory arrived from Winter Haven, Florida, dated May 10, 1982. It was from a Miss Luke Swanhart. Isn't that a great name? I would like to have met her. From her letters (there were two), I am certain that she was a most interesting and gracious lady. Her first letter follows:

Dear Dr. DeFoliart:

I was recently invited to a small informal gathering and was offered a small dish of rather peculiar looking morsels to sample.

So I did and found them exquisitely delightful for the palate, eagerly enquiring the recipe. She smiled graciously and calmly said one word...grasshoppers!

I thought I was about to die! But soon I retained a sense of calm remembering how robustly delicious they were, realizing that the aversion was simply a state of mind rather than anything tangible.

I'm always thoroughly intrigued with insects, being a major hobby to study fully giving me hours of pleasure; now that I realized their use as a source of nutrition (a locust plague? Let them come) I am even more fascinated, struck with total astonishment but lack datum on their nutritional value in terms of protein, calories, carbohydrates, vitamins and minerals.

So I earnestly and would most appreciate any information concerning their nutritional qualities of the most common insects one would be most likely to consume, or a source where I can obtain such jeweled knowledge.

Also, if you have any recipes off hand I would deeply appreciate receiving some. My friend just fried them—I relish variety in all things of life.

Thank you so much for your time and possible assistance.

Yours sincerely,

Miss Swanhart's second letter (dated June 5) was nearly two pages long, single-spaced, so I have settled for simply excerpting a few parts:

Dear Dr. DeFoliart:

I wish to express my deepest appreciation for taking the time and answering my request, for your immense generosity.

I have various physician friends and they said they are willing to try some insects, that is, "as long as you don't talk about it while eating." I experimented with some insect cookery and manifested a delightful cricket quiche, and that crickets are especially nice as meatballs in a spaghetti sauce

Fixing them still bothers me a bit but it's also true that the slaughter of cows is equally--correction—is more unpleasant; I have generally assessed that a person with a higher IQ is more willing to listen to the facts of insect cookery before rendering judgment and that the average IQ person will immediately dismiss the idea, calling it "unnatural."

Miss Swanhart went on to discuss DNA, John the Baptist and what he ate, and how she was now raising her own crickets even though she lives in the middle of the city. In my estimation, Miss Swanhart's observation regarding IQ would seem to gain confirmation from some of the newspaper columns earlier in this chapter, such as the one by the Boca Raton editors.

In writing the first rough drafts of these first two chapters, I found and pored over correspondence, clippings, reports, etc. in manila folders that hadn't been opened in years. I remembered that Ronald Taylor PhD, author of *Butterflies in My Stomach* (published in 1975), described hectic experiences similar to mine when he first started addressing groups on the 'insects as food' subject. I quote one paragraph, as an example, from his preface:

The Biology Club on campus [University of California-Irvine] learned of the talk I was about to give [at Rotary Club] and asked if I would speak to them on the same subject, which I did a couple of weeks later. The following morning the enterprising public relations officer of the university, eager to spread the word

regarding activities on the new campus, issued a fairly standard publicity release. That afternoon I was besieged by reporters and photographers from many newspapers, and in something of a daze held what in effect was a press conference on the subject of insects as human food.

That was followed by newspaper articles with creative titles, calls from radio and television stations, etc. It is interesting, too, that Taylor used the heading, "The Beginning," for his preface.

Chapter 3. Research: Tripping to Colorado After Mormon Crickets

An interesting letter arrived, dated July 9, 1975, from Dr. Charles F. Tiernan of the U.S. Forest Service in Provo, Utah, describing interest in a possible cooperative effort trying to harvest Mormon crickets:

Dear Professor deFoliart:

I have been an advocate of changing basic attitudes regarding insects in this country for some time. I've tried to promote insect appreciation as a form of recreation and as a natural resource within the U.S. Forest Service. Recently an article in the L.A. Times (May 21, 1975) about your work on insects as a possible food source was given to me. I appreciate your ideas and your struggles.

My research deals mainly with the relationship of shrub insects in the Great Basin to habitat improvement for big game, particularly deer and antelope. While Mormon cricket epidemics here do not occur as large or as frequently as in the past, they are regarded as a problem and often control measures are used. I believe that when and where these outbreaks occur, the insects should be harvested, dried, ground and considered a food source or supplement for humans or pets or both. I would like to pursue this.

What has been published on the use of insects as food? What insects have you investigated? What are your thoughts on harvesting? Are you interested in the possibility of a cooperative effort with me on Mormon crickets? How about recipes?

Sincerely yours,

This was the first in an off-and-on exchange of correspondence that helped lead to a meeting in Vernal, Utah, in 1978 to initiate field work on the Mormon cricket.

I don't know how I can have so much luck. I remembered those early trips west as being very interesting and sort of tenseful, but I had grown vague on details. Then, I stumbled onto a goldmine, a sheaf of papers, handwritten, titled "Cricket trip memoirs 5/31 - 6/7/1978." I will reproduce these notes without alteration because I think they portray the mood of the time better than any reconstruction could (the Marsha mentioned in these notes was Marsha Lisitza, my lab tech, who also went on this trip):

May 31 - Wednesday

5:00 pm - arrive Vernal, check in at motel.

5:15-Tiernan calls

6:00 - All meet in my room for one-drink Happy Hour

7:00 - Go to Mexican place for dinner

June 1 - Thursday

6:30 am - Meet for breakfast

7:30 - Head for Dinosaur National Monument to Meet "Lew" – a ranger who Tiernan has been in contact with
AM - Arrive at Visitor Center. Find Lew is on one-day float down Green River. View dinosaur excavations at Visitor Center
Noon - Picnic lunch provided by Shirley Tiernan
PM – Arrive at Monument headquarters. Girl there very helpful. Contacts Ranger at Ladore in far north end of park. He gives us three names who know about crickets – Durcy, Creasy and (?). Decide to drive the 100 miles to Greystone to see Durcy since he apparently has no phone number. Also call Wildlife Refuge Center to talk to Creasy but find that this is their day off. Third party doesn't answer the phone.
Late pm – Arrive at Greystone (pop. 2), talk to Durcy (about 85 yrs old or more). Says he doesn't follow crickets anymore; we should talk to Penny Creasy – who knows where they are. Drive the 140 miles back to Vernal. Marsha and I in back of van all day – Charlie and Shirley up front.
Evening – Clean up, split bottle of wine in Tiernan's room.
9:30 pm – Have dinner
Note – Marsha and I ride entire 300+ miles this day sitting on sleeping bags in back of Tiernan's van.

June 2 – Friday

6:30 am – Meet for breakfast
7:30 – Call Creasy's – connect! Head for Brown's Park, taking both cars
10:30 – Arrive, meet Creasys, unload and try to start trail bike
11:30 – Leave for cricket location, Tiernans in van, Penny C., Marsha and I in her pickup.
12:30 pm – See first cricket! Admire, pop in alcohol.
1:00 – Have picnic lunch provided by Shirley Tiernan.
3:00 – Tiernans leave for Provo. Penny takes us to couple more nearby places. No crickets.
6:00 – Return to Wildlife Refuge. Leave for Vernal.
9:00 pm – Arrive Vernal. Call home, have dinner in hotel dining room at 9:30, just before it closes. No Happy Hour.

June 3 – Saturday

6:30 am – Breakfast. Decide too much time commuting from Vernal. Decide to pack up and look for motel in Maybell – only 55 miles from cricket grounds.
8:30 – Get gas, find dry ice place and go to market for snacks for lunch.
9:00 – Leave for Brown's Park. Arrive, tell Creasys if we don't come by their house by 7:00 pm, check on us. Marsha opens first gate – closes herself on the wrong side. Obviously hopes no one saw it, but I was looking through the rear view mirror.
11:30 – Arrive at cricket grounds. Tense moments when it takes Marsha 30 min. to get scale to work. Start collecting and weighing crickets. After about one hour,

big wind comes up and have to move everything into car. Stuff everywhere – no room to work. Hard to get organized.

4:30 pm – Decide better head for Maybell, because have no motel reservations anywhere – and it's Saturday.

5:00 pm – Congratulate selves on making it in and out of cricket grounds without high-centering car. It takes 30 min. each way to cover last 4 miles.

6:00 pm – Arrive Maybell. Woman who owns Rose Motel not home. We tell her son to tell her 2 rooms are sold and go eat at the Conoco Café. I have a bowl of chili. Hear from lady who runs café that woman who runs motel eccentric and son on dope. Decide to go to Craig 30 miles east [rework the preceding to mask identities]

7:30 – Arrive Craig – find vacancy. Feel lucky. Go get lunch snacks for next day. Marsha pooped. I have about 5 brandies to celebrate Sat. and go to bed.

Note – In checking in, motel owner says reservations only good through Sunday night. Might be able to handle us on Monday but will have to move to different rooms.

June 4 – Sunday

6:30 am – Breakfast. I don't feel well; weak and right fingers tingle. Afraid might be getting ready to have 1st heart attack. Buy gas and go to cricket fields anyway. Marsha drives.

9:30 – Arrive and collect and weigh crickets

11:30 – I get light-headed. Fingers still tingle. Think about fact that 2 hrs to nearest medical services – and Marsha doesn't like thought of driving first 4 miles. I lay down in back seat of car – Marsha collects and weighs by herself. I write down weights.

3:00 pm – I get out and do a little collecting.

6:00 – Leave cricket grounds

8:00 – Arrive Craig – clean up – shop for lunch tomorrow. Make reservation at different motel for Monday night. Tell them we will be in late but be sure to hold. Then back to my room, spread out crickets to dry on newspaper in bathroom.

9:30 pm – Go have light dinner. Return to room, call home – hang up – look in bathroom – crickets all over, from floor to ceiling – gather up and put back in dry ice chest – close bathroom door.

June 5 – Monday

7:00 am – Breakfast

8:00 – Check out of motel. Operator calls around to find out who has dry ice – gives me name – go there – they sold out on Saturday – get gas – go to hardware store to buy short piece of metal for barrier test – luckily find dry ice at Safeway store, just delivered.

9:00 – Head for cricket fields. Raining.

11:00 – Arrive. Rains threaten all day but make good collections. Worry about getting out.

3:00 pm – Starts raining. Big decision whether to leave or wait rain out and collect late.
3:30 – Decide had enough. Head out.
4:00 – Congratulate selves on making it out of ruts to good road. Expect to deliver borrowed shovel to Refuge Center, be in Craig by 7:00 and have decent evening for a change.
4:05 – Stuck in mud on hill.
4:10 – Decide to start walking (road untravelled) to highway 8 miles away. Thunderstorms all around. Highway is one which as you turn on it at Maybell has sign “No services next 100 miles.”
6:30 – Arrive at farmhouse on highway. Sign says “Beware of dog.” Luckily, family at home. He and I go out and get car.
8:00 – Arrive at Refuge Center to return shovel and let know we’re safe. Marsha calls motel in Craig to let them know again we’re coming. They say, “rented rooms 30 min. ago.” Creasy says 3 hrs to Vernal, only 2 hrs to Rock Springs, first 30 miles gravel. Decide to go to Rock Springs although nearly decide to go to Craig first to tell motel operator what a first class shithead he is.
8:30 – Leave for Rock Springs. Skirt very ominous thunderhead for 30 miles.
10:30 pm – Arrive Rock Springs. Check in Outlaw Inn. Marsha too tired for anything. I go find open café and have deluxe cheeseburger. Come home, pour brandy and write memoirs of first protein trip.

There was a second trip to Colorado the last week in June, primarily because when we were there in early June very few of the crickets had reached the adult stage. On both trips, in addition to trying to collect as many crickets as possible for nutrient analyses and feeding trials we weighed crickets individually so we could estimate the amount of protein in a Mormon cricket band of any given size. These results were reported by DeFoliart et al (1982) from which the abstract is quoted at the end of this chapter.

There remained some unfinished business from our first two field trips. The following letter to Penny and Jim Creasy was dated July 24, 1978:

Dear Penny and Jim:

By now you have probably received some Wisconsin cheese. We sent it United Parcel because, at the time, it looked like there might be a postal strike and cheese wouldn't stand too many weeks in the mail. Hope you enjoy it. It's just a token of our appreciation for all the help you gave us this summer.

So far, all of the crickets are still in the freezer. We've been so busy with mosquito work that we haven't even been able to get them in the drying oven yet. When we do get back to them, I will let you know how the analyses turn out. I think we got enough crickets for a small chick feeding trial. If the biochemical analyses and the feeding trial look promising, I will probably be out there for a week or two next summer working on a harvest method. If so, I hope to be able to reimburse you more satisfactorily for any time and mileage that you put in in our behalf.

I hope you are having a good summer and that, by now, you have solved the housing problem for this Fall in Craig. Best regards.

Sincerely,

Another letter, also dated July 24, was addressed to Frank and Cathy Hector:

Dear Frank and Cathy:

By now you have probably received some Wisconsin cheese. We sent it United Parcel since it looked at the time like there might be a postal strike. It's just a token of our appreciation for your help in getting our car off that muddy hillside back in June.

Sincerely,

We moved into 1979 with a letter dated January 5 to Charlie Tiernan:

Dear Charlie:

Enjoyed hearing from you and appreciated very much getting the inventory of vegetation, the list of people with information on Mormon crickets, and the two articles. Thanks very much. I should have answered sooner but was teaching this Fall Semester and everything else gets bogged down during a teaching semester.

We got back to crickets only this past week. Marsha began oven-drying them and we hope to get some samples over to Dr. Sunde within a few weeks so that he can begin chemical analyses. I will keep you informed of progress.

I hope you are liking your new post in Montana. Harry Coppel mentioned that he had talked to you and relayed your greetings.

The cricket work may go a little slow this spring because, among other reasons, I'll be gone for one month on a trip to India. But, at least we've got a start and incidentally, I did succeed in getting some continuing funding.

Thanks again for the materials you sent and best wishes.

Sincerely,

In the summer of 1979, I couldn't spare anyone from the lab to go to Colorado for cricket collecting. So I asked Lou if she would like to go with me and sort of vacation in Colorado for a few days. I told her the scenery would be great, and she could be a lot of help for me. And, of course, she would be great company. We would have a ball. [Fill in the details about trapping methods, etc. when the necessary documents are at hand]

It had gotten to be a long, drawn-out trip, including working right through the 4th of July. We were leaving Craig early in the mornings and not getting back into town until after all of the food places were closed except MacDonald's. We were dying for some salad, and for something, anything, besides MacDonald's burgers and fries. Finally, after about seven days, we got back into town a few minutes before Kentucky Fried Chicken closed. We got salad, we got mashed potatoes and gravy and we got chicken. We hurried

on to the motel. Lou hurried toward the room carrying the food. I jumped out of the car, nearly running to the nearest ice container so we could have a martini with dinner, and then we sat down to what we considered at the time the most sumptuous feast either of us had ever beheld. In fact, for many years after, we remembered that Kentucky Fried as probably the best dinner we had ever had. Or if not the very best, definitely one of the very best.

It was a day or two after our feast and coming down to about time to head home with our load of crickets, when, sitting on the edge of the Datsun with the door open and resting between rounds of checking the bait stations, I remarked to Lou, who was standing a few feet away, "This probably seems like a long hard week to you, honey, but actually, this is just sort of an ordinary, run-of-the-mill work week in the life of an entomologist." She looked at me, then off toward the distant mountains for several moments, then slowly back to me and said, "Bullshit." We had been married 29 years but that was the first time I had ever heard her use one of those four-letter words or any combination of those four-letter words.

Everybody in academia and probably most other walks of life knows well how much time and effort can be spent explaining and sweating what should be the small stuff. Often it pertains to travel expenses, and the following two letters are examples from our Mormon cricket project. The first was dated July 19, 1979, and written to accompany and explain our detailed travel expenses:

To Whom It May Concern:

This was a complicated trip, expenses-wise, since my wife accompanied me, and 2-3 days' vacation were inserted en route both to and from Craig, Colorado, the base of operations. Although she put in approximately 100 hours of project work during the period, July 2-8th, saving me the necessity of transporting project personnel, no reimbursement is claimed for her expenses. Direct en route time to Craig and return is estimated at about 5 1/2 days.

Two trips last year were made via airline to Denver or Salt Lake City and vehicle rental for subsequent transportation from those points. The amount of equipment required this year ruled out air transportation, and ground transportation from Madison was cheaper anyway than two airline tickets plus vehicle rental. I used my personal vehicle, a Datsun pickup, rather than attempting to rent a fleet vehicle, both because of the complications of adding vacation to a business trip and because the exact timing of the trip (dependent on reports of cricket activity from cooperators in Colorado) remained uncertain virtually up to the time of departure.

The major supplies purchased were dry ice for preservation of collected crickets and cantaloupe and watermelon for cricket bait. Dry ice prices ranged from 15 cents to 75 cents per pound.

If there are other items or aspects for which further explanation is desired, please let me know.

Sincerely,

The second letter, dated August 1, 1979, was also addressed to Whom It May Concern (Subject: Bill for services to UW Hatch Project 5133 by P. Creasy, Brown's Park, Colorado):

The attached letter itemizes services rendered by Mrs. Penny Creasy during our trip to northwest Colorado, July 2-8th, relative to objectives of Hatch Project #5133. Mrs. Creasy is a part-time Mormon cricket scout for the USDA. She has given us a great deal of help, time and transportation, without charge, on two previous trips, and our work there would be impossible without her knowledge and help in locating accessible cricket bands.

This year, to again ensure her availability, and with the prior consent of Dean R.L. Hughes, I suggested that we pay her \$6.00 per hour and 17 cents per mile for effort on our project. For the 11 1/2 hours worked and 202 miles travelled, as detailed in the attached letter, the bill for services rendered totals \$103.34.

Her address: [deleted here]

Toward the end of the 1979 season, I felt that the Mormon cricket project was at a point where we should take on a graduate student. All of my previous experience and all of my pipelines for recruiting graduate students involved students interested in medical entomology. This time I thought I should look for somebody locally so it would be possible to talk it over face to face with anybody interested before signing anyone up. I hung the following notice, dated July 17, 1979, in a couple of places in our building, Russell Laboratories, and waited:

Research Assistantship

Available beginning of Spring Semester 1980. Subjects of investigation will be food selection and food conversion efficiency of the Mormon cricket, Anabrus simplex. This is part of a project on possible utilization of insects as a source of protein.

In addition to the usual requirements for graduate students, the successful applicant must be able to spend mid-May to early August in scenic northwestern Colorado.

Interested persons should contact Professor G. R. DeFoliart, 545 Russell Labs.

It took only two or three days before this personable, obviously very intelligent young man showed up at my office door, wanting to know about the assistantship on the Mormon cricket and Colorado. His name was Mark Finke, and, although we didn't think a whole lot about it at the time, he was destined to become probably the first joint major entomology/nutritional sciences PhD in American history. Mark established connection with Professor Norlin J. Benevenga as his major professor for the nutritional sciences part of the combination.

For the 1980 field work in Colorado, I sent my lab assistant, Jim Rosenkranz to accompany Mark. I received a nice picture postcard (showing Dinosaur National Monument), signed by Jim, which said:

Scenic NW Colorado - ha! The McClouds and the Creasies are all disappointed that you and Lou stayed home this year. Everyone's been real nice to us, we even have a trailer to use at Brown's Park. USDA has been no help. We find bait everywhere. They even use horses and choppers. Jim & Penny are celebrating their 25th tonite, we are invited. I hope you don't mind. If I sign a card for you, Lou - give it to Marsha? See you.

Mark and Jim must have been earning their keep on this trip. Penny Creasy sent me a list of her expenses (hours and miles) on July 24 and started and closed her letter as follows:

Dear Gene:

Hope you are having a good summer. Ours has been busy and warm.

If the success of the project is measured by the number of specimens collected, you should have a raging success. It probably doesn't matter that I am impressed, but I truly am. There has been some consciencious and hard work going on.

Here are the hours and mileage:

If we can be of help again, please let us know. It has been an interesting experience. Take care.

Sincerely,

[Describe the corral I rigged up and took to Colorado, if I can find the description]

[Other possible harvest methods for poultry feed, such as using a rope treated with quick-breakdown insecticide]

During the summer of 1980 we were interviewed by someone (I don't remember who) from the Information Office of the College of Ag and Life Sciences. It was released July 10 as a Research Division "Science Report," and gives an idea of how we were viewing our Mormon cricket work by then. It was titled "Raising Insects for Feed Studied by UW Researchers":

It may be a while before farmers start trying to raise insects, but now the idea is no longer as far-fetched as it once might have seemed.

Pressure is increasing to use corn, soybeans and other grains for human consumption rather than for livestock feed. That's why University of Wisconsin-Madison researchers are seeking ways to use insects as livestock feed.

Research to date indicates that, under controlled conditions, some insects have the ability to transform wasteland vegetation and types of forages not well utilized by livestock into high-protein livestock feed.

The appetites of some plant-feeding insects could be a real “plus” for livestock feeders, according to UW-Madison entomologist and project director G.R. DeFoliart.

Cattle, for example, may have to consume 15 pounds of forage to increase body weight by a pound. Larval stages of some insects can gain a pound of weight with as little as two pounds of forage—a conversion efficiency of 50 percent. Several other insects have a conversion efficiency of 20 percent.

And as a general rule, dried insects contain approximately 60 percent crude protein.

Researchers selected four insects that had high conversion efficiencies and that also fed on plants which are not now well utilized by livestock. They also selected insects that would be relatively easy to rear and handle.

Insects now being studied are southern armyworms, Mormon crickets, tomato hornworms, and promethia moths.

Most research to date has dealt with Mormon crickets, 1 ½-inch long dark brown insects which have plagued western farmers and ranchers for decades. They look like fat grasshoppers.

The crickets pose no threat to areas east of the Great Plains, DeFoliart explains, although they are endemic in several western states in spite of insecticide control efforts.

Bands of the crickets damage crops and pile up on roadways. Before insecticides, control efforts ranged from running sheep herds through grain fields to crush them, to setting up “blockades” 10-inches high around fields to keep the wingless pests—they can’t fly or jump—out of crops.

Researchers are looking for a way to use this protein instead of destroying it.

“We want to see how the crickets fulfill the dietary needs of poultry,” DeFoliart says. “Our ultimate goal is to eliminate or reduce the need for other protein feedstuffs in the poultry diet.”

Mormon crickets weigh slightly more than one gram, dry weight. Females are larger and contain slightly more fat than males, according to M. L. Sunde, UW-Madison poultry scientist.

Chickens fed ground, dried crickets (a product resembling coffee grounds) fared well, although the economic feasibility of the ration isn’t yet known.

“The average broiler chicken eats about eight pounds of feed in its lifetime. Thirty percent or 2.4 pounds of this amount could be ground crickets,” Sunde says. “A laying hen eats about 80 pounds of feed. Twenty percent or 16 pounds could be crickets.”

Bands of half-grown migrating crickets—100 to 500 crickets per square foot—can cover several square miles.

“This density becomes much lower as they approach maturity,” DeFoliart explains. “But even at densities of 20 crickets per square yard, a band can contain over 34 tons of high-protein powder per square mile.”

These figures don’t represent the actual protein production per square mile, however, since a band of crickets at this density forages over several square miles before reaching adulthood.

Entomology research assistant Mark Finke and another student will spend about four weeks in Colorado this summer studying and collecting crickets and their eggs to bring back to Wisconsin for research.

Mormon crickets always migrate from their hatching grounds in a straight line. They feed as they go, covering one-half mile to one mile per day. The band stops each day after sundown and begins to move again the next day.

“They don’t necessarily travel in the same direction every day,” Finke says. “If they did, they would be easy to trap. But there’s no way to predict which direction the band will head the next day.”

Mormon crickets are omnivorous, consuming over 400 plant species. They prefer some plants, and Finke hopes to determine their preferences this winter. Because they eat anything, including each other, they could be an excellent method of converting low quality or scrub forages into protein and calories for animal and human consumption.

Using Mormon crickets for a protein source isn’t a new idea. Native Americans harvested them for winter food, made soups, roasted and pounded them into a coarse meal, and ground them with grass seed to make a paste they baked and ate. Those who were too hungry to wait for the drying, grinding and baking process simply pulled off the crickets’ heads and legs and ate them “raw.”

Some insects have been man’s traditional enemies, destroying his crops in fields and in storage.

But principles learned in today’s research could change these age-old foes into a palatable—at least to livestock—food source.

I saw only two media take-offs from this, one by Wayne Anderson’s column, Marketplace, in *Feedstuffs* of October 13, 1980, which followed the Science Report account (without embellishment for a nice change), and a very short blurb in the June, 1981 *Agri-News*.

The results of our cricket weighings which were spread over the three-year period, 1978 to 1980 were reported in the first technical paper that emanated from the project (DeFoliart et al 1982). The short four-sentence Abstract of that paper is reproduced below:

Adults of *Anabrus simplex* Haldeman collected near Greystone, Colo., were found to have a mean dry weight (males and females combined) of 1.08 g and a crude protein content of 58%. At cricket densities of 10 to 20/m², a 1-km² band of crickets represents ca. 11 to 22 metric tons of potentially harvestable high-protein powder. Corn-cricket-based diets produced significantly better growth of broiler chicks than was produced by a conventional corn-soybean based diet. Based on current prices for corn and soybean meal, the wholesale value of crickets of the aforementioned densities in a km² band would range from \$3,300 to \$6,600 if harvested for use as a high-protein feed.

References Cited:

DeFoliart, G.R., M.D. Finke, and M.L. Sunde. 1982. Potential value of the Mormon cricket (Orthoptera: Tettigoniidae) harvested as a high-protein feed for poultry. *J. Econ. Entomol.* 75(5): 848-852.

Chapter 4. Trying to Do Grantsmanship Like an Ordinary Scientist

It was only a couple of months after the symposium that the first attempts were made to find outside funding. The first goal was not to find research support, but to fund a conference on the potential of insects as food or animal feed. I had not intended to approach NIH (National Institutes of Health) about such funding but decided it was a good place to start after I heard that George Luttermoser, Executive Secretary of the NIH Tropical Medicine and Parasitology Study Section, had been inquiring about who it was at Wisconsin that was doing research on insects as protein. I knew who Dr. Luttermoser was as I had just earlier been appointed to a 4-year term, beginning July 1, 1975, as a member of his Trop Med Study Section. NIH study sections provide peer review of research grant applications, and my appointment was because of my presumed expertise on mosquitoes and mosquito-borne arboviruses, and other medically important insects, not because of any presumed knowledge about insects as protein. I wrote (June 19, 1975) to Dr. Luttermoser as follows:

Dear George:

Bob Hanson told me you asked him who is the entomologist at Wisconsin who has been doing something with insects as protein. I'm probably the one you heard about. I haven't done anything but I did say some things that were picked up and carried everywhere by press, radio and TV. Some of it in very garbled fashion.

Back on April 22 I presented a paper here at "A Symposium on Unconventional Sources of Protein." Enclosed is a manuscript that I adapted from that presentation and which has been accepted for publication in the December issue of the Bulletin of the Entomological Society of America.

I think the subject is worthy of some exploratory research in a number of directions, and I would like to stir up some interest among entomologists and other biologists. Probably the most valuable thing that could be done next would be to convene a workshop or symposium from among the few who have done pertinent research and from those who are most knowledgeable about the biology of certain insect groups and can best estimate their mass-production potential as a source of protein and/or calories.

Our Department is interested in hosting such a conference and I have planned to contact NSF or Rockefeller to see if they might be interested in a proposal for support. Is there any chance that NIH might be interested? An amount of about \$25,000 would probably be adequate to pay travel fare and maybe a \$100 honorarium in lieu of expenses to some 15 to 20 participants for a 2-day meeting.

The packet of applications arrived two or three days ago. I may be in Oklahoma for a meeting part of next week although that is uncertain at the moment. If you have not called before I leave, I will call you as per your note that came with the packet.

Sincerely,

He responded by letter of July 1 that he had so far had no luck in finding anyone interested in sponsoring the proposed conference and suggested several agencies and names that I might try. I don't remember that I actually contacted any of them, but on August 4th did write to the National Science Foundation (NSF) outlining the conference idea and asking if they would be receptive to a formal proposal. I received a reply, dated October 30, 1975, from Richard C. Warder, head of the Resources Division. It was a very polite letter, which is duplicated below as an excellent example of what I would come to know over the next decade and a half as the classic rejection letter. Rejection letters seldom if ever say a proposal is rotten or non-meritorious in any way, or openly laugh at its total absurdity, only that it does not fit the donor's current program objectives:

Dear Dr. DeFoliart:

After careful review, we have determined the proposed research entitled, "Insects as a Source of Protein," does not support our program objectives as they are presently defined and budgeted. For that reason, no further processing of your proposal is planned at this time.

Please understand that this does not constitute any judgement of the research merits of your proposal, but rather we have considered your research in relation to our program priorities.

We encourage you to continue contributing your researchable ideas to the Resources Program.

Sincerely yours,

It did bother me slightly that it was twice called a research proposal -- suggesting that the subject itself was probably so far removed from NSF's "program objectives as presently defined" that it might not have had, conceivably might not have had, a very careful reading.

Our first application for research support went to NIH, probably because that was where I had been getting most of my mosquito research funding. Of course this wouldn't go to the same study section, Tropical Medicine and Parasitology, that had been so congenial in providing funding for mosquito/virus studies. This one would go to the Nutrition Study Section where I was not known from Adam.

Some football coaches much prefer the run over the pass. One of these was Daryl Royal of the University of Texas Longhorns who used to say, When you pass, three things can happen and two of them are bad. The two bad things are that the pass will fall incomplete, or, worse yet, be intercepted. It's the same way with grant applications sent to NIH. Of the three things that can happen, two of them are bad. The good thing is that it might be Approved **and** funded. The bad things are that it could be Disapproved or maybe approved but with insufficient priority for funding. For practical purposes, there is very little difference between disapproval and approval without funding. Our application, titled "Insects as a High Protein Food Resource," and asking for \$29,552 the first year and \$91,252 over a three-year period, was forwarded by the UW's Research Administration-Financial to NIH's Division of Research Grants in Bethesda, Maryland

on October 25, 1979. Our “I regret to inform you . . .” letter from NIH was dated June 5, 1980 and the accompanying pink Summary Statement was stamped “Disapproval.”

We decided to try again, this time requesting a budget of \$35,161 the first year and \$102,949 over three years. It was forwarded from the UW Financial office on February 25, 1981. I heard from Dr. John R. Schubert, Executive Secretary of the Nutrition Study Section, dated April 10, 1981, that NIH considered this a revised application and would need a statement “specifying what significant changes have been made [including] additions, deletions, revisions and any responses to criticisms in the previous summary statement.” It should also “incorporate any work done since the prior version was submitted,” and “the required statement should be provided without delay, preferably for receipt within three weeks.” I responded to Dr. Schubert under date of April 24:

Dear Dr. Schubert:

Thank you for alerting me to the fact that a revision statement was needed to accompany our proposal, “Insects as a High-Protein Food Resource.” The current proposal is such a complete re-write that it hardly occurred to me that it is nevertheless a revision of last year’s proposal. The Statement is enclosed, plus information on the period covered since last review and personnel involved during that period.

Regarding the part of the Instruction Sheet (p. 13) which states: “These changes must be further identified by appropriate underlining, indenting or changing of typography within the text,” I think it would be impossible to do this since the current version is completely rewritten, not to mention that the application form has been changed since last year’s proposal was submitted. I hope that you concur in this.

Our project has undergone institutional review regarding the use of human subjects and I was informed some time ago that a copy had been sent to you. I will check on that.

Again, thanks for calling these deficiencies to our attention.

Sincerely,

The Revision Statement was as follows:

A. Specific Aims:

More narrowly focused now, proposing studies on only three insect species. An important addition to this proposal is the inclusion of the grey cricket, Acheta domesticus, an omnivore which we consider to have tremendous potential as a rapid recycler of a wide range of organic wastes directly to high protein powder. The conceived nutritional studies are now broader and in much greater detail than formerly, as will become apparent in the Preliminary Results and Methods sections.

B. Significance:

Introductory paragraphs: All new.

Quality of Insect Protein: All new except that first two paragraphs were extracted from the previous proposal.

Insect Food, Growth, and Food Conversion Efficiency: Quite similar to original version but less than half as long.

Methods of Management and Harvest: Now focuses on only three species, one of which was not included in the prior version. A significant change of viewpoint as to the priority of criteria for selecting candidate species is described in the last paragraph.

Summary Statement: New.

C. Preliminary Studies:

All new, including all tabular data except those on proximate and amino acid analyses of Mormon cricket (parts of Tables 1 and 2, respectively).

D. Methods:

Newly described are planned studies on metabolizable energy, vitamin content, and bioavailability of certain amino acids and minerals for each of the insect species; procedures for determining feed/gain ratios and growth rates of the grey cricket on a variety of animal manures; and feed trials involving rats (slope ratio assay) as well as chicks, in the case of the grey cricket which is a candidate for both poultry and direct human consumption.

Responses to Criticisms in Summary Statement:

- 1) “Although there have been a number of scientific articles and books written on the subject of insects as human food, none of them are cited in this application.”

Three books (References 1, 4, 5) relative to insects as human food are cited this time. They were not included before because they mainly summarize information of an observational nature on use of insects by preindustrial cultures, and recipes, but provide little experimental data on nutritional value of insects. We have again not extensively cited articles that contain such information as they would only unnecessarily lengthen the Literature Cited. Ruddle (1973) is cited as an example of this type of literature.

- 2) “The actual procedures that are related to nutrition are only sketchily described and do not represent a strong scientific approach for determining protein quality.”

This criticism was very much deserved. See response under (3).

- 3) “The experimental plan is ambiguous and vague in several places, partly no doubt, because precise methodology must be developed following choices of insects and of their feed sources.”

A year ago we were still on a fishing trip, uncertain just where to drive the first wedges into this subject which is still essentially virgin research territory. Narrowing the focus to include only three insect species, better perspective on systems that appear actually feasible for development, and accumulation of some nutritional data have eliminated some of the problems. It is one thing to say insects would make nice nutritious food, it is another to identify which species may lend themselves to economic production on a significant scale and how, at least possibly, this might be accomplished. Regarding Criticism #2, specifically, I believe that perusal of the protocols and experimental procedures outlined in the Preliminary Studies and Methods sections will show that this deficiency has been corrected. The procedures described are designed to lead to the formulation and testing of complete diets based in each case on the specific insect and test animal involved.

- 4) “Even more, extensive mineral analyses of the insect material produced would be interesting and possibly revealing but it is not suggested that these will be attempted.”

Studies on mineral content and availability are outlined in the present proposal.

- 5) “Some of the observations supporting the potential compatibility of insect production with other, conventional types of animal agriculture are open to question.”

That is true and that is why the research is needed. The USDA annually sprays or baits several sizeable areas in the western states for Mormon cricket control. Our minimum objective in quantifying the nutritional value of the crickets is not only to establish a new protein source but to supplant chemical control with cricket harvest, thus reducing the pesticide load on the environment. There is evidence (discussed more fully in the previous proposal) that on the grassland types of range found in Colorado, Wyoming, eastern Idaho, and Montana, the crickets largely utilize plants different than those utilized by livestock. If this can be more firmly established, it would simply be an additional reason for recognizing the Mormon cricket as a manageable resource. Of much greater potential importance, however, is that

if such a change of attitude can be effected regarding the Mormon cricket, it could serve as a prototype effort for the development of similar studies and programs involving migratory locusts. The latter are devastating pests of crops in most of the poorest agricultural regions of the world. Huge amounts of insecticide are expended in international control efforts, yet the locusts represent a potentially manageable food resource.

- 6) Regarding permethrin in baits for Mormon cricket harvest: "It would be useful to have LD₅₀ or similar quantitative data."

The rat LD₅₀ is given this time, plus assurances that baited material will be analyzed for permethrin residues. Actually, any permethrin present should break down to nontoxic compounds during the drying process.

- 7) "The proposal would be more attractive if restricted to those insects that could be mass-produced on organic wastes."

The grey cricket, a colony of which we established only about 4 of 5 months ago is rapidly becoming the focal point of the project. We believe that it has all of the attributes necessary to become a "world class" food insect. We believe that, nutritionally, it will be at least equivalent to the Mormon cricket (protein content is higher, but amino acid analysis is not completed). In recent tests (after the proposal was submitted), it has shown excellent growth on ground, dry poultry manure without any supplementation. Although only tests of growth on animal wastes are specified in the proposal, there is now reason to believe that the grey cricket can also equally recycle a wide variety of wastes of plant origin. Finally, it has unlimited flexibility as to scale of production, from family-size operations (many gourmet food buffs rear their own) to village size to commercial production on any scale desired. It even has a very pleasant "chirp." We are excited about the prospects with this insect.

- 8) The use of taste panels to test flavor of chickens grown on diets that include insects has been reviewed and approved by the University of Wisconsin Committee for Protection of Human Subjects.

Additional Information for Preliminary Studies Section

Period covered: Approximately February 15, 1980 to February 15, 1981.

Personnel:

G.R. DeFoliart, Professor, entire period, 20% effort.

M.L. Sunde, Professor, entire period, 05% effort.

M.D. Finke, Research Asst (Grad student), entire period, 50% effort.

S.V. Landry, Research Asst (Grad student), June 1, 1980 to end of period, 50% effort.

Our letter from NIH (from Gerald F. Combs, Nutrition Program Director, National Institute of Arthritis, Diabetes, and Digestive, and Kidney Diseases) was dated September 28 and notified us that our grant application was recommended for approval, but, “We regret, however, that because of its relative competitive position an award cannot be made. . . .” Well, this had to be thought of as progress, or at least a sign of respectability, even if we still had no money. Indeed our pink slip (Summary Statement) was stamped Approval and the critique was much kinder this time.

While all of this was going on with NIH, I composed a letter, really a pre-proposal, asking potential donors if they would like to receive a proposal. From the second paragraph, it is obvious that I had already concluded that if I was going to continue trying to peddle this miserable subject, I needed to make a list of all of the good points (my good points) that I could think of, to help establish personal credibility.

Dear [several different addressees, all of them presidents or executive directors of foundations:]

This letter is to inquire whether the Kellogg foundation might have an interest in either long-term or in short-term emergency support for research on the possible use of insects as a high protein food resource.

Let me briefly introduce myself. I am a professor of medical entomology here at the University of Wisconsin and a former chairman of the Department of Entomology (1968-76). My major research focus is on mosquito-borne arboviruses and, particularly, the transmission dynamics of LaCrosse virus, one of the California encephalitis group. We are now attempting to model this system with the belief that the virus can be locally eradicated using currently available technology. Currently, and for the past 15 years this program has been supported by the National Institutes of Health.

I became interested in the possible use of insects as a food and feed resource several years ago, and two years ago obtained modest funding (about \$8,000 annually) from the College of Agricultural and Life Sciences to initiate research on the subject. An approximately equivalent amount was obtained a year ago from the University of Wisconsin Graduate School and I now have two graduate students on the project.

One reason for seeking additional support now is that the funding from the Graduate School is temporary and interim until outside support can be found. A second reason is that there is a third graduate student who is eager to become involved in the project. The availability of a motivated student is important, as I have been reluctant to recruit students for a field of research endeavor that does not yet exist as far as future career opportunities are concerned.

Briefly, my reasons for believing that this subject warrants research exploration are the following. The few bits of research that have been done indicate that insect protein is of high quality nutritionally, nearly as good as bone or fish meal and somewhat superior to soybean meal. Some insects are also high in fat and therefore a good source of calories. They are, of course a natural food for many kinds of animals and have been used as food by many human (mainly pre-industrial) cultures. Of great importance is the fact that insects in general

have great reproductive capacity and rapid growth rate and some species show extremely high food conversion efficiencies, in the range of 20-50 percent, depending on the substrate—insect combination involved.

Finally, since almost every substance of organic origin is utilized as food by one insect species or another, it should be possible to develop insect production systems based on vegetation and/or waste substances of nearly any geographical area. Such systems appear particularly adaptable to Third World situations because they would be, initially at least, labor intensive and in warmer climates would require no fossil energy input.

Our work is still primarily at the screening level—looking for the most promising substrate—insect combinations. Our basic experimental protocol for candidate species is to determine growth and food conversion efficiencies on a variety of cheap or waste substrates and the amount of protein potentially harvestable; nutritional screening includes determining proximate composition of the insects (crude protein, fat, fiber and mineral content), amino acid pattern, and conducting chick feeding trials. For the nutritional studies, I have the cooperation and participation of Dr. M. L. Sunde, biochemist and nutritionist, in the Poultry Science Department. I think that insects have great future potential for direct human consumption, but because of the aversion that many people have as yet, we are focusing now on developing insect-poultry systems since poultry are among the most widely acceptable of meat animals, among the most efficient in feed conversion, and among the meat animals most available to people of marginal economic circumstances.

So far we have worked only on North American species because of their availability and the small size of our project. We are currently working on three species, the Mormon cricket and two species of Lepidopterous (moth) larvae, and have accumulated a considerable amount of data on the Mormon cricket. Cricket powder (58% crude protein) can be substituted for the soybean meal in chick diets with no loss in growth or efficiency. Although the Mormon cricket has food potential of its own, my reason for initiating work on it was to gain some insights that might be applicable in similar studies on some of the migratory locusts that occur in chronic food shortage regions and which I believe represent a tremendous potential food source.

The above will give you an idea of where we are now. So far this has been operated as a small sideline project but I am now ready to expand it because I believe that the potential benefits are enormous. There are three additional insect species that I would like to begin work on and have a topflight graduate student ready to go on two of them.

If this endeavor seems of interest to you, I would be happy to submit a proposal. Possible funding support of about \$10,000 per year, or preferably at \$18,000-\$20,000 per year would be of interest to me. In closing, I sincerely appreciate any consideration that you may give to this inquiry.

Sincerely,

I fired off three copies of this on September 5, 1980, to the W.K. Kellogg Foundation, The Rockefeller Foundation and the Hill Family Foundation, and two more on October 10 to the Compton Trust and The Ford Foundation. I waited, but I didn't hear from anybody wanting to see a proposal. In fact, I didn't hear at all from Compton or the Hill Family (unless responses were sent that have become lost in the ensuing years). The fact that not even one out of five wanted to look at a proposal helped to strengthen the thought that this was going to be a long, hard sell. Maybe harder than I had anticipated. The score was now 7-0; seven proposals or pre-proposals submitted, zero proposals funded.

The next ports of call were the USDA (U.S. Department of Agriculture), Science and Education Administration, asking for \$141,972 over three years, and the John D. and Catherine T. MacArthur Foundation inquiring about their Prize Fellows Program. The USDA proposal was forwarded to them on February 25, 1981, and I was informed under date of April 6 that the proposal didn't fit the guidelines for 1981 and had been withdrawn from competition. My letter to the MacArthur Foundation, dated May 11, 1981, began with the following paragraph:

I noted in the newspaper recently (Wisconsin State Journal, April 22) that the John D. and Catherine T. MacArthur Foundation is planning to support the efforts of a number of people who "eschew the conventional wisdom" and who "show promise of making some kind of major contribution to mankind." For several years I have been trying to develop a subject that I believe might qualify for your consideration. Briefly stated, it is that insects constitute a potential high-protein food resource which, if exploited could significantly increase our ability to overcome present and impending world food shortages.

Totally, the letter was two pages long. Based on my record of getting funding for this subject, I thought it seemed obvious that I qualified as one of those who "eschew the conventional wisdom." I received a letter from Gerald Freund, Vice President, thanking me for my interest in the Prize Fellows Program and asking me to please note that direct applications cannot be considered. Candidates can be nominated only by designated nominators who serve anonymously and are located throughout the country.

Two proposals prepared in 1986 went nowhere. One, in fact, was aborted before leaving campus.

It was a 4 ½ page pre-proposal to be directed to the Program in Science and Technology Transfer of the AID (Agency for International Development) Office of the Science Advisor. It would have as collaborators myself and Dr. Julieta Ramos-Elorduy de Conconi of the Instituto de Biología at the Universidad Nacional Autónoma de México in Mexico City. We were asking for a 3-year budget of \$128, 546 for a project titled "Enhancing the Value of Certain Insects as a Source of Food and Income in Rural Mexico. Dr. Conconi, who was spending about six weeks in our lab, had already done extensive research on the use of insects as food in Mexico. The trouble with this proposal was that I had not yet learned that one must always read the directions carefully before embarking on the job to be done. This AID program was aimed at stimulating new and innovative research on problems confronting developing countries. Submissions from scientists in those countries in cooperation with U.S. scientists were encouraged. It was

only after the pre-proposal was finished that I noticed that Mexico was not considered by AID (in this program at least) to be a developing country. Mexico was a “middle income country.” So, it would have been a great collaboration, but we should have read the rules first.

The other outside funding effort in 1986 was an application to the W.K. Kellogg Foundation asking for, depending on which options they might choose, around \$100,000. They chose none of the options offered, and themselves offered no counter-options.

I seemed to start getting serious again in 1987 about getting some outside money from somewhere. Funding requests to the Rockefeller Foundation (June 2, 1987) and the World Resources Institute (May 28) introduced the newly created Food Insects Research and Development Project at the University of Wisconsin. The covering letter to Rockefeller is duplicated below:

Dear Sir/Madam:

A new interdisciplinary project at the University of Wisconsin is aimed at preserving and developing a world resource that may be new even to the Rockefeller Foundation. The project is called the Food Insects Research and Development Project. Insects have been used from time immemorial as a food resource by indigenous peoples of non-European origin. Because of western attitudes, however, this food insect use has been ignored or discouraged, even among populations that are not economically able to compensate for the nutritional loss. What is needed, and needed rather urgently if this resource is not to be irretrievably lost, is advocacy and reinforcement by the scientific community of the concept that insects are no less “respectable” than western-approved plants and animals as a source of nutrition. Creation of the Project is intended as the first step in providing this advocacy and reinforcement.

For several years research has been conducted here at the University of Wisconsin on insects as a high-protein source for poultry. More recently, we have conducted rat-feeding trials, the results of which will be appearing as a series of papers in the Journal of Nutrition. This effort is currently being expanded to include human nutritionists and other food scientists and engineers as well as the original animal nutritionists and entomologists. Objectives include in-depth studies on the food quality of insects as well as developing mass-production and mass harvest systems for certain food/feed insects.

It seems obvious that any attempt to maximize the contribution that insects could make to human nutrition should include building on the existing base in cultures having a strong tradition of food insect use. Equally obvious, if insect use is not to disappear, is the necessity of simultaneously trying to reverse, or at least partially counter, the centuries-old tide of negative western influence. This is a gargantuan task, of course, but maybe not impossible considering the increasing concerns about environmental degradation (including rainforest destruction) and increasing emphasis on appropriate technology, alternative crops, and developing systems of sustainable agriculture.

The project already has the expertise and knowledge base for assuming an advocacy role, but research is still needed to strengthen the advocacy position (the plant and animal sciences have a head start of several centuries). In most cases a

research component of greater or lesser depth will also be necessary in establishing specific development programs.

I have enclosed a short 3-page “Synopsis of Rationale and Objectives” and a longer, more detailed Background Document which describes the scope of the subject and multiplicity of approaches warranting attention. We are now looking for funding for specific projects that will support and strengthen the overall advocacy program. Approximate budget needs for activating specific projects are described on pages 37-38 of the Background Document.

I would appreciate hearing from you as to interest that the Rockefeller Foundation might have in supporting one or more specific aspects of the program. I apologize for the bulkiness of the documentation, but although the use of insects as food is not new, the attempt to involve and integrate food, agricultural and social scientists in developing the potential is new and requires more than a perfunctory explanation of rationale and procedure.

Sincerely,

The covering letter to the World Resources Institute (WRI) was nearly identical except for the fourth and fifth paragraphs which are printed below:

So far as I know, WRI does not directly fund endeavors such as this (still requiring a research component), but I am writing to you for two reasons. The first is to let you know that the Project exists, as its goals are aimed at helping to alleviate several of the problems that are among the major concerns and commitments of WRI, e.g., improved nutrition among the rural poor of the developing world (and thus hopefully having the additional benefit of reducing pressures for tropical forest destruction); potential new options in the promotion of sustainable agriculture in Africa and elsewhere; and reduced pesticide use through substitution of managed harvest of a number of major pest insects as food or as poultry and livestock feed.

Second, in beginning our search for funding sources, I anticipate that our most frequent experience will be that the potential donor organization will find this a square peg that is difficult to fit into round holes. This is particularly true because, although the Project already has the expertise and knowledge base for assuming an advocacy role, research is still needed to strengthen the advocacy position (the plant and animal sciences have a headstart of several centuries). Also, in most cases a research component of greater or lesser depth will be necessary in establishing specific development programs. Thus, I would very much appreciate any assistance that WRI might give by providing leads to organizations that seem particularly likely to have an interest in supporting the Project’s objectives.

I got the usual rejection from Rockefeller, written by Alva A. App, Director of Agricultural Sciences, but he did close with a nice sentence, “We are very sorry not to be more encouraging since your proposal and research interest are unique and certainly

deserve careful exploration.” The first paragraph of the response from WRI, written by Jessica T. Mathews, Vice President and Director of Research, is duplicated below:

As you guessed, the Food Insects Research and Development Project is new to WRI. I am convinced by your material however that it is well worth pursuing. This is one more example, of which we have seen so many, of the importance of extracting the wisdom from traditional systems and technologies and applying the best that modern science can bring to bear to raise their potential. We are glad to know about the project and hope you will keep us informed as it moves along.

In a second paragraph, she listed several possible funding sources that we might try. In late September of 1987, I sent identical proposals and cover letters to the H.J. Heinz Company Foundation and to the Thomas J. Lipton Foundation, Inc. (neither of which were suggested by Mathews). The cover letter was as follows:

Dear [different names]

Because the subject matter of this proposal is quite unusual, I hope that it will be acceptable that it is described by letter rather than in some more rigid format. It comes as a surprise to most people in the United States, even to those expert in the food and agricultural sciences, that insects are an important and traditional source of food throughout the rural areas of much of the developing world. While international efforts to improve agricultural production have been successful in converting many developing countries from food importers to net exporters, those efforts have not been so successful in substantially reducing malnutrition among indigenous populations. It is in this latter dimension that insects, given the proper attention, can make an enormous contribution to human nutrition. We have attempted to document this statement as briefly as possible in the enclosed background paper.

Beginning in June, 1986, at the University of Wisconsin, a formerly small research project on insects as a high-protein source for poultry production has been expanded into an interdisciplinary undertaking called the Food Insects Research and Development Project. It includes among others, human and animal nutritionists, food chemists, engineers and microbiologists, and entomologists, totally about 25 UW faculty who are available as advisors/collaborators on specific projects that may be undertaken.

Goals during this past year of organization have been to, first, establish an authentic North American voice of advocacy for the concept that insects are a food as wholesome and respectable as any other; secondly, to begin establishing cooperative ties with interested scientists and others in Third World countries; and third, to begin identifying the types of research, development, technology transfer, and extension activity that will bring about the most effective utilization of the indigenous food insect resources in those countries. In those countries where food insect use is traditional, it is only logical that insects be included along with plant and other animal resources in any agricultural development plan.

Although the Number 1 goal is establishing global advocacy for the recognition of insects as an important food resource in the Third World, a second

major goal is to introduce Americans to insects as food, initially as snack foods. Germane to both of these efforts is the need for in-depth studies on the food quality of insects. Biochemical analyses, of which there are many, have shown insects to be high in protein, high in energy, high in various vitamins and minerals, and low in saturated fatty acids and cholesterol. Except for protein quality, however, studies on bioavailability are almost nonexistent. Nothing is known, for example, about the nutritional quality of insect fiber.

Specific objectives of the Project are the following (rationales and approaches are described in the enclosed background paper):

- 1) Develop up-to-date inventories on the use of insects as food and/or animal feed in each of the 40 or more countries where such use is important.
- 2) Establish better communications among scientists and others who are interested in insects as food and/or as animal feed.
- 3) Assist, if and as able and needed, Third World scientists and others interested in maximizing the nutritional contribution of their indigenous food insect resources.
- 4) Development of mass-harvest methods for potential food/feed insects that are attracted to light or to chemically-baited traps.
- 5) Development of controlled and semi-controlled mass production methods for insects used as food in developing countries.
- 6) Development of mass-harvest strategies for migratory locusts, grasshoppers, the Mormon cricket and other major pest species that form destructive aggregations that move en masse in nature.
- 7) Develop insect recycling systems for converting organic wastes and underutilized substances into high-protein feed supplements for poultry, swine and fish production.
- 8) Education of the American public as to the palatability and nutritional quality of insects and their importance as food in much of the developing world.
- 9) Develop, as "small farmer" enterprises, controlled mass-production methods for certain insects as snack items on the U.S. market.
- 10) Conduct in-depth studies on the food quality and safety of selected insects.
- 11) Insects as food for long-term space flight.

Significant progress has been made in establishing a framework within which these objectives can be accomplished. For progress to continue, however, specific funding will be essential. Thus, I am writing to acquaint you with the Project and its goals and to determine whether one or more aspects of the program are compatible with the program interests of the Lipton Foundation. We are looking first for donor organizations that would be interested in supporting the general operating budget of the Project to the extent of \$5,000 or more for one or more years. The operating budget needed is approximately \$15,000 per year and will be used to support the general program of strengthening advocacy and for such exploratory research and other activity as is necessary in pursuing each and all of the above-listed objectives. These funds will also help support the one staff

position in the Project, a half-time entomology specialist (page 20 of the background paper).

Secondly, we wish to identify potential donors who would be receptive to specific proposals relating to objectives 3, 6, 9, or 10 above. Except for projects under Objective #3 which will continue to be variable in their funding needs, these will usually involve a graduate student or postdoctoral appointee and require funding at a level of \$15,000 to \$20,000 per year for 2-3 years. While many of the objectives are suitable for funding by international agencies such as U.S.A.I.D., we particularly hope to identify one or more food company foundations to whom Objectives 9 and 10 are of interest (pp. 32-37 of the background paper). These relate to the production and nutritional quality of certain insect products intended for the U.S. market.

The enclosed background paper is intended to provide wider perspective on the rationales of this proposal. Although the use of insects as food is not new, the integration of food, agricultural and social scientists in an attempt to develop and extend the potential is new and unique. We would very much appreciate hearing as to interest that the Lipton Foundation might have in supporting this program.

Sincerely,

Some people might think it would take a lot of brass to send proposals promoting the virtues of insects as food to established titans of the food industry like Heinz and Lipton. For all I know, the recipients may have cringed with the hope that nobody would ever hear about this. For my part, by now I was so accustomed to rejections that they were like water off a duck's back. Two more meant nothing. The responses from the food company foundations were like any others, very apologetic for having to say no. Both wished me success elsewhere and neither said anything like, "And please, never try to contact us again."

A fifth application in 1987 was submitted closer to home – right here in Wisconsin, in fact. The Wisconsin Department of Agriculture, Trade and Consumer Protection had just established (in August) the Sustainable Agriculture Demonstration Grant Program, which would "provide grants to Wisconsin individuals, groups or organizations for demonstrations of agricultural practices that can improve energy efficiency or reduce energy consumption and which have a positive effect on farm profitability and the environment." Restricted to Wisconsin, this looked like reduced odds. A pre-application was required and we submitted ours on October 5. We must have gotten a "thumbs up" on the pre-application, because we submitted a full application dated November 23. The pre-application, titled "The production of honeybee brood as a snack food for the U.S. market," gives a pretty concise description of what the project was all about and is reproduced below:

[copy most of it]

Despite reduced odds, we did not win. Undaunted, and bowed but not broken, we again submitted an application (September 2, 1988) to the Wisconsin Sustainable Agriculture

Demonstration Grant Program. This was a slightly revised version of the one submitted the previous year. On January 4, 1989 we were notified that Ag Department Secretary Howard Richards had approved 22 projects for 1989 and 1990. Our project was not one of them.

Another turn-down in 1988 (the letter regretting to inform us was dated April 12) was a pre-proposal titled “Maximizing the Nutritional Contribution of Insects as a Food and Animal Feed Resource in Brazil,” which had been submitted for funding under the U.S. – Brazil Science and Technology Initiative. This was under the direction of the U.S.D.A., with the money furnished by the Department of State and the National Science Foundation.

Also submitted in 1988 (October 11) was an application to the Charles A. Lindbergh Fund, Inc., titled “Insects as Food: An Overlooked Resource That Can Promote a Better Balance Between Technology and Environment.” This was a lot of energy expended for the possible awarding of a maximum of \$10, 580 (“a symbolic amount representing the cost of the ‘Spirit of St. Louis’”). Our title reflected the Lindbergh Program’s objective of achieving “a better balance between technology and our human and natural environment.” The Fund’s concept of balance is based on the vision of Charles Lindbergh, who said, “The human future depends on our ability to combine the knowledge of science with the wisdom of wildness.” I gave them nine pages and a request for \$10,100. In addition, each applicant was required to name two “endorsers” who could attest to his/her ability to carry out the proposed work successfully. I decided I would haul out two heavy-hitters, Stanley D. Beck of the U.W who would be elected to the National Academy of Sciences only a year later, and David Pimentel of Cornell University, internationally known for his expertise on efficiency in agriculture and effect of pesticides on environments. Dave and I had known each other since our Cornell grad student days. I learned later that in 1988, 217 applications were received and reviewed, 8 were funded, with average size of grant \$10,096.88. With numbers like that, you can lose even with heavy-hitters at your side. (About this same time, I was attempting to organize, and find funding for, an international symposium to be held in conjunction with the ESA centennial anniversary; see Chapter 11 for that story.)

My only hope was that one of my old standby’s would rescue me. I’m talking about The Rockefeller Foundation, the W.K Kellogg Foundation, and the World Resources Institute. Rockefeller and Kellogg both noted that they did not fund conferences unless they were part of, or essential to, projects they were already funding. I thought Jessica Mathews’ reply, for WRI, sounded like she might be getting a little tired of hearing from me:

Dear Dr. DeFoliart:

Your impression is incorrect, WRI – like any other non-profit – has trouble enough paying for its own conferences etc.

I wish you the best of luck in finding the needed funds.

Sincerely,

On December 17, 1990, I wrote to Dr. Fred Buelow, Director of the Curricular Revitalization Project here at the U.W. I wanted his opinion on a proposal on outreach I wanted to send to the Kellogg Foundation. As the Foundation furnished support for the CRP, I wanted to be sure that the proposal wouldn't in any way screw-up the relationship. The letter to Buelow was as follows:

Dear Fred:

Thanks for agreeing to look over this proposal and give me an idea of whether you think it might get anywhere with the Kellogg Foundation. I believe that with this subject, more than most others, it is necessary to provide some solid documentation. It makes a bulky packet but the backgrounding is there in case the reviewer wants it.

As long as I had major outside funding for the medical entomology program, I could "bootleg" this project, but I had to let that funding expire (in September) in order to "retire" and spend full-time on this project. With no staffing and the large volume of correspondence now generated by this project (the Department is hassling me lately about my postage and clerical time costs), the situation is getting fairly critical. The Center for Biology Education is interested in providing some interim support for Objectives 6 and 7 of this proposal, but maintains that the rest of the project is an "established fact." That is true, but unless some new financial underpinnings are found soon, the larger project will fast become the victim of its own success, and, in my opinion, all of the other objectives derive their validity only within the context of objectives 1-3. So I am unwilling to accept separate support for Objectives 6 and 7 without first guaranteeing the survival of the core part of the project.

I certainly appreciate your willingness to take a look at this.

Sincerely,

This was followed on January 17, 1991 by a letter to Dr. Thomas L. Thorburn, Coordinator of Agricultural Programs at the Kellogg Foundation:

Dear Dr. Thorburn:

The enclosed proposal, "Educational Outreach Program on Insects as a Food Resource," is, in part, an outgrowth of the Kellogg-sponsored Curricular Revitalization Project here at the University of Wisconsin. Because of that, I asked Dr. Fred Buelow here whether there would be any objection to sending the proposal to the Kellogg representative who has worked with the University. As there was none, I am sending the proposal to you.

For reasons described in the introduction of the proposal, I believe that the project has important implications for agriculture both here in the United States and in the developing world. What started initially as a modest effort to network interested scientists is suddenly ballooning into a major educational opportunity. At the very time when the outreach effort appears to be "taking off," however, we are caught with staffing and operational funding (both of which are essentially zero) that is entirely inadequate to meet project demands. For the past couple of

months, in a trend that is definitely upward, the project has been generating up toward 100 pieces of correspondence per month, much of it responding to requests for printed materials. We are in danger of becoming victims of our own success.

The budget request is \$38,000 for one year with optional renewal. I apologize for the bulkiness of the packet, but wanted to provide such documentation and backgrounding as might be useful in evaluating the proposal. If the Kellogg Foundation is interested in the proposal, I will be happy to furnish any additional information that may be desired. Your consideration of the proposal is very much appreciated.

Sincerely,

Receipt of the proposal, titled “Educational Outreach Program on Insects as a Food Resource” was acknowledged by Thorburn’s secretary, January 25, and the usual rejection letter, from Dr. Thorburn himself was dated March 26. Following this, I launched my last spray gun effort to secure funding. Cover letters were dated June 3, 1991 (except one dated June 5) and sent to these eight foundations (listed alphabetically): Andrew W. Mellon Foundation, Compton Foundation, Inc., Ford Foundation, Gaylord and Dorothy Donnelley Foundation, General Service Foundation, Jessie Smith Noyes Foundation, The Pew Charitable Trusts, and The Prospect Hill Foundation. Counting Kellogg just a few weeks earlier, it was a total of nine.

The rejection letters came in, dated from June 10 to July 25. For the second time out of two tries, no acknowledgement at all was received from the Compton Foundation. I’ve wondered if maybe they thought someone was trying to play a practical joke on them, seeing if he could get them to respond to a request for funds to show that insects make good food. Actually, there were a couple of nice remarks among the rejections, remarks that might have given encouragement to a younger person. In the letter from Stephen Viederman, president of the Jessie Smith Noyes Foundation, for example, he penned in at the end of the formal letter: “Sorry. I found your materials of great interest, as a student of food history and culture.”

By now the score had risen to Rejections (?) – Fundings (?) A score like this would crush the confidence of most people, especially likely for anyone who had nothing to fall back on. Fortunately, I had plenty to fall back on. By 1991, NIH had supported my main research program, the mosquito/virus project, “Biology and Control of California-Group Viruses” for 23 consecutive years. Funding for other projects in medical entomology had also come relatively easily. So all of those rejections by agencies and the foundations on food insect proposals in no way damaged my self-respect. I was confident that we had accomplished a lot and were simply ahead of the pack and deserved funding support whether we got it or not. The 1991 proposal is duplicated below. The reader can judge for him/herself :

[Copy]

Chapter 5. Internal Budget Support: The College of Ag and Life Sciences

In 1978, I had been on the UW campus for 19 years without applying for a Hatch project. Having a Hatch grant (although only one) was considered almost a “sacred right” by research faculty in the College of Agricultural and Life Sciences. So you can imagine the depth and breadth of my “smugness” as I prepared my first application. Also, having this built-in advantage was causing me to look forward, with some anticipation I think, to taking the Ag deans (all of whom I liked) off into some very virgin territory. In fact, it could be that no Ag deans anywhere had ever been taken into such virgin territory before.

Before submitting the proposal, I sent a draft to several people just to see how they would react. Wendell Burkholder, a colleague in Entomology, wrote back: “Thanks for letting me read . . . I have had an interest in this work for many years. Your proposal is excellent and I hope it is supported. I will provide any insect culture and rearing procedures that you may need and also will give you help in any way I can.” Stan Beck, another Entomology colleague, responded, “. . . I have reviewed the proposal in detail, and am of the opinion that it constitutes a subject well worth vigorous investigation. I will be pleased to be associated with the program as an advisor.” Bob Pfadt, Professor of Entomology at the University of Wyoming, and an expert on grasshoppers, first answered several questions I had asked, then added, “I am happy to be listed as an informal advisor on grasshoppers in your Hatch Proposal.” OK. Forward!

Hatch Project # 5133, October 1978 through September 1982

The title of my first Hatch proposal was “Investigation of Insects as a Food Resource.” The full proposal, for those sufficiently interested, is added as Appendix # 1. The starting date would be October 1, 1978, and the first year objectives and approach as listed on the CRIS form were:

24 Objectives: Determine nutritive value of house fly, Musca domestica, pupae and cigarette beetle, Lasioderma serricornis, pupae reared in various waste materials as a protein supplement for poultry; similarly determine nutritive value of the Mormon cricket, Anabrus simplex; the greater wax moth larva, Galleria mellonella; the fall armyworm, Spodoptera frugiperda; and the southern armyworm, Spodoptera eridania.

25 Approach: The consumption index, growth rate, and efficiency of conversion of ingested food to body substance will be determined for the above insects reared on a variety of waste or low-cost plant and animal substrates. Pupae or larvae from substrates that produce good growth will be subjected to analyses for crude protein, amino acids, fatty acids, minerals and other constituents as may be warranted. If biochemical analyses of Mormon crickets shows them to be a good protein source, the behavior of cricket bands will be studied in the field in order to devise ways of harvesting them.

Professor Milt Sunde (Poultry Science) was listed as Co-Investigator, and personnel included Marsha Lisitza, Specialist. The requested budget for the first year was \$11, 150, and for the total of three years, \$41,514.

Under date of April 17, 1978, Bob Hougas (Robert W., Associate Dean and Director, CALS) forwarded to me the consensus report from the peer review panel. Dean Hougas suggested that: “Since there are a number of questions that have been raised, we propose that you and the chairman of the review panel meet with us to discuss these questions.” The panel (of three professors) had indeed raised some questions – about a page and a half double-spaced. But I liked the way the report started off, and this was the important thing because I wasn’t sure yet what kind of reception the subject was going to ordinarily get:

The investigator presents an interesting and imaginative approach to the use of insects as a food resource. Certainly, there is no argument against the need for inexpensive sources of good protein for human or for animal consumption. Insects represent a potentially important protein source. We do not know if the international orientation of significant parts of this project in any way makes it less eligible for funding. We simply point this out for consideration by the CALS Administration.

The major questions that the evaluating committee had centered about its extremely broad scope and ambitious objectives. There is clearly more proposed than can be done by the principal and one half-time specialist

If you are going to get questions, that’s the kind to get. You want them to say it’s overly ambitious. The scope is too broad. The investigator needs to prioritize. Anyway, on May 2nd, I sent six copies of five pages of revisions. On May 12, Bob Hougas informed me that they had approved my revised Hatch proposal and would be submitting it to Cooperative Research, USDA. On June 27th I had word from Bob Bray (R.W., Associate Dean and Director, CALS) that my proposal had been approved by USDA. My first Hatch Project Number was #5133.

On July 14, 1978, I wrote the first of what would become many letters which are necessary when you’re living on the edge, juggling a few cents here and a few cents there in order to make ends meet on shoestring budgets. The letter was to Dean Bray:

Dear Bob:

I was very glad to hear that my Hatch proposal has been approved.

Since the budget amount awarded was somewhat less than originally requested, I would like to suggest the following revisions of the budget:

- 1) Reduce M.A. Lisitza, Specialist, from 50% to 40% time and from \$6,400 to \$5,000 salary.
- 2) Reduce Supplies from \$750 to 700.
- 3) Leave Travel at \$1,800.
- 4) Delete space renovation of \$1,500.

These changes reduce the Entomology 1st year total from \$10,450 to \$7,500, this latter being, I understand, the amount awarded.

Thank you.

Sincerely,

The above was returned, stamped approved by Dean Bray. On September 1, 1978, a letter went out to Mr. Frank W. Kooistra, Assistant Dean and Director, CALS, and business officer:

Dear Frank:

Since talking to you the other day I have found that an adequate drying oven will cost a little more than \$500. As you thought you could okay only about \$200, can I suggest that I put \$300 that I can squeeze from an NIH Supplies budget with the above \$200 State and go ahead and order the oven.

The remaining \$1,000 of State money then would be held to combine with \$3,000 Hatch and \$2,569 from Grad School for the microscope. As you recall, the \$1,200 State was originally approved to supplement \$4,250 I have from NIH for a vehicle but the NIH money will still be available this time next year and I've decided we can squeeze another year out of our present vehicle.

Let me know if the above is okay or not. Thanks

Sincerely,

This came back stamped approved September 5 and signed by Frank. Continuing with High Finance, the following request was sent to Dean Bray, January 13, 1981:

Dear Bob:

This is a request that my Hatch Project (#5133) be extended for one additional year beyond the three years, 1978-1981, that were originally approved. As you will see from the annual report to be submitted soon, we have made significant progress in the first 2 1/3 years of work in this essentially virgin field of endeavor – exploring the potential of insects as a high protein source – and we are still picking up momentum. One manuscript is ready for submission and two others will be in preparation within two to three months. So far, we have not been successful in securing outside funding for this program, although efforts to do that will continue.

Your consideration of this request is greatly appreciated, and if you desire more information before the annual report is due, please let me know. Hopefully, funding can continue at the present (third year level), i.e., graduate assistant stipend plus \$700 in supplies and \$500 for travel.

Sincerely,

(signed)

cc: Mallory Boush [Entomology Department Chair]

The next letter on this, January 16, 1981, was from Dean Bray to Mallory Boush:

This will respond to a letter from G.R. DeFoliart requesting a one-year extension of his Hatch research project, #5133.

In accordance with his request, the Research Division is extending the termination date to September 30, 1982. It should be emphasized, however, that this decision is based on the College's change in policy in which the "normal" duration of most Hatch projects is now set at four years. In other words, the one-year extension granted simply brings the duration of this project to four years rather than the three-year period stipulated in the project as initially approved. Further, the Research Division will not provide one-year extensions to any project of four-year duration unless there are extremely extenuating circumstances.

Sincerely,

Then another problem and some complicated math, and another letter to Bob Bray (March 11, 1981):

Dear Bob:

The budget for my Hatch Project #5133 includes one RA [research assistantship] of which \$5,357 is shown from SEA funds and \$1,339 from State funds.

I have three graduate students on this subject now although I have no outside support as yet (proposals have been submitted to NIH and USDA). It was my intention to support one of the students, Stephen Landry for 10 months and another, Barbara Nakagaki, for two months on the Hatch stipend. In order to conserve the Hatch money, and use it that way, I put Landry's appointment for October and November on some other funds I had that had to be used before December 1, 1980, thus creating the two months for Nakagaki who started January 1, 1981. In attempting to put Nakagaki on my Hatch budget for March and April, however, I've been informed today that the Hatch stipend is used up.

My total personnel budget, both mosquito and food insect programs, is squeezed down so tight this year that I can't absorb even this relatively small reversal from current resources. It's beside the point that I don't feel responsible for the situation since the project budget clearly indicates a full 50% RA. The important point is that I sure hope that you can find some way to restore the necessary amount to the project budget. I will surely appreciate anything that can be done.

Sincerely,

Once again, Ag Administration comes through and saves the day. Dean Bray writes, March 16, 1981:

Dear Gene:

This is in response to your letter in which you are apparently short \$1,339 for the RA on your Hatch project #5133. As you will recall as chairman, that at that time we had split assistantships – some partially supported by Hatch and some State.

The split assistantships in your department has continued to be on your project. It is my understanding that Dean Walsh decided that where there were partial assistantships on State, that he would flush those out to full assistants in the 1980-81 budget. In other words, he added additional State funds for a State Research Assistantship in your department. Apparently, it was not recognized by our fiscal officers or him that you were already using the \$1,339 with Hatch funds to support a research assistantship. In other words, the department benefited through this budget add, but apparently Dr. Boush utilized your \$1,339 in a research assistantship provided to other than you.

We will be pleased to add \$1,339 in Hatch funds this year to provide the full stipend for a research assistantship until October 1. At the time of budget negotiations, we will work with Dr. Boush in correcting this situation.

Sincerely yours,

Business continues March 16, 1982 as I get a note from Carolyn Knorr, our Department's head secretary: "The Dean's Office has approved your request for additional funding on your Hatch project number 5133. \$1,000 has been added to your supplies category." On July 28th I write to Dean Bray: "Please transfer the \$260.00 remaining in the extra labor category back to supplies. The hourly laborer finished the work in less time than expected. This transfer is on Project #142-5133. Thank you." It came back signed and stamped "Request Approved," July 30. Well, for all of this money juggling, what did we get in the way of results? Following is the Termination Report, for CALS Research Division use, dated January 13, 1983 and covering the four years of the project, from October 1, 1978 through September 30, 1982:

As in any effort to determine the potential of feedstuff, our first step with each insect species was chemical analysis. Proximate analyses of the three major species included (males and females combined) revealed crude protein contents of 58% for Mormon cricket (Anabrus simplex), 67% for grey cricket (Acheta domesticus), and 55% for southern armyworm (Spodoptera eridania).

Based on our proximate, amino acid, and mineral analyses of the Mormon cricket, purified diets were formulated and fed to broiler chicks such that ground crickets supplied all the protein in the diet. These experiments showed the protein to be well balanced and readily available to chicks and that the limiting amino acid is arginine and to a lesser extent methionine. When broiler chicks were fed a corn-ground cricket diet growth was good and there was no significant response to amino acid supplementation.

Comparing chicks on conventional corn-soybean diets with those on corn-ground cricket diets, after eight weeks we found no significant differences in final weights (2095 vs 1947 g, respectively) or in feed/gain (2.25 vs 2.19). There was also no effect on carcass quality.

In addition to being a good source of protein and energy some initial chemical analysis indicated that Mormon crickets may also be a good source of certain minerals.

In addition to the amino acid supplementation studies with chicks, cricket protein was also evaluated with rats using the slope ratio assay. Using this method, young male rats are fed a glucose-based diet in which the test protein is the only protein source in the diet. Rats were fed a protein-free diet as well as diets in which graded levels of the test protein were substituted for glucose. In addition to ground crickets, three other proteins (lactalbumin, soy protein, and corn gluten meal) were tested for comparative purposes. The measure of protein quality using this method is the slope of the regression line. The regression line for a good quality protein has a steep slope while the slope of a poorer quality protein is much less steep. Results from these experiments indicates that for rats lactalbumin is far superior to cricket protein, but that cricket protein is lightly better than soy protein, and vastly superior to the protein in corn gluten meal.

We have made some progress in establishing an economic value for the Mormon cricket as a protein source. At cricket densities of 10 to 20/m², a one km² band of crickets represents about 11-22 metric tons of high protein powder. Based on current prices for corn and soybean meal (July 1981), the wholesale value of crickets of the above densities in a km² band would range from \$3,300 to \$6,600 if harvested for use as a high-protein feed. We cannot yet estimate however the cost of harvest although we expect it to prove to be minor compared to the value of the crickets.

Graduate students whose stipends were paid under this grant at one time or another were Mark Finke, Steve Landry and Barb Nakagaki.

Hatch Project # 5176, October 1982 through September 1986

As the original Hatch project headed toward its termination date, I readied a new proposal titled "The Grey Cricket (Acheta domesticus) as a Food and Feed Resource." It is reproduced as Appendix 2 for those who might want more details. For those who want only barely more detail, I list here the four Objectives:

- 1) Determine efficiency of the grey cricket (Acheta domesticus) in converting animal excreta and various vegetable processing wastes into insect biomass.
- 2) Determine protein, amino acid, metabolizable energy, vitamin and mineral content of the grey cricket and the amino acid and minerals bioavailability when this insect powder is fed as part of the diet of chicks and rats.
- 3) Devise a prototype mass-harvest method for the grey cricket if it appears warranted by the outcome of the nutritional studies.
- 4) Continue to give preliminary exploration to such insect protein production systems as may seem potentially promising.

The Approach for these objectives was briefly summarized as follows in the CRIS form:

Efficiency in converting excreta and processing wastes into insect biomass will be determined by measuring standard parameters such as relative growth rate (RGR), relative consumption rate (RCR), and efficiency of conversion of ingested food (ECI). Nutritional evaluation will include conventional biochemical methods of analysis for protein, fat, amino acids, metabolizable energy, vitamin and mineral content, and chick and rat feeding trials to determine bioavailability of amino acids and minerals.

Again, Milt Sunde was a Co-Investigator. The budget requested for four years was \$47,596, and for the first year \$16,559 which included one and a half research assistantships to partly cover two graduate students, Barb Nakagaki and Mark Finke.

Dean Hougas, on February 11, 1982, sent me a copy of the peer evaluation, stating in his letter: "The reviewers have recommended approval of your proposal subject to your consideration of several suggestions and a few questions." The first of seven specific suggestions and questions by the panel was: "Basic format of proposal is good with the exception of design and methods of statistical analysis." I enclosed my response (one page) to the concerns of the review panel in a letter March 4th to Dean Hougas. My responses were apparently barely satisfactory judging from an April 19th letter to Dean Hougas from Neal Jorgensen, a professor of dairy science and chair of the panel:

I reviewed the original proposal and the comments sent in response to the review committee's questions. Dr. DeFoliart's responses to the questions are acceptable; however, they do not, in all cases provide a clear answer. For example: Item 3): Balance studies will provide information on the apparent absorption of minerals. This is satisfactory, but the response to the best measure of mineral deficiencies is lacking. We do accept that they will check with Ganther and Gregor [two profs in Nutritional Sciences] about the best test to use. Such a response would not be adequate for NIH, NSF type proposals.

All in all, the comments are adequate to approve the proposal for consideration for funding.

In a letter April 26th, 1982, Hougas told me they were approving my project. I wrote to him on May 7th:

Dear Bob:

I am leaving Sunday for Costa Rica to determine whether insects and especially the grey cricket, might possibly be used to help reduce their protein deficiency problem down there. This represents an unexpectedly early test of our theories on insects as a potentially significant protein source, but I welcome the opportunity anyway, because it has forced us to do some crash thinking about how and whether we could really put this show into the real world right now.

The enclosed document is a brief and hurried summary of our first thoughts on it, and it is intended mainly as a rough framework within which my students and I will be redirecting some of our own thinking. The reason I'm sending a copy over to you is that I believe this is a very critical stage in our

pursuit of this subject, and without renewal of our Hatch grant we truly will be sunk. I'm already bootlegging two of my three "protein students" on "non-protein" monies, and even if the Costa Rica trip should result in development of a funded project, the Hatch funding would still be essential for awhile yet.

I think that the fact that we have even been offered this opportunity, only four years after starting from scratch in what was completely virgin scientific territory is an indication that good progress has been made. So, since Hatch funding decisions haven't been made yet, I wanted to let you know that we may be closer to a pay-off on this project than we thought we were when the Hatch renewal was submitted.

Regards,

On October 16, 1984, Dean Jorgensen wrote to Jeff Wyman, Entomology Chair: "We will approve your request for purchase of one incubator as per your letter of October 10, 1984. We will add \$969 to Dr. DeFoliart's Hatch Project 5176. These funds will be taken from the department's capital equipment allotment for 1984-85."

[Decide whether to copy the Annual Reports in whole or in part, or simply go with the Termination Report for the whole 4 years]

On January 4, 1985, I broke a string of more than 45 months (not counting the incubator) of not asking the CALS deans to juggle any money on my behalf when I wrote to Neal Jorgensen, who had become a relatively new Associate Dean of CALS. The letter will show that I had had no let-up in juggling; I just hadn't had to bother the deans about it:

Dear Neal:

This is to request permission to use \$625 of RA money from Hatch Project 5176 as half of one month's salary for Dr. Mark Finke as a Research Associate. Project 5176 is budgeted for 1.16 RAs, so use of \$625 for this purpose would still leave \$729 above the \$8122 for the current occupant, Barbara Nakagaki.

Finke's research has been directly related to Project 5176. One paper has been accepted for publication and five more are in the final stages of preparation. All of this research will be reported under Project 5176 even though nearly all of his RA stipend has been bootlegged from other sources for most of the past three years. I will be juggling two unbudgeted postdocs for awhile, hence the need to scratch for any available dollars. Finke is still conducting research while finalizing manuscripts.

Thanks for considering this request, and please let me know if there are questions pertaining to it.

Sincerely,

The Dean's response, dated January 8, revealed that the Deans were short enough of money themselves that they could quibble over small amounts:

Dear Gene:

We are approving your request to use \$625 of RA funds from Hatch 5176 to support Dr. Mark Finke for half of one month.

I hope you can help us out by saving \$410 within project 5176 to pick up the increase in RA stipend from July 1 through September 30, 1985. Appreciate your help.

Sincerely,

I should have never broken the string. On June 12, 1985, I had to write Neal again to explain a very extraordinarily complicated trip I was getting ready to take. What made it extraordinarily complicated was that part of it would be reimbursable, my part, and part of it not reimbursable, my wife, Lou's part:

Dear Neal:

This is a request to use some of the remaining supplies and travel budget in my Hatch Project #5176 (up to about \$250) to partially defray expenses to northwest Colorado to test a portable unit for harvesting Mormon crickets on a large scale as a high protein poultry and livestock feed. For the past seven years, we (my students or I) have annually made a trip to the Dinosaur National Monument area to collect crickets for nutritional studies. We've established that ground cricket powder is the nutritional equivalent of soybean meal when fed as the high-protein part of chick diets. If the harvest method is successful, we will have provided an economically feasible method that 1) yields a feed product of commercial value, 2) simultaneously can serve as an insect pest management (IPM) technique, and 3) requires no fossil fuel or electrical energy. I regard this as a notable first of a kind – if it works out.

My wife and I have to be in Jackson, Wyoming June 28th for a wedding. Ordinarily, we would proceed northwestward from Laramie, Wyoming to Jackson, a distance of approximately 400 miles. I propose that, instead, we proceed from Laramie to Craig, Colorado, where we will be based for three days and four nights before heading north to Jackson. I am asking that Hatch funds be used for expenses incurred from arrival in Craig to arrival in Jackson, including meals, lodging and gasoline (not mileage). The portable harvest unit is compact enough and light enough that it will fit into the back end of my wife's Plymouth Horizon (barely). I am not sure at the moment whether we will be making the Craig stopover on the way or coming back from Jackson (dependant on the cricket situation), but either way, distances and length of time in Colorado will be the same.

I think this is an important, possibly culminating, part of one aspect of our insect protein research, and the price tag couldn't be cheaper for 3 ½ days of field research in western Colorado.

Your consideration of this request is greatly appreciated and please let me know if there are questions pertaining to it.

Sincerely,

Four other people were copied with this letter. Dean Jorgensen stamped it “Request Approved” one day later.

To show how really weird and nutty this work could get at times, I’m including the first couple of paragraphs of the following letter, dated June 17, 1985 to (now) Dr. Mark Finke at Ralston Purina Company in Checkerboard Square, St. Louis. The unprecedentedly crazy part is mentioned in the second sentence:

Dear Mark:

Enclosed is a “preliminary” “rough” draft of a manuscript on cricket harvest equipment. I don’t ordinarily write a ms before doing the work but in this case I thought it would help clarify the kinds of information needed in Colorado. If the system should prove to work beautifully, I’m not above sending the manuscript to Science and it is in that format. It’s not the usual thing they publish as far as sophisticated instrumentation, etc., but as indicated in the 1st paragraph this is a unique and important “first,” (if it works) method developed in modern times for tapping insects as a food resource on a fairly large scale.

I’m still trying to find a satisfactory way to kill crickets, once they are bagged. I still have hopes for plain heat and suffocation and will test synergized pyrethrins (residues should be gone within 2-3 days during sun-drying although I want to check with Hsia [professor of toxicology in the UW Department of Entomology] on this, but neither ethyl acetate nor chloroform have worked even on grey crickets (at room temp.). Plan to try the latter again, however, in sun-heated black plastic bags.

.....

It was sometime, I believe, during the summer of 1985 that The Capital Times, a Madison newspaper published an article titled, “Bugs feast on Western crops.” The article, distributed by the N.Y. Times News Service, was datelined Mountain Home, Idaho and was all about grasshoppers and Mormon crickets, or Mormon beetles as the taxonomically challenged reporter called them. I give you, for example, the second to last paragraph: “Conservationists, meanwhile, are trying to stall the spraying of insecticides for Mormon beetles, which are grasshopper-sized members of the cricket family, in the area of Dinosaur National Monument.” [Decide whether I want to reprint the whole article.]

On July 15, 1985, I wrote to Dean Jorgensen:

Dear Neal:

I will be making a second trip to Colorado re studying harvest methods for the Mormon cricket. This trip will incur expenses of more than \$500 and I would like permission to use the remaining Supplies/Travel money in my Hatch Project 5176 (about \$95) to defray them in part. A similar request for an earlier trip (letter of June 12th) was approved. Expected departure this time is July 21st.

Thanks for considering this.

Sincerely,

On August 19, 1985, I wrote to Paul Jelle, another member of the Ag College business office: “Please transfer my unused supply balance to travel on project 5176 to cover my upcoming cricket collecting trip out west. . . .”

It was more than half a year later before we had to bother the deans again with quibbly money problems. I wrote to Jorgensen on May 9, 1986:

Dear Neal:

Pursuant to our telephone conversation we have completely exhausted our supplies and travel budgets under Project 5176, and have also exhausted some supplementary funding from other sources that we have used in the past. I’m expecting some additional funding to be available by July 1, but with summer starting we are in critical need of about \$500 to keep us going until then. Needed mainly are chemicals, gasoline and supplies for battery-powered aspirators. Any help that could be given on this will be sincerely appreciated.

Sincerely,

This came back signed and stamped “Request Approved, May 13, 1986.” On May 19, I gave to Carolyn Knorr, our Department Administrator a memo Re: Hatch Account 142-5176: “Please transfer the remaining \$133.68 in our Travel budget to Supplies to help erase the \$139.53 deficit in that category.”

[Letter to Dean Jorgensen dated December 30, 1987 refers to “my current Hatch Project 5176 budget.” Determine whether the date or the Hatch number is wrong in this letter.]

The termination date of Hatch # 5176 was September 30, 1986. The Termination Report to the Research Division of CALS was dated January 20, 1987, and in my humble opinion, it packed a lot of good info. In this report, for the first time, Professor N.J. Benevenga of Animal Sciences was identified as a Cooperator in addition to Milt Sunde who had been listed from the start. Although not listed previously on # 5176 project reports, Professor Benevenga had long been an important player in the program, serving as Mark Finke’s co-major professor and spearheading all experimental work on rats:

[Main accomplishments] Nutritional studies on Acheta have been conducted in parallel with similar studies on the Mormon cricket (Anabrus simplex), for which larger amounts of cricket meal were available, and results on both species are summarized together. In earlier studies on the Mormon cricket (DeFoliart et al 1982), proximate analysis revealed a crude protein content of 58% (dry weight basis), and amino acid analysis indicated that methionine, arginine, and tryptophan, in that order, would be limiting amino acids. In feeding trials, however, practical corn-cricket-based diets produced significantly better growth of broiler chicks to three weeks of age than was produced by a conventional corn-soybean based diet supplemented with methionine. Supplementation of the corn-

cricket diet with purified amino acids did not significantly increase the weight of chicks feeding on that diet over those on the unsupplemented corn-cricket diet. Finke et al (1985), using Mormon crickets in purified diets, found that arginine and methionine are colimiting. In a 8-week chick feeding trial, however, in which Mormon crickets were incorporated into practical diets replacing soybean meal as the major protein source, there were no significant differences in weight gain or feed/gain ratios in the corn-Mormon cricket diet compared to the corn-soybean meal diet. Both diets were supplemented with amino acids and formulated to meet or exceed Research Council (1977) recommendations. In taste-panel tests, no off-flavor was detected in Mormon cricket-fed broiler meat. Using both semi-purified and practical diets in chick feeding trials (to three weeks of age) involving Acheta crickets, Nakagaki et al (1987) found no significant differences in final weights of chicks fed the practical experimental (corn-cricket) and reference (corn-soybean) diets. In the trials using practical diets, feed/gain ratios improved significantly, however, when diets were supplemented with both methionine and arginine but not with either alone. Feed/gain ratios in trials with the purified diets indicated that tryptophan is also limiting.

Data (unpublished) on Japanese quail show Mormon crickets to be a suitable source for egg production. There was no effect on egg size, egg production, feed/gain efficiency or egg fertility compared to a corn-soy control.

Landry et al. (1986) reported a crude protein content of 49-58% (dry weight basis) for larvae of six North American lepidopteran species representing three families. Amino acid analysis indicated deficiencies in arginine, methionine, cysteine, and possibly lysine if larvae are used in chick rations, these findings being consistent with those of other investigators on Lepidoptera and in regard to the sulphur-containing amino acids. Methionine and cysteine appear to be deficient when determined by biochemical methods. In chick feeding trials, however, weight gains and feed/gain ratios of chicks fed corn-larvae diets to three weeks of age did not differ significantly from chicks fed a conventional corn-soybean control diet (Landry et al. 1986).

Finke et al (1987a) used a four parameter logistic model to describe the dose-response relationship of rats fed diets containing 12 levels of casein, peanut meal, or wheat gluten. The model was capable of accurately describing the entire response curve of rats fed diets containing each of the three protein sources. Incorporation of a technique known as parameter sharing into the curve fitting process facilitated convergence of the parameter estimates for b (protein free) and Rmax (maximum response) for all curves with those observed and or expected. Parameter sharing also provided a method by which the curves could be differentiated on a statistical basis. These data indicate that the relative value of a protein source is dependent upon the concentration of the protein in the diet. The application of nonlinear models combined with parameter sharing provides a technique by which protein values can be evaluated at levels of animal performance from maintenance to maximum growth.

Finke et al (1987b), in rat feeding trials, evaluated the protein quality of Mormon cricket protein alone, when mixed with a complimentary protein source, and when supplemented with methionine. Corn gluten meal (CCM) was selected

as the complimentary protein source because of its high methionine content. When Mormon cricket meal (MCM) was mixed with CGM the protein quality of these mixtures was improved over either of the two protein sources when fed alone. When MCM was supplemented with methionine the protein quality of MCM was increased above that seen for any of the CGM-MCM protein mixtures. Rats fed diets containing MCM supplemented with methionine had a maximum weight gain at dietary protein concentrations around 16%. The protein requirement (as ideal protein) for growth as recommended by the NRC is 12% which shows the high nutritional quality of MCM protein when supplemented with methionine.

Finke et al (1987c) compared Mormon cricket (MC), house cricket (HC) (= grey cricket) (Acheta domesticus), and eastern tent caterpillar (TC) (Malacosoma americanum) to lactalbumin and isolated soy protein when fed to weanling rats. Non-linear models were used to describe the dose-response curves and protein quality was determined by comparing the dose-response curves at various performance levels (Finke et al 1987a). When compared to lactalbumin, the three insect protein sources and soy protein were inferior in their ability to promote maintenance or maximum growth. MC was equal to, however, and HC (Acheta) superior to soy protein at all levels of intake. The ability of TC protein to promote maximum growth or nitrogen retention was only half that of soy protein but toxicity rather than protein quality may have been responsible.

[How the findings from this research will benefit society] Studies on the nutritional value of insects either to humans or to poultry and other meat animals are in their infancy. Data obtained in this project, however, together with published results from several other investigators, suggest that insects warrant serious attention as a food resource. Their ubiquitousness and their utilization of almost every kind of organic substance for growth suggests a nearly endless array of possibilities for developing food insect production systems.

The publications were beginning to flow now, and 2 abstracts, 2 published papers and 4 papers either accepted for publication or submitted were listed.

Hatch Project # 3038

Early in 1986, I began putting together a new Hatch proposal. It was titled, "Mass Production of the House Cricket, Acheta domesticus." It is reproduced as Appendix #3 [Decide whether to actually do this]. Under date of March 27, 1986, Dean Jorgensen forwarded to me the Review Panel's comments. They raised ten points, mostly minor, with the following introductory paragraph:

The committee found the proposal to be generally well written, the subject to be of importance, and the experimental approach, for the most part, to be soundly conceived. We have assigned the project a rating of 1.5, this rating being intended to convey our belief that the proposal should be funded, that some revisions are desirable, but that the suggested revisions are of a nature such that the committee

does not feel the need to be involved in assessing the suitability of the revised text.

It always makes the proposer feel good when the reviewers say they don't need to see the revised text. It makes him feel that they have some faith in his competence and his own good faith. Neal had asked for three copies of the revision. I sent them along with the following letter on April 4, 1986:

Dear Neal:

Enclosed are three revised proposals, "Mass Production of the House Cricket, *Acheta domestica*, as Food and Feed." Changes have been made in the proposal to address points 1-8 raised by the reviewers.

Regarding reviewer's point 9, we have long intended to visit one of the commercial cricket-bait producers to see if they have techniques that we would find useful. The nearest is in Memphis, Tennessee, however, and we've always had higher priorities for our limited funding. We know about the techniques and equipment they recommend to their retailers and my impression is they don't have any trade secrets that would be particularly enlightening to us. With the fancy price they get for their crickets as bait, they can easily afford labor intensive production.

Regarding point 10, we established a good connection in 1982 in Costa Rica under the Title XII program, and I have had occasional queries regarding the subject from people in other developing countries despite the low profile this project has deliberately maintained up to now. We have essentially enough basic vertebrate nutritional data now, on poultry and rats, but we need to have a bona fide system that we are confident can produce crickets economically in commercial quantities before attempting to set up pilot operations in developing countries. That is, in fact, what we hope to achieve during this next Hatch renewal. The subject has fascinating possibilities in many directions and my regret is that I haven't up to now been able to put more time into it. The future looks better, however, as I don't anticipate ever being called downstairs again to save the department as chairman.

We mention in the Hatch proposal that a partially overlapping proposal was approved for one year's support by the Graduate School, subject to submission of a proposal to an outside funding agency prior to July 1. I doubt now that we can meet that requirement. It would be premature to go for outside funding before our rat data are in manuscript form and accepted for publication. Our rat data, about four good papers worth, reposes in a Ph.D. thesis by Mark Finke, and with Fink now running his usual hectic pace for Ralston-Purina, it is slow going getting the thesis converted to manuscripts.

Sincerely,

The last sentence of the second to last paragraph in the letter above refers to my second period of service as department chair. It was from January 1, 1982 through December 31,

1983, a two-year period that became the bloodiest in department history [tell briefly what this was about without condemning anyone by name].

The never-ending shuffling of small sums of money continued as noted in a January 19, 1988 letter to me from Dean Jorgensen: “Gene, we will add \$1,527 to cover one and one-half months RA stipend plus fringe benefits to your Hatch project 3038.” This was in response to a request dated December 1987, which said in part:

This is to help us through a period that would otherwise extend to at least March 1, 1988 and possibly July 1 without stipend support. As I mentioned, the student, Leonard Huebner, has arranged for part-time employment after the first of the year which, with the requested help from the College, will enable him to stay in school and our project to continue until July 1 when other RA funding is assured.

Of 14 active Hatch projects for the year 1989 (October) – 1990 (September), at \$14,498 ours was third from lowest in the amount awarded. So I felt we were still giving the college a good deal.

In our Annual Report to the Research Division for the year 1989, we digressed from cricket studies, our main effort in the project, to report some results on an interesting idea we had concerning Japanese beetles and also to update progress on a cooperative project with researchers in Nepal (see Chapter 11). Our idea on the beetles was to have farmers trap them and use them as the high-protein component in their poultry feed. The results on Japanese beetles were never published, but we thought the idea was good enough that I take this opportunity to summarize what we found:

In previous years we have diverted some effort under this project to insects of potential food/animal feed importance other than the cricket, Acheta domesticus. Most of the reportable progress the past year concerns the Japanese beetle (Popillia japonica) and a complex of crop insects in Nepal that are attracted in large numbers to light traps. These insects are being investigated as a high-protein source for poultry in North America and Nepal respectively. In each case their harvest for use as feed is envisioned as a component in integrated pest management and low-input sustainable agriculture.

The Japanese beetle is a major pest of turf, small fruits, vegetable gardens and ornamental plants in the eastern United States. One method of protecting plants from these beetles is the use of floral/pheromone-baited traps. A single trap holds 4,000-5,000 beetles and can fill to overflowing in less than 24 hours when the beetles are numerous. The protein quality of beetles collected in such traps in Ohio and Kentucky was tested experimentally in chick feeding trials.

Proximate and amino acid analyses revealed the beetles to be very high in crude protein (72.4% dry weight basis), but very unbalanced relative to chick requirements for specific amino acids, being particularly deficient in arginine, lysine and methionine if based on a 20% ground beetle/70% ground corn formulation. This amino acid deficiency was confirmed in chicks fed to three weeks of age on the above diet, chicks on this diet gaining less than half the weight of those fed the standard NRC reference diet, and having a significantly higher feed/gain ratio.

Chicks fed basal diets containing 15% beetles/65% corn/10% soybean meal and supplemented with various amino acids at various levels showed significantly better growth than those on the 20% beetle diet but not as good as those on the NRC reference diet. Feed/gain ratios were also significantly improved by addition of the soybean meal and amino acid supplementation.

These results with Japanese beetles do not conform to our previous results with a variety of other insect species showing chick growth and feed/gain ratios to be as high or higher on the corn/insect diets as on corn/soybean meal diets. Japanese beetle adults appear to have little utility in chick diets. Whether they might have any use in feed formulations for other animals remains to be determined.

Our contribution to the Nepal cooperative project consisted of getting taxonomic determinations on several species of scarabaeid beetles (primarily) that are attracted to light traps along with the target insect, Brachytrupes portentosus (an indigenous cricket), proximate analyses on the cricket, the beetles, whole mustard seed and mustard seed cake, and conducting amino acid analysis of the cricket. These data will be used in formulating experimental diets for chick feed trials to be conducted in Nepal.

In the annual reports to the CALS Research Division, in addition to the summary of progress, researchers are asked to respond to several other questions, three of which I responded to as follows in our report for 1989:

2) In layman language, indicate how the research results to date may, will or have been of benefit to the clientele served by the College:

Project results to date have not been of direct benefit to the clientele served by the College. If the project is successful, however, it could open the door to a whole new class of low-input alternative crops for small farms dedicated to the principles of sustainable agriculture. Further, a change in the attitude of Americans toward insects as food might be followed by a change in attitude toward insects in food, thus helping to reduce the pressure for pesticide use that is primarily cosmetic. Although insects are not needed at the present time as a source of nutrition in the United States, greater awareness on the part of Americans as to their palatability and food quality and their continuing nutritional importance in much of the Third World could help to focus needed research on this resource in regions where food insect use is traditional and could make an increased contribution to reducing problems of chronic malnutrition.

3) If this research has been used in extension programs during the past year, describe how it was utilized:

Not used by extension, but a public education effort was launched in 1987. It has included press releases, which, as indicated by feedback, carried the theme of insects as food to scores of millions of people, initiation of a 1-credit course on the subject at the University of Wisconsin, and initiation of The Food Insects

Newsletter which has a rapidly expanding mailing list and is helping to network interested researchers.

4) Will the objectives of this research be accomplished during the time span allotted to this project? If not, please indicate why:

No. There are endless domestic and global ramifications to this subject.

The 1991 Termination Report returned to coverage of the main objectives of the project, mass rearing the cricket, *Acheta domesticus*. Our budget for the 1990-1991 year was \$15,301 which was, I believe, the highest single-year budget during our 13 years on Hatch budgeting. I don't know how we got that extra (5th) year that carried me up through my retirement date. I can find no record of applying for an extension (with a normal four-year span, Project 3038 should have ended September 30, 1990), so I will simply attribute the extra time to the wonderful generosity and discerning intelligence of the Ag College research and business administrators with whom I was so lucky to have to deal with over my last 13 years as an active faculty member. To the Termination Report summary of progress: [copy the entire page and a half]

There were two late items of business, additional examples of the generosity and discernment I was talking about. On February 21, 1991, I wrote to Paul Jelle, saying I would like to request that page charges and reprints "on the attached requisition" be paid by Hatch funds inasmuch as the article reports research done under Hatch support. Two days later, I received the familiar "Request Approved" signed by Paul. My last letter of record pertaining to Hatch was to Paul Jelle dated March 5:

Dear Paul:

Following up on the information you gave to Carol Scheele the other day, I would like to request that the three month student stipend in my Hatch Project #3038 be converted to \$1,000 in hourly labor and \$2,200 in supplies/services. The graduate student involved, Megha Parajulee, is doing an excellent job on his Master's degree research and will have the opportunity, as of July 1, to initiate a Ph.D. program under Tom Phillips in this department.

All of our previous work with the cricket (*Acheta domesticus*) under #3038 has been under high-temperature (about 30 degrees C) conditions. We are now attempting to develop this insect as a standard live "laboratory animal" for school biology programs (from elementary up) and, to increase flexibility, we are re-evaluating some biological parameters at ambient temperature. The reason for my request is that, although Parajulee's stipend will no longer come from this project after July 1, we will still have his inputs and we hope to carry this work to completion.

I very much hope this request can be favorably considered, and please let me know if any additional information is needed.

Sincerely,

My letter came back stamped "Request Approved" March 18th.

Chapter 6. Internal Budget Support: The Graduate School

The University of Wisconsin Graduate School, like the College of Agricultural and Life Sciences Administration, we found to be another assemblage of thinking adults whose actions were not bound by cultural limitations. [Expound a bit further along these lines – people there, etc.]

On May 1, 1978, I wrote to Dean Robert M. Bock, of the Graduate School, asking for \$2,000 which would enable us to make trips to Utah and Wyoming to collect Mormon crickets and rangeland grasshoppers, respectively. If we could make those collections during the upcoming summer (1978), it would move our program ahead by one full year, not a bad payoff for a measly \$2,000.

Dear Dean Bock:

Attached to this letter is a copy of a new Hatch project proposal entitled “Investigation of Insects as a Food Resource”. It has been recommended for funding by a CALS peer review panel. The parts to which this letter is pertinent are the introduction (pp 1-2), Rangeland Grasshoppers (pp 7-11) and Mormon Cricket (pp 11-12).

In the proposal, I requested, in addition to the regular first year budget beginning October 1 (if funded), and interim budget that would permit making necessary field collections in Wyoming and Utah during the upcoming summer. If these collections can be made this summer, it will advance the entire project timetable by one year. Equally important is that we expect to get publishable data from these first trips, as described in the proposal (p. 20). This would mean that, if Hatch support is not forthcoming, or even if it is, we would more quickly be in a position to seek funding from NSF or other outside sources.

Bob Hougas told me that there is little or no chance for interim funding from Hatch and suggested that I contact you. Specifically, we would like to make a trip to Utah about the first week in June, possibly a little earlier, to collect Mormon cricket material and a trip to Wyoming during the first half of July to collect grasshopper material. These trips would permit us to largely accomplish all objectives and procedure except B3 and C2 under both grasshoppers and Mormon crickets. As described under Budget Justification, travel expenses to Utah might total as much as \$900 and to Wyoming as much as \$750. In addition, a Torbal Balance Model DLM-2 (accuracy to 5 mg; cost \$265) for weighing material in the field, and a small amount for supplies (about \$85 for containers, small cages and construction of a prototype “hopperdozer”) would be needed.

Altogether, the above totals \$750 needed as of July 1 and \$1250 needed sooner than that. If I could get permission I would be glad to divert \$750 from the Research Associate stipend in my Grad School grant, Project #190380, which becomes available July 1, to this purpose. That would not solve the problem, however, of how to get to Utah in June.

The time elements in this request are admittedly absurd. I wouldn't consider making the request on such short notice if I didn't feel that, suddenly, we

are ready to go on this project, and that, for the lack of \$2,000, we will be frozen at the starting gate for a full year. If I can get to Utah and Wyoming to make the field collections, I have \$500 on deposit at WARF which can be used by Dr. Sunde to purchase the initial biochemical analyses.

Whether anything can be done at this late date or not, I very much appreciate your considering this request. My office telephone number is 262-5958.

Sincerely,

xc: Assoc. Dean R.W. Hougas

Carol E. Miller, Jr. responded for the Research Committee of the Grad School, dated May 22, 1978:

Dear Professor DeFoliart:

The Research Committee has reviewed your request for support of your research entitled "INVESTIGATION OF INSECTS AS A FOOD RESOURCE".

I am pleased to inform you that it approved your request and will provide \$2,000.00 for travel as requested. Any balance at June 30, 1978 will be carried over to your project number 190380 for 1978-79.

.....

The remaining few sentences covered routine. My Project Number would be 181567, my Fund/ Account Number would be 135-0662. This was one of the most crucial little chunks of money that we obtained (timewise) during this whole food thing. Because of the \$2,000, we were able to get out west and get started on Mormon crickets one full year sooner than would have been the case otherwise. [Find out what #190380 was all about]

The next word of record from the Graduate School (in my old files at least) was December 14, 1979 from Dean Bock: "The Research Committee has given careful consideration to your July 1, 1980 to June 30, 1981 grant application to do research on 'INSECTS AS A HIGH PROTEIN SOURCE', and will provide the following support," the support consisting of \$6,144 for a research assistantship and \$3,080 for supplies and travel. Fringe benefits are taken care of separately, the Committee suggests that USDA, the NSF applied science program and/or Rockefeller be contacted for their interest in supporting this research. The Project Number was 110509, the Fund/Account Number 135-0536.

Almost one year to the day later (December 12, 1980), we (Milt Sunde and I) heard again from Dean Bock that we were approved for another year, July 1981 to June 30, 1982. Several conditions were attached, one being that the award was contingent on our submitting a proposal to an outside agency by March 1, 1981, another being that we must get approval of our research from the human subjects committee before the grant would be activated. Our Project Number was 120239 this time, our Fund/Account Number was 135-0541 and the title of our grant the same as the year before.

By letter of May 12, 1981, we were reminded by the Accounting Coordinator, Ruth May, that the subject grant was awarded on a conditional basis, and an update on the status of these conditions was needed prior to June 1, 1981. On May 26, I wrote to Ms. May:

Relative to my award for “Insects As a High Protein Source” (Acct 135-0541; Proj. No. 120239), no outside funding attempts have yet been successful.

A proposal submitted to NIH in February 1980 was rejected. That proposal was completely rewritten and submitted again in February 1981; if it should be approved at a priority level allowing funding, it would become active December 1, 1981.

A similar proposal was submitted to USDA in February, 1981, but I was asked to withdraw it because it did not quite fit within the scope of their Human Nutrition program.

Exploratory letters were written to five foundations in September, 1980. Four replies were negative because the subject was not within the scope of their present programs and no acknowledgement was received from the fifth organization. An exploratory letter was sent to a sixth foundation early this month. No reply has been received as yet.

Sincerely,

We heard from Ms. May, dated June 2, 1981, that the committee regretted our inability to obtain outside funding, but hoped that we would continue to seek extramural support, and reminded us that activation of our award remained conditional on receipt of the required clearance from the human subjects committee. On July 16, we were notified that we had met all conditions and our award was being activated. On December 11, 1981, we were notified by Dean Bock that our attempt for a third year of support was not successful: “We are very sorry to report that due to the large number of requests received by the Research Committee and the limited funds available, it was not possible to support your request for a 1982-83 grant to do research on ‘INSECTS AS A HIGH PROTEIN SOURCE’”.

We were back at it in 1985 and I received the following letter, dated December 13, from Dean Bock:

Dear Professor DeFoliart:

The Research Committee has given careful consideration to your July 1, 1986 to June 30, 1987 grant application to do research on “THE GRAY CRICKET (ACHETA DOMESTICUS) AS AN ECONOMICALLY-FEASIBLE SYSTEM FOR RECYCLING POULTRY MANURE INTO A HIGH-PROTEIN FEED SUPPLEMENT FOR POULTRY”, and will provide the following support within the conditions set forth below

The conditions were the ones I was accustomed to – must make an extramural application before July 1, 1986, and, since our research was using biological materials, must submit the form required from the Madison Campus Biological Safety Committee (note that this

is different from the clearance required from the human subjects committee; we weren't talking about insects as human food in this particular proposal). The grant would provide a research assistantship for \$9, 636 and \$174 for equipment. Our new Project Number was 170589, our Fund/Account Number 135-0547. I received a reminder, dated May 12, 1986, from Jim Knickmeyer, Accounting Coordinator, that the Accounting Office must be notified prior to June 1 as to whether these conditions had been met. On May 14, I wrote to Mr. Knickmeyer:

Because of unexpected delays in bringing several manuscripts to completion, which I feel are a prerequisite to seeking extramural support, I will be unable to meet the conditions stipulated by the Research Committee for awarding the research grant titled, "The Gray Cricket (Acheta domesticus) as an Economically Feasible System For Recycling Poultry Manure Into a High-Protein Feed Supplement for Poultry," Project No. 170589, Fund/Account 135-0547. We nevertheless appreciate the expressed willingness of the Committee to help fund this project.

Sincerely,

Carol Miller responded for the Grad School under date of May 23: "The Research Committee has agreed to delay activation of your 1986-87 Graduate School award (fund/account 135-0547) until an appropriate extramural application is submitted and we have received the required approval of your research from the Madison Campus Biological Safety Committee." This letter from Miller was definitely an "up"; they had not summarily dismissed us, as I had expected them to do. Feeling that the Committee was definitely on our side, on July 3, 1986, I wrote a long, long letter to Miller:

Dear Dean Miller:

The Research Committee grant for research on "The Grey Cricket (Acheta domesticus) as an Economically-Feasible System For Recycling Poultry Manure Into a High Protein Feed Supplement For Poultry," was awarded to me on the condition that an application would be made for extramural support. By letter of May 14, 1986 to Mr. Jim Knickmeyer, I stated that I would be unable to meet this condition because of delays in bringing to completion several manuscripts which I felt were prerequisite to seeking extramural support. That being the case I had made no effort to recruit a graduate student for the RA awarded, and planned no attempt to meet the conditions necessary to activate the award.

Several things happened rather precipitously after that, and I am now interested in activating the award if possible. Although an outside proposal has not yet been submitted there is tangible evidence that the way is being cleared to do so. The first draft of the first of the critical manuscripts has been completed (copy attached), a first draft of the second manuscript will be completed within a week, and the third written a couple of weeks after that. All three should be ready for submission to the Journal of Nutrition within the next 6-8 weeks.

Regarding anticipated submission of an application for outside support, I have prepared a draft of a proposal for creation of a "Food Insect Research

Center” on the UW campus (copy attached), and am starting the process now of exploring reaction to the idea both at the CALS level and with relevant faculty. The conceived structure of the center would consist basically of an Advisory Committee of 8-10 faculty who are interested and have relevant expertise and a minimum of two non-faculty staff positions plus an operating budget provided by a core grant provided by an outside agency or foundation. Barring other advice our first attempt at outside funding is likely to be the Kellogg Foundation.

I am convinced that now is the time to expand horizons on insects as a food resource and that the best way to do that is to gather a “critical mass” of faculty talent that can stimulate interdisciplinary research on several fronts simultaneously. There are many ramifications to the subject that must be addressed if we are to bring to fruition even a single food insect production system – aspects ranging from basic biology to innovative marketing of a completely new class of products. I believe that recognition of a Center, as proposed here, at the University of Wisconsin with its prestigious history of nutrition research, could provide a level of instant credibility that would be invaluable in attempting to develop what is currently essentially a non-existent field of endeavor.

Relative to the RA award by the Research Committee, two events of the past 10 days dictate a sudden need for fast action if possible. Discussions with Dr. E. E. Erickson, Director of USDA Bee Research Laboratory here, have resulted in “bee brood” (larvae and pupae) assuming much higher priority in this program than before. Unfortunately, the Bee Laboratory is closing as of August 11th and moving, along with Dr. Erickson, to Tucson, Arizona. Except for one phase of research that will continue here for three years, most of the bee colonies will be phased out. This presents an excellent opportunity to collect enough bee brood for several research objectives. This coincides with the sudden appearance of a graduate student applicant, Mr. Leonard Huebner (M.S., Insect Physiology, University of Minnesota) who is interested in the food insect program. His research, if the RA is activated, would initially be divided between studies on grey (=house) cricket nutritional requirements relative to manure recycling and preliminary studies on nutritional value of brood as determined by biochemical analyses and rat feeding trials. His first task, however, will be to collect and process large quantities of bee brood while such an excellent opportunity exists, and to gain as much overlap as possible with Dr. Erickson. Although he will not be located here after August 11th, Dr. Erickson will retain his adjunct professorship in the Entomology Department until the final phase-out of the bee research program three years from now. Thus he will be available as one of Huebner’s advisory committee, and aside from that is highly interested in collaborating on the bee brood project. I can support Huebner as an LTE for a month or two from other funds, but after that would be dependent on the Research Committee RA.

I apologize for the rough condition of some of the enclosed materials. After typing the 18-page body of the Proposal, my word processor person left and is currently in the middle of a three-week tour of Europe. Material added after her departure appears as Addendum I, Appendices I and II, and Production Models

for Acheta and Apis. Only the production models will be left as appendices after the first revision of the proposal. Whether or not the Center idea is endorsed by the CALS administration and by faculty that would be involved, I anticipate being able to submit an application for outside funding within three to four months. Other time commitments, notably completion of a major review article on another subject, preclude a shorter period.

Consideration by the Committee of this request to activate the award is very much appreciated, and, again, I apologize for the preliminary condition of much of the enclosed documentation, not to mention its bulk.

Sincerely,

Just as Dean Miller's previous letter had been an "upper," this next letter (July 14th) from Miller, responding to my long, long letter, was a "downer": "I am sorry to tell you that the Committee confirmed its earlier decision in my letter of May 23, 1986. Please contact us after you have submitted your application to the Kellogg Foundation or another agency." It wasn't until a letter dated November 10, 1986 that Dean Miller was able to thank us for informing them that we had submitted an application to the Kellogg Foundation, and they were thus activating our award to begin December 1, 1986 and running to June 30, 1987.

Late in 1986, September 9, we submitted a new proposal on a new insect subject, the honey bee, for Grad School support. We heard from Dean Bock under date of December 12: "We are very sorry to report that because of the large number of requests received by the Research Committee and the limited funds available, it was not possible to support your request for a 1987-88 grant to do research on "THE PRODUCTION AND QUALITY OF HONEY BEE BROOD AS FOOD".

Undeterred, a year later we dusted off the honey bee proposal and resubmitted it. We heard back from Dean Bock, under date of December 11, 1987: "The Research Committee has given careful consideration to your July 1, 1988 to June 30, 1989 grant application to do research on "THE PRODUCTION OF HONEY BEE BROOD AS A SNACK FOOD FOR THE U.S. MARKET", and will provide the following support within the conditions set forth below . . ." What it provided was a research assistantship for \$11,460. The proposal was a condensed version of the one submitted to the Wisconsin Sustainable Agriculture Demonstration Grant Program. It was the second-to-last proposal for food insects research that I submitted to the Graduate School. Before submitting the absolute last research proposal, for variety, on April 19, 1988, I asked for an international travel award:

I have been invited to present a paper and chair a symposium at the First International Congress of Ethnobiology to be held July 19-24 in Belem, Brazil (letter attached). The symposium title is "World Potential for Little-Known Native Plant and Animal Food Sources." The subject matter of the Congress and the symposium is a fairly recent area of interest and involvement for me, and I would very much like to accept this invitation. Therefore, I would appreciate consideration for a travel award to the Congress. Unless memory fails me, I have

not previously applied to the Graduate School for a travel award. Thank you for considering this request.

I heard back from Carol Miller, dated May 2:

Dear Professor DeFoliart:

The Research Committee requires major participation at a major international meeting to be eligible for air fare.

Being unfamiliar with the First International Congress of Ethnobiology could you please send to us copies of any information you have about the meeting. In addition, please tell us the length of your presentation and whether there is time set aside for discussion of it.

Sincerely,

I responded to Dean Miller's questions on June 2:

Dear Dean Miller:

This is a follow-up to my letter of April 19th requesting air fare to attend the First International Congress of Ethnobiology in Belem, Brazil. Additional information on the congress is enclosed, as you requested (letter of May 2).

The final program has not been received but papers will be, basically, 20 minutes in length, with 10 minutes for discussion subject to variation determined by the symposium organizers. My paper, abstract enclosed, will presumably be part of the symposium titled, "World Potential for Little Known Native Plant and Animal Food Sources". I was asked to chair this symposium, but its organizer is Dr. Darrel Posey who is also Chairman of the Congress. I have been out of the country much of the past six weeks, and out-of-touch relative to the Congress and do not know at the moment whether the symposium on "Little Known Foods" will be one of the general symposia or possibly one of the key symposia.

Please return the brochure if possible. Thank you.

Sincerely,

I heard from Dean Miller under date of June 16, and am pleased to tell you that the most important sentence in his letter said: "I am pleased to inform you that the committee will provide up to the equivalent of the regular APEX rate between Madison and Belem, Brazil." Unfortunately, only eight days later, June 24, my birthday, no less, I had to write back to Dean Miller:

Dear Dean Miller:

I very much appreciate the travel award to attend the Bioethnology Congress in Brazil. When I started to make airline reservations back on June 2nd, I found the Varig direct flight Miami-to-Belem already booked solid past mid-August. Alternative flight arrangements have proven impossible both in terms of

cost and time away. So my paper will be read in my absence, and Fund/Account #135-0630 will not be used. Again, thanks very much for the favorable consideration.

Sincerely,

I heard back from Dean Miller, dated June 30, expressing the Committee's regrets that I was unable to attend the Congress and telling me that my "eligibility to apply for additional foreign travel support has now been restored." That was mentioned because, as I had been told earlier, "Committee policy provides support once in a three fiscal year period to faculty members who are invited to present major papers."

My absolute last word from the Graduate School was a letter December 7, 1990 from John Wiley for the Research Committee:

Dear Professor DeFoliart:

We are very sorry to report that because of the large number of requests received by the Research Committee and the limited funds available, it was not possible to support your request for a 1991-92 grant to do research on "DEVELOPMENT OF A FECUNDITY MODEL FOR USE IN MASS-PRODUCTION OF THE CRICKET ACHETA DOMESTICUS".

Sincerely,

It was too bad having to end on a negative note, but I had no complaints on the Grad School. They had demonstrated nothing but open-mindedness in considering our proposals.

Chapter 7. Visitors to the Food Insects Lab and Trips Abroad

Costa Rica

Our first trip abroad was an eight-day trip to Costa Rica from May 9 to 16, 1982. The trip was made under Title XII funding with valuable help and an initial push from Dr. Tom Yuill (Department of Veterinary Sciences) and Dr. Kenneth Shapiro, Director of International Agricultural Programs. Tom is a virologist with whom I had had much collaboration on mosquito-borne virus studies. He also had had much research experience in the American tropics. The trip was made under the Title XII program known as “Strengthening Grant for an Integrated Program in Animal Health and Production.” Copied below is my “Report on Trip to Costa Rica,” dated May 24, 1982:

Purpose: This trip was made to contact Costa Rican agricultural scientists who could help determine whether insect protein production systems researched at the University of Wisconsin might be beneficial in reducing the protein deficiency problem which constitutes the number 1 nutritional problem in both the human and meat animal populations in Costa Rica.

May 9:

I arrived at the San Jose airport during a nice driving rainstorm in the late afternoon and was met by Dr. Jane Homan, who I must say at the outset was a most effective contact person. She provided transportation, was present at all sessions, served as interpreter when necessary (frequently) and provided briefings and insights that were invaluable in helping to make the trip successful in accomplishing its objectives. [Here, I should further identify Jane Homan as having done her PhD graduate work under the direction of Tom Yuill and later joined the staffing of the International Ag Programs. From Day One, I considered her an extremely valuable asset to the University in support of its international programs, and over time she proved of great value to my specific program as she developed a strong interest in the potential of insects as a manageable food resource.]

May 10:

During the morning we met with Dr. Mario Murillo, poultry scientist, and Dr. Carlos Campabadal, animal nutritionist, of the Facultad de Agronomia, University of Costa Rica to discuss whether mass-reared grey cricket (*Acheta domestica*) powder seemed a feasible option for supplying a much needed high protein source for broiler and egg production in Costa Rica. Dr. Murillo is also Director, Escuela de Zootecnia. Both he and Dr. Campabadal had received prior information regarding the subject, although not directly from me. Also present were Dr. William Ramirez and Elizabeth Carazo, University of Costa Rica entomologists whose specialty is Hymenoptera, particularly honeybees.

The conclusion from this meeting was that grey cricket production can fit very well into poultry husbandry as practiced in Costa Rica and that cricket protein powder can potentially be locally produced and available to poultry growers at a significantly lower price than soybean meal, which is currently the major high-protein source (see

attached AID pre-proposal). It was agreed by all present, in fact quite enthusiastically so, that a research project should be prepared that would address certain questions pertaining to devising the most efficient methods of mass-producing crickets (see pre-proposal).

Luis F. Jiron, an entomologist interested in the project, and a former graduate student of mine (M.S. degree, 1981) joined us during the latter part of the meeting.

I spent the afternoon incorporating the new information from the morning session into the draft of a research project pre-proposal to be submitted to AID.

May 11:

Inasmuch as one aim of the proposed project is to identify and develop new insect protein production systems based on insects native to Costa Rica, we met during the morning with Dr. Francisco Fallas and Luis Jiron at the National Museum. Dr. Fallas is an expert on certain orthopteroid insects, and especially the cockroaches, certain of which should be given consideration as a possible insect protein source. Dr. Fallas agreed to be available as a consultant in regard to these insects.

The afternoon was spent in further consolidating information for the pre-proposal.

May 12:

During the morning we again met with Dr. Mario Murillo regarding various aspects of developing a joint research project aimed at utilizing the grey cricket, and possibly other insects, as a high-protein source for Costa Rican poultry. Dr. Campabadal had planned to attend this meeting but was unable to do so because of his impending departure for Mexico. (We did succeed in meeting briefly with he and Dr. Murillo during the late afternoon.)

During the early afternoon we visited the Entomology Museum of the University of Costa Rica, meeting a number of the specialists there. Later in the afternoon, we met with Dr. Rodrigo Zeledon, Director of CONICIT (Consejo Nacional de Investigaciones Cientificas y Tecnologicas), and discussed with him the potential of insects, particularly the grey cricket, as sources of locally produced protein for Costa Rica, and the possibility of alternative funding, including from CONICIT, for a research and development project. He also had received prior information regarding the subject and expressed favorable impressions regarding it.

May 13:

During the morning, Murillo, Homan and I met with Mr. Earhart Rupprecht, AID Rural Development Officer at the American Embassy. In addition to discussing possible project funding routes through AID, he raised the question as to whether insects might also serve as a protein source for *Teolapia*, a freshwater fish that is cultured in Costa Rica and which, with more readily available protein, could be a much more important factor in the country's nutrition. Actually, crickets predictably are as good a source of protein for some species of fish as they are for poultry and pigs although the necessary experimental work remains to be done. There is no reason why the project cannot be expanded to include *Teolapia* if that is considered desirable by those making the final decisions on the scope of funding for the project.

During the afternoon we met with Dr. Gilbert Fuentes, pest control entomologist with the Facultad de Agronomia, again briefly with Dr. Murillo, and with Dr. Carlos

Chaves, nutritionist in the Facultad de Agronomia who is in charge of the University Experimental Station at Rio Frio. The station has certain advantages as a location for the first cricket mass-rearing facility, and Dr. Chaves was very helpful and enthusiastic about the possibility of locating the prototype facility at Rio Frio.

May 14:

We left at 5:00 a.m. for Rio Frio, a trip that requires nearly six hours each way although Rio Frio is only 120 km from San Jose. A new road is scheduled to be built within 2-3 years. Luis Jiron and Dr. Fallas accompanied us on this trip which was made to acquaint ourselves with the facilities at the experimental farm.

May 15:

During the morning, we visited the Fabio Baudrit Experimental Farm at Alajuela, about 25 km northwest of San Jose.

May 16:

I left San Jose at 9:00 a.m. on the return trip to Madison, Wisconsin.

Conclusion:

I think that the discussions gave strong indication that grey cricket powder can compete favorably as a high-protein source in Costa Rica, with possibly significant benefits for the country. As a result of the trip, our research on the insect here at the University of Wisconsin is being refocused to strengthen that possibility. In addition a project proposal involving participants from the University of Costa Rica and the University of Wisconsin is being submitted to AID (copy attached).

May 24, 1982

On May 26, I wrote to Dr. Howard Minners, Science Advisor to the Agency for International Development (AID) in Washington, DC:

Dear Dr. Minners:

We are submitting a project preproposal, the original of which will be submitted via AID in Costa Rica. The title is "Development of the Grey Cricket (Acheta domesticus) and Insects Native to Costa Rica as High Protein Sources for Poultry." Inasmuch as they are uncertain whether the copy being sent from there will reach your office by the June 1 deadline, I was asked to also submit a copy from here.

If there are any questions regarding the pre-proposal, to which I might respond, please let me know.

Sincerely,

The proposed budget was \$127,414 over two years. I received a letter, dated July 15, from Dr. Irvin M. Asher (Office of the Science Advisor, AID, Washington) that the preproposal had been received and sent on to a technically relevant internal AID group

for review, and they hoped to inform me in early August whether or not they wished to receive a full proposal for further review. I heard from Dr. Asher again on August 5:

Dear Professor DeFoliart:

We have completed an intra-Agency review of your preproposal entitled “Development of the Grey Cricket (Acheta domesticus) and Insects Native to Costa Rica as High Protein Sources for Poultry (3A-29)”, submitted to our Program in Science and Technology Cooperation. Unfortunately, it was not selected for inclusion in subsequent stages of our review process.

We want to thank you for your interest in our program, and wish you success in finding an appropriate source of support.

Yours truly,

Where had we heard that before? This sounded like *deja vue* (spelling?) all over again. We weren't going to be any luckier linked up with Third World scientists than we had been winging it alone in North America. The Comments on 3A-29 from the AID panel were sent to us:

“A long way to get much protein of any significant value, and what do the crickets eat?”

“Investigator has already completed basic studies on subject which should not require additional donor for continuation. Also, some of the feedstuffs proposed for feeding the crickets can be fed directly to livestock without the extra ‘step.’ ”

“ . . . lacks some estimates of the total cost of mass-rearing insects; it only presents the labor costs per ton.”

[DECIDE WHETHER TO COPY THE A3-29 proposal here or possibly the 1984 proposal that comes up later. It will probably be influenced by how much proposal copying turns up in Chapters 3 and 4 on gray cricket]

On September 9, 1982, I wrote to Dr. Mario Murillo (with copy to Dr. Carlos Campabodal) at the University of Costa Rica:

Dear Mario:

By now Jane Homan has probably told you that we did not get approval for funding from AID. It's too bad – I thought that we had a pretty good chance.

Although we didn't get the grant, we are going to keep right on doing what we planned to do under the grant at this end, and I still hope to be ready, if you and Carlos are still interested, to start a pilot production facility in Costa Rica in little more than a year from now. At that time we may be in a position to set things up there with relatively little additional funding. All of this assumes, of course, that the research here during the next year continues to indicate favorable prospects for such a project.

Thanks for the “cricket-feed” samples. We are beginning, now, tests on their acceptability to the crickets and food conversion efficiency that can be achieved with them. We will keep you informed of results and other progress, and will look forward to receiving any other materials. Mark Finke mentioned that for some of the analyses he will be conducting it would be better not to exceed about 50 to 55 degrees C during the drying process.

I hope things are going well there (for both of you) and look forward to hearing from you, and especially anything that may be relevant to our continued cooperation. I still have fond memories of my visit down there last spring.

Sincerely,

After this letter, there seems to have been a break in the continuity of contact. In my files, I find no further correspondence concerning either the AID preproposal or our Costa Rican colleagues. The next happenings of findable records related to Costa Rica were in 1984. I received a letter from Tom Yuill, dated June 5, which was obviously, or apparently, in response to another preproposal, this one titled “Development of Mass-Reared Crickets and Roaches as a Possible Protein Supplement for Costa Rica Poultry and Swine.”:

Dear Gene:

The Steering Committee of the Title XII Integrated Animal Health and Production project has discussed your proposal for postdoctoral support for the insect protein research that you submitted to us. There was considerable enthusiasm for the development of this area of research and its usefulness to the poultry industry in Costa Rica and other developing countries. However, there was one major question and one problem relating to the proposal that we request your response to.

Ken Shapiro, Associate Dean of International Agriculture, informed us that Title XII Strengthening Grants could not be used for direct support of graduate student or postdoctoral stipends. He pointed out that the purpose of the Strengthening Grant money is for faculty development and AID auditors have been disallowing stipends. Apparently, the only alternative we could consider would be picking up an equivalent portion of your salary and then with Entomology Department and CALS approval, utilization of the salary savings for paying your postdoc.

The second concern is whether the proposed research activity will bring you to the point where you will be ready to begin activities in Costa Rica. It wasn't clear to us what the next step of this research project would be.

Sincerely,

Following receipt of Yuill's letter, I contacted Associate Dean Frank Kooistra (CALS) and was granted approval for the salary manipulations necessary to get around the AID requirements. Then I wrote to Tom (June 20) describing just where we were regarding Costa Rica and probable time frames:

Dear Tom:

Thank you for your letter regarding the Title XII Committee's interest in our "crickets as protein" proposal. If the award is made, I have department approval for putting the title XII funds into my salary and using the salary savings to support the postdoc position. Also, I have talked to Frank Kooistra and there appears to be no problem as far as CALS is concerned (letter to CALS attached). Regarding how the postdoc will be used, it will permit us to complete all critical questions relating to the nutritional quality of crickets as a protein supplement for poultry and hogs and questions relating to their actual use in specific feed formulations. In other words, by the end of the year, with the postdoc, we should be confident about how to use cricket powder as a substitute for other high protein supplements. As mentioned in the objectives of the proposal, the next step is to determine the true digestibility of cricket protein. Phelps (Phelps et al, 1975) showed that termites were of extremely low quality when fed to rats. However the low quality appears to have been related to their low digestibility which was probably a result of the pretreatment of the protein source. We plan to determine the digestibility of the two cricket species that we are currently studying and then use this data along with our amino acid analysis and protein complementation studies to formulate a series of practical diets for swine. We will then run a series of feeding trials to evaluate these diets in a small scale production operation to test their possible application in a full scale swine production system.

There is the possibility also that a feeding trial on fish could be conducted. We have planned to do this eventually because Tilapia is highly regarded in Costa Rica as a potential food source.

Less certain right now is how soon we will have cricket production procedures that make cricket protein superior cost-wise to conventional supplements. It will be necessary to make more progress on this aspect before we can take the next step, which is to set up a pilot facility in Costa Rica. As I mentioned in the proposal we have screened several agricultural byproducts from Costa Rica as cricket food but only one appears to have potential as a basic cricket diet – rice hulls supplemented with peanut hulls (not more than 25%). On chick mash at 33 degrees C, it takes 40-45 days for 80-90% of the crickets to get to the adult stage. We hope to work out a rice hull-based diet that will bring them to maturity in not more than 50-60 days, but I am sure that we will not have all of these mass-rearing problems solved in less than a year.

Up to now, of the two graduate students on this project, Mark Finke and Barbara Nakagaki, Finke's research has dealt primarily, and Nakagaki's partially, with nutritional value of the crickets. Much of Nakagaki's time, and much of our inadequate facilities, have been utilized simply in rearing enough gray crickets to conduct the necessary chick and rat feeding trials. If I can retain Finke for several extra months, we will accomplish more than a beginning student could accomplish in two years toward finishing up that aspect of our work. It will then permit Nakagaki to focus more emphasis on cricket mass-production procedures. In reality, I would be surprised if it doesn't take more than one year before we will be ready to design a pilot cricket production project for Costa Rica, but I am

now free of all administrative responsibilities and my intention is to expedite this aspect of the work as much as possible.

Actually, Finke is looking very hard for a job, so there is no certainty that I can retain him for several months even if this Title XII funding is received. I do not know what flexibility we may have in this regard, that is, reallocating the money if Finke departs before the end of the year. He will receive his Ph.D. in August.

I certainly appreciate the Committee's interest in this project, especially since it has been such a "shoestring endeavor", budgetwise, all along. Please let me know if I can clarify any other points for the Committee in regard to the project.

Sincerely,

The last piece of correspondence in my Costa Rica file was a copy of a letter from Ken Shapiro to Tom Yuill, dated October 16, 1984:

Preliminary accounting of the Strengthening Grant indicates we probably will have enough money for DeFoliart's project. Can he proceed or is it too late?

Tom had forwarded the copy on to me. Any response I made must have been by phone.

Mexico

In the spring of 1986, I had the unexpected and very great pleasure of receiving a letter, dated April 14, from Dr. Julieta Ramos-Elorduy de Conconi of the National Autonomous University of Mexico, stating that she had been awarded an AID (Agency for International Development) scholarship for a short-term research visit to a research institution in the United States, and she would like to spend it, if possible, in our laboratory at the University of Wisconsin. Dr. Conconi had been conducting extensive research since about 1974 on the insects used as food in Mexico and was a prolific producer of technical papers on their use and nutritional value. About a decade later, I was to have the honor of being asked by Julieta to write the Foreword for her recipe book (published in English in the United States), "Creepy Crawly Cuisine," subtitled "The Gourmet Guide to Edible Insects," (1997). I started the Foreword by saying:

Professor Julieta Ramos-Elorduy has probably contributed more to our knowledge of edible insects than has any other person, past or present. For more than twenty years, she and able colleagues at the National Autonomous University in Mexico have studied the use of insects as food in the Mexican countryside. Such use of insects dates to precolumbian times, and the Mexican researchers have documented use of more than two hundred species. . . .

But back to 1986. I responded to Julieta under date of April 25:

Dear Dr. de Conconi:

It was a very pleasant surprise to hear that you may be able to come to Madison for a 4-6 week stay in our laboratory. I most assuredly extend a warm invitation.

It is a little difficult to come up with possible research subjects on which much progress could be made in such a short time. Most of our work for the past three years has been focused on the house cricket, *Acheta domestica*. We have a great deal of data on its nutritional value in both rats and chicks although none of it has yet come into publication. We are currently focused on screening various cheap and underutilized materials such as manures and vine meals for their adequacy as cricket feed ingredients in supporting satisfactory growth in an effort to cheaply mass-produce the crickets. One possibility for your stay here would be to screen several agricultural or other "waste" materials widely available in Mexico for their utility as cricket feed ingredients. We can go into more detail later if this suggestion might be of interest to you.

Another possibility that might be completable in 6 weeks or less would be to conduct a chick feeding trial on another candidate insect species, depending on whether we have enough dried insect powder available for such a test. I have the input of two nutritionists when needed, Dr. M.L. Sunde in the Department of Poultry Sciences, and Dr. Noel Benevenga in Nutritional Sciences and you certainly could tap their expertise, if desirable, while here.

I am wondering whether AID expects a publication or merely a research report to result from your stay? Relative to costs to AID, as long as AID is underwriting your airfare, personal stipend, and living allowance, there will be no further costs, unless we find that supplies or analyses, etc, will amount to an appreciable amount. Most of my funding is for mosquito research and I have only a very small budget for the insect protein project.

I will be teaching during the Fall semester, but after September 26 rather than before July 25 would probably be a better time for your visit from my standpoint. Wisconsin weather is usually pretty nice into December. You might let me know how much leeway you have as far as the timing of the visit is concerned.

I am looking forward to hearing from you and hope that we shall indeed be able to arrange a visit that will prove worthwhile.

Sincerely,

There were several exchanges of correspondence between Dr. de Conconi and I regarding such topics as how we might obtain any experimental results of any real value in the few weeks that would be available, what kind of housing she preferred (cheap, because of very limited funds from AID) and how many seminars we should schedule her to give. It was obvious that we would need a few more dollars than we had if we were going to conduct any experiments. It was obviously time for one of my famous attempts to get research funds from someone besides the Ag College or the Graduate School. I wrote (September 2, 1986) to Peter Dorner, Dean of International Studies and Programs, and Chairman of the Hewlett Committee:

Dear Dean Dorner:

Professor Julieta de Conconi of the National University of Mexico, Mexico City, will be on the Madison campus from October 6th to November 13th under a travel grant from AID. She will be conducting research in my laboratory in certain aspects of utilizing insects as food for humans and as feed for domestic animals. In addition she will present several seminars and will be contacting others on this campus that have relevant expertise.

My Hatch project on Insects as a Food Resource has a very small supplies budget, less than \$1,000. Relative to Dr. Conconi's research here it will be necessary to pay for a number of biochemical analyses. At my request she asked AID to provide sufficient funding for the analyses and for other supplies to be used during her stay, but AID will cover only her travel and living expenses.

Therefore, since Professor Conconi's visit appears to fall well within the purposes and requisites of the Hewlett Awards, I am asking whether up to \$500 might be made available to help cover her research expenses while here. Her visit is especially timely, incidentally, in regard to a current organizational effort on this campus (See the enclosed copy of "A Proposal For Expansion of the Interdisciplinary Food Insects Research Program at the University of Wisconsin-Madison").

Thanks for considering this request. Any help will of course be greatly appreciated.

Sincerely,
(signed)

P.S., Peter – You are welcome to keep the enclosed document if it's of interest. Otherwise, I wouldn't mind getting it back. I've been going broke getting copies distributed to all of the program collaborators, plus a few others.

Peter responded September 8th:

Dear Gene:

The Hewlett Committee will not meet until early October, which is too late to be helpful to you on your request for research supplies for visiting scholar Professor Julietta de Conconi. I am taking the liberty of responding for the Committee on the basis of past experience. We have been reluctant to provide such support in the past for several reasons. There is a very large number of visiting scholars on this campus each year and our relatively small fund could be completely exhausted if we decided to fund such requests. Since this scholar's visit seems clearly to be closely related to your ongoing research, might the Graduate School be able to provide some help to you? Or the College?

I am sorry that I cannot respond more favorably. If the Committee feels differently when we meet in early October, I will be back in touch.

Sincerely yours,
(signed)

P.S. I am returning the document outlining the several projects. Sounds fascinating.

If you can't get money, the second best thing is to be told your stuff sounds fascinating.

Among other further preparations for Dr. Conconi's visit, on September 29th I wrote to Mr. Frank Cooper at the Federal Building in Hyattsville, Maryland:

Dear Mr. Cooper:

Dr. Julieta Ramos-Elorduy de Conconi of the National University of Mexico, Mexico City, will be spending six weeks in my laboratory doing biological research on the use of crickets (Acheta domesticus) for recycling several agricultural wastes into high-protein feed for poultry. I was informed today, by a call from Mexico City, that I should contact you for clearance regarding the agricultural waste materials that Dr. Conconi will be bringing with her (port of entry, Chicago on October 5th). These include mango, pineapple, banana, carrot and sugarcane. All of these samples will be dehydrated, dried at 50 degrees C for 4 days (and, I believe, ground to a coarse powder) prior to leaving Mexico. Biochemical analyses (i.e., proximate and amino acids) will be conducted on both the waste materials and the crickets to which they are fed. Both crickets and excess sample materials, if any, will be incinerated at the conclusion of the experiments.

If I can supply additional information that may be needed

Sincerely,

One of my immediate problems before Julieta's arrival was where to find decent space for her in my crowded lab complex. In discussing this with students, I even briefly suggested as a possibility quartering her with Barb Nakagaki (one of my students) over in the Old Dairy Barn. I had a lot of space on the second floor over there, but it was, of course, obvious that it was part of an old dairy barn. In fact, one of my mosquito students, Jeff Beehler, said, "Boss, if you take Julieta over to the Old Dairy Barn, she's going to think she came to the Third World."

In the mail of November 4, there was a nice surprise for me, a check for \$250. It was from Development Associates, Inc., International Training Programs, Arlington, Virginia. Finally, a success in getting outside money. The trouble was, I don't remember asking for this money (there is no record of it in surviving files), and, in fact, I don't remember now that I had ever heard of Development Associates, Inc. of Arlington, Virginia. So, I don't know why they decided to send me money. Of course that is a much smaller problem than not getting any money.

I don't remember who may have suggested it, or who I was supposed to send it to, or why, but, under date of November 13, 1986, I wrote a letter "To Whom It May Concern," sort of summarizing Julieta's stay in Madison:

This is to say that we have very much enjoyed the visit of Dr. Julieta Ramos-Elorduy de Conconi to the University of Wisconsin. Much was accomplished during her nearly six weeks (October 6 - November 13) here in the Department of Entomology.

An experiment was conducted to determine the nutritional value of several fruit wastes from Mexico (banana, pineapple, mango, orange and sugarcane) in promoting growth of the cricket, Acheta domesticus. This insect is considered to be an excellent potential food species. In addition, she established contacts with several scientists representing various disciplines in the newly created Food Insects Research Program here at the University. Several of these contacts are expected to lead to cooperative research on food insects in the near future.

While here, Dr. de Conconi presented three seminars on the use of insects as food in Mexico. These were well attended and well-received by faculty and students alike. During her visit, she established excellent rapport with our faculty and students, who, I can say, are genuinely sorry to see her visit come to an end.

In summary, I believe that much was accomplished by her stay here, both in exchange of information on the potential of insects as food, and in tangible plans for research on this subject.

Sincerely,

I want to double punctuate what is already strongly indicated in the above letter, that Julieta was a thoroughly delightful guest. Her enthusiasm for her subject, the fact that insects are an important and colorful food in Mexico, was unmistakable. Her energy, obvious even in the laboratory, readily explained why, judging from the voluminous amount of her published research, she must be indefatigable in the field. Although afflicted with sometimes poor postal connections, we continued an irregular correspondence after her departure for home. After a bit of a lapse, I wrote to her, dated June 4, 1987:

Dear Julieta:

The past several months have really flown by since I received your letter. I was sorry to hear about the auto accident in December [a car in which her children were riding was hit by another car] but glad to hear that nobody was apparently seriously injured. There is practically no news from here worth telling. All of the students seem very busy.

Lou and Linda are fine. Linda will become a part-time science writer for the University-Industry Relations program later this year. She's really excited about that. She will also be back in school this Fall semester with a major in IPM, with a secondary emphasis on journalism.

We have a possible source of funding for Walt Goodman for a trip to Mexico relative to your agave worm culturing project. I imagine you will be hearing from him regarding that.

During this week, I have been writing to 6 or 7 people suggesting that we ought to start a periodic newsletter and offering to serve as editor for the first year or two. It seems to me that such a means of communication might be of benefit to

all of us who are interested in insects as food. These first letters have gone to people who have worked on insects as human food. If the response is favorable, I will also contact the people who have worked on insects primarily as poultry and livestock feed. I've also asked how much interest there would be in organizing an international symposium, probably for 1989. We would be glad to host such a symposium here in Madison. I think we could probably find sufficient funding for limited coverage of expenses for major participants. Let me know what you think about these ideas.

The mild weather we were having while you were here continued the remainder of the winter and spring. It was one of our warmest winters on record. We still fondly remember your visit with us. Best regards.

Sincerely,

Everyone, including AID, must have felt that Julieta's visit went quite well. About a year later, I had a letter dated October 9, 1987 from Jose Manuel Pino Moreno, one of Julieta's associates at the Instituto de Biologia at the National Autonomous University in Mexico City. He had applied to AID for study/research abroad to work on using insects as a feed ingredient in a powder or pelleted form, and AID had directed that he come to our laboratory. Jose arrived October 22, and I scheduled him for meetings with Sunde and Benevenga on October 23rd. He brought grasshopper (*Sphenarium*) and mealworm (*Tenebrio*) samples from Mexico. We furnished *Acheta* crickets. We had various nutrient analyses conducted on these samples at the UWEX Soil and Plant Analysis Lab on Mineral Point Road. Jose focused his attention on possible use of pelleted insect formulations as chicken feed. His stay at UW concluded on November 30th 1987; Jose later submitted an excellent 17-page summary of his studies and research results while here in Madison.

Colombia, Pat Conway and Silk for Life

Patricia Conway of Milwaukee, Wisconsin, was the originator of the Silk for Life Project, a fascinating plan to substitute silkworm and silk production for coca (cocaine) production as a livelihood for farmers in Colombia. Pat started her project on an even shakier shoestring than I was used to dealing with in pushing the merits of insects as food. Before telling you when and how Pat and I began to work together, in order to give you an overview of the thinking that undergirded her project, I will copy below part of an attractive Silk for Life brochure that was probably published in about 1990 or 1991:

A process of transformation, simple in its conception, profound in its implications is underway in Colombia. Farm families are gaining independence and a better living through silk production, which replaces cocaine as the prime mover of their rural economy. You can play a vital role in this transformation through your financial contributions or volunteer activities.

The Colombian silk is sold in several forms to U.S. artisans and merchants. Local disadvantaged women are trained and employed in Wisconsin to hand weave the

silk yarn into elegant scarves. The scarves are then embroidered by Hmong craftswomen with a colorful butterfly monogram. By purchasing a scarf you can ensure the success of this project.

.....

Colombian coca farmers are very receptive to this economic development program. A typical farmer in remote Andes “coca country” earns only \$100 per month raising coca. A family cultivating silkworms (sericulture) earns \$300 per month, which supports them comfortably.

As farmers teach farmers the techniques of sericulture, the commitment to raise cocoons, not cocaine, grows stronger. Many farmers are anxiously awaiting mulberry cuttings so they, too, can begin the transformation process.

.....

Silk for Life has several interdependent goals. Colombian farmers’ success at crop substitution supports women in Colombia and Wisconsin in their efforts to break the cycle of poverty and hopelessness.

The greater the demand for scarves, the greater the demand for silk. The greater the demand for silk, the greater the demand for farmers to replace coca plants with mulberry plants.

This beautiful circle of meaning can involve you.

My second contact from Patricia Conway was a letter in April 1987. My first contact was recorded in a P.S. added to her letter to me. The P.S. said: “Hello! Do you remember me? (I brought in the 70 wasps from Colombia to be identified.) Do you think there is a chance your department or the Entomological Society might be able to help us in some way?” In the letter itself, she said (among many other things): “It was about ten years ago that desperate South American farmers, particularly in Colombia, began growing coca leaves to sell to the big cocaine industry, for a price that far exceeded what they had been receiving from the sale of their traditional crops.” I could personally identify with one sentence in Pat’s letter: “We need people and institutions to lend us their good name so that we may continue to promote and develop our information gathering and funding efforts.” That was exactly my rationale in gathering prestigious UW faculty, especially food scientists, under the banner of The Food Insects Research and Development Project. It would help the cause to be aligned with a diversity of respectable scientists.

Pat’s letter was accompanied by several enclosures which explained what it was all about (I was soon to learn that she was as good or better than me in coming up with voluminous documentation on short notice to back up whatever point she was trying to make). First, who is Pat Conway? She is a bilingual registered nurse, born in Milwaukee, and a trained community organizer with experience in both the U.S. and Colombia. She had lived and worked the past six winters in a squatters’ community in Bogota,

Colombia, and had been twice to the village of Pan de Azucar (about 100 families) where she taught the local children how to catch and handle butterflies. With her friend there, Dona Aurora Narvaez, she purchased a small farm (for \$100) to serve as the site for a pilot project in butterfly farming and silkworm production. Another associate in Colombia was Professor Rodrigo Torres Nunez, the leading expert on butterflies in Colombia. The two initial objectives at Pan de Azucar were to start the first butterfly farm in Colombia, and to work with the Colombian Coffee Federation in establishing an experimental silkworm farm.

I responded under date of April 15 to Pat's letter:

Dear Patricia:

I read with interest your letter regarding an effort to initiate butterfly farming as a source of income in Pan de Azucar. I was already familiar with the similar undertaking in Papua New Guinea, and thought it a good idea when I first read about it several years ago. Enclosed is a small contribution (\$40). [If I had had any idea at the time that any of this would ever get into print, I would have made a much larger contribution.]

Before recommending that others consider contributing, I would want to know more about the project. For example, would there be enough of a continuing demand for the species that occur in Cauca and can be cultured, that the farm would be a source of income for participating families for any significant period of time. In other words, wouldn't the market soon become saturated with those species that the farm can produce? How many people will benefit; what proportion of income will go to overhead, etc.? Also, although I presume that the shipped specimens will consist almost entirely of cultured stock, I, and others I'm sure, would want to be assured that there would not be any significantly increased collecting pressure on species that may already be endangered.

Your project and the silkworm project of Prof. Torres is somewhat similar in intent to a project of mine. I have recently organized the Food Insects Research Program here at the University, the primary objective being to enhance the availability of insects as a source of food in those cultures where the tradition already exists. The Yukpa of eastern Colombia, for example, use a variety of insect species as complementary food sources throughout the year. I am wondering whether in your travels to Cauca, you have seen or heard of any such use in southwestern Colombia.

Relative to the possible silkworm experiment, as a byproduct of the silk industry in Asia, the pupae are used both as human food and as a high protein source for poultry. We have a considerable amount of data from chick and rat feeding trials on the nutritional value of insects, including lepidopterans, and these data might be of interest to you relative to the silkworm project. These things all boil down to a question of economic feasibility in the end, and anything that increases the margin between product price and cost of production becomes important.

Sincerely,

With a letter to me written August 6th, Pat enclosed a Final Report of her trip to Colombia, June 12 to July 29, 1987. In it she mentioned: "We are working closely with the biologist in Cauca who runs the silk worm farm for the Coffee Federation. She is providing all the technical assistance we need to care for our young mulberry bushes and to import our silk worm eggs from Japan in November." The relationship between Pat's project, the Coffee Federation, and a women's silk products cooperative in Timbio is described more clearly in this report. The silk farmers financed and sponsored by the Coffee Federation were obligated to sell their cocoons only to the thread factory for export to the Orient. The women's cooperative could buy back only the damaged or unacceptable cocoons for their handicrafts. These were in short supply, so the cooperative was a ready market for cocoons from Pat's group which also produced their own hand crafted silk items in cooperation with the women's co-op. Pat reports that, in July, project enthusiasts were preparing to plant the first 2,000 mulberry bushes on the pilot farm. The bushes had been donated by the founder of the women's co-op.

In addition to soliciting donations to keep her program going during the late summer and fall of 1987, Pat started sending funding proposals to churches and other sources. It was about this time, on Pat's initiative, that we decided to submit a joint proposal to Earthwatch. Pat prepared the proposal after getting inputs from others involved. Reproduced below are the sections on Research Objectives and on Significance:

Research Objectives and Methods

- 1.) Establish a cottage industry as a source of income in Pan de Azucar
 - a) The co-op leader in Timbio will cooperate in organizing a silk handicrafts co-op in Pan de Azucar. b) The silkworm biologist in Timbio will aid in the importation of eggs from China. c) Silkworm egg production and potential disease problems will be studied under Colombian conditions. d) A model silkworm farm will be established in Pan de Azucar. e) Maximum silkworm production per hectare of mulberry bushes will be determined. f) A manual will be published on small farm silkworm production as a means of crop diversification in coffee growing regions of Colombia.
- 2.) Determine the best use of the pupal byproduct as an income-generating resource in Pan de Azucar
 - a) Studies, including biochemical analyses (proximates, amino acids, minerals) and chick feeding trials, will be conducted to determine the protein quality of Colombia-produced silkworm pupae. b) Obtain estimates of the potential annual production of this high-protein supplement per hectare of mulberry bushes. c) Determine the value of silkworm frass (dry fecal pellets) as a pond fish food.
- 3.) Determine the potential of lantern-trapped insects in reviving pond fish culture in Pan de Azucar

- a) Studies similar to 2a above will be conducted on pond fish.

Significance of Research

The local community of Pan de Azucar will reap the benefits of a new cottage industry in the area and economical fish and chicken production, thus improving the quality of the local diet.

As the lack of cheap animal protein sources is the major problem confronting poultry, swine and pond fish producers throughout the developing world, the pupal byproduct may represent a major export resource for the farmers of the region, especially so if lantern-trapped insects prove adequate to provide local poultry and fish production needs.

The outcome of the studies, along with those of similar studies elsewhere, have nutritional and economic empowerment implications far broader than for Pan de Azucar alone. Both technical and popular publications are expected to result.

I heard from Pat, letter of October 5, that our rejection letter from Earthwatch simply said we didn't qualify because we're not using any Earthwatch volunteers. Well, that was true, but we explained in the proposal why none could be used the first year or two:

Need for Volunteers

Because of the political situation in the region, it would be unwise at the present time to bring new American volunteers into the area. Patricia Conway has access because of ties originating more than six years ago. Her effort is entirely volunteer, except for the need for living expenses during the approximately six months per year that she is in Colombia.

Other professional input, from Timbio, the National University of Colombia (Bogota), and the University of Wisconsin, is all on an unpaid basis except for necessary operating expenses.

Ms. Conway's tasks and responsibilities as the only U.S. volunteer will be to coordinate the on-site organizing and research activities. Project dates for the first year of the program will be November 21, 1987 to April 21, 1988.

It is possible that we will be able to invite American volunteers to the project site after one or two years of operation.

Despite the Earthwatch rejection, I did get one good thing done for Pat's project – the donation of two old stereoscopic dissecting microscopes to be sent to Pan de Azucar, as detailed in the following letter of October 5th to Professor Robert Jeanne, Chair of the Academic Committee of the UW Entomology Department:

Dear Bob:

Relative to the old stereoscopic microscopes being declared "surplus" by the Academic Committee, I wish to request that two of them be assigned to the Food Insects Research and Development Project for use at two remote field stations in Colombia, S.A. The two locations are 4-5 hours apart by rough road not hospitable to microscope transportation. They will be used by two Colombian entomologists who are Project cooperators. This cooperative endeavor is expected

to continue indefinitely, and the studies may eventually be integrated with graduate programs here at UW for both cooperators, one as a Ph.D. candidate, the other as a Masters Degree candidate.

Please let me know if any additional information is desired by the Committee in acting upon this request.

Sincerely,

I wasn't just making up that part about possible graduate students in order to strengthen my request to the Department. Rodrigo Torres, who had a Masters degree was interested in going for a Ph.D. in entomology, and Judith Ramirez, the silkworm biologist for the Coffee Federation was interested in going for a Masters degree in entomology. Pat and I had discussed the matter and concluded that both were qualified, and that their graduate research programs could be evolved from the needs of the Colombian silkworm project.

In November, 1987, Pat invited me to become a Board member of the Rural Alternatives – Colombia Exchange, which is what she was calling her project at that time. I accepted, but although there were only two board meetings a year I never made it over to Milwaukee to attend one. It was one more time when my program seemed stretched so thin that we were unable to take advantage of a golden opportunity in a country that could benefit greatly from what we were trying to do. A letter from Pat, dated December 20, 1987, touches on a number of possibilities we had discussed and shows they were ready and willing down there, but in the end, I was unable to deliver from my end. Pat wrote:

Dear Gene:

Well, after missing my flight on Tuesday, the 15th, due to the storm, I made it safe and sound on Wednesday, and now I'm enjoying lots of warmth and sunshine.

I've had a few good discussions with Rodrigo Torres, and he's very anxious to collaborate in any way he can. He does have a few students identifying insects in common Colombian garbage, and I'll include their scientific names with this mailing.

We discussed the large white larva that some families are consuming here, and Rodrigo told me that there is a biologist friend of his that is growing them in great quantity on a nearby farm. The scientific name is: Coleoptera, Scarabaeidae, Dynastinae, Ancognatha sp. (?) I'll be talking to the family in Cauca that, according to their neighbors, fry them and find them tasty.

If you'd like more information on these larvae, please let me know. Also, if you'd like me to bring back samples of these and other insects, please send me instructions and let me know if I need some sort of authorization from the university to bring them into the country.

Rodrigo and I were thinking about trying some crude experiments with lantern trapped insects and silkworm frass and pupae. If you have guidelines on how we should proceed, please send them; otherwise, we'll do some simple feeding trials, if for nothing else, to begin to introduce the idea to Pan de Azucar.

One thing Rodrigo mentioned was that he could use some of his students for conducting some feeding trials with fish at the university. Do you have any

models, and do you have any suggestions for the type of fish. Rodrigo will begin with Tilapia, I believe.

He's anxious to send you mounted material, if it would do any good. A problem that he mentioned is that mounting pins are impossible to acquire here in Colombia. I brought him some 00's, but he's wondering if you have access to large quantities in the range of 00 to 3. This might be something to look into for other scientists in your FIRDP group.

As you can see, I've enclosed the silkworm manual, and I translated a few lines that have key information, but you'll need to get it formally translated, I guess. I just don't have time to work on translating before we leave for Pan de Azucar on Tuesday, the 22nd.

Of course Rodrigo is delighted to hear all the good news about studying for one semester in Madison, he awaits more information. For now, you can write to me at the Bogota address, and as soon as I get a P.O. Box in Popayan, I'll send you the new address.

That's all for now. Take care, and Happy Holidays.

Sincerely,

I'm not sure just what I might have been doing for, to, or about the silk project the last part of 1987 and the early part of 1988, but Pat's "Rural Alternatives – The Colombia Exchange" Newsletter # 5 (April 1988) stated: "Gene DeFoliart, PhD, our technical and scientific director for the project, will research and inform us on how to obtain fertile silkworm eggs to take back to Colombia in September. Dr. DeFoliart is currently in Nepal, working on his Food Insects Research and Development Project." These expectations seemed to be corroborated by the minutes of the first Board of Advisors meeting, held April 26: "Pat brought everyone up to date on our research efforts regarding importing and incubating silkworm eggs. She reported that Dr. Gene DeFoliart will assist us with this when he returns from Nepal, and in the meantime, Jane Ebert, a parishoner from St. Therese Parish will help us obtain hobby silkworm eggs."

In self-defense, I am lucky that I have found a letter I wrote to Pat on June 15, 1988, which will show that, even if I wasn't making much headway on getting silkworm eggs, I was doing something, not just sitting around:

Dear Pat:

I received Newsletter #6 a few days ago. Congratulations on landing \$10 million! That will take a lot of silkworms, but speaking of silkworms I note that you have found a supplier for eggs. The enclosed copy of my report to the international Agricultural Programs Office on my recent Asia trip contains some references to a couple of other silkworm projects that you may find interesting.

Will you let me know if the following is the address for Rodrigo Torres?
[address given]

The first issue of the Food Insects Newsletter will be ready to mail within a week or two, and I want to put him on the mailing list. I'll send his first one care of you, but will need his address soon for inclusion in a directory.

I'm hoping to make it to the Fundraiser on June 24th (my birthday no less) but can't be certain. I've been swamped since returning from Asia. I will be heading for Belem, Brazil the latter part of July to attend the First International Congress of Ethnobiology. I'll be giving a paper on food insects and chairing a symposium on "World Potential for Little-Known Native Plant and Animal Food Sources." Have to go to Ohio for a few days early in July and several in-state trips around that one. Such is life these days!

I hope your present momentum in the Rural Alternatives program continues.

Sincerely,

The \$10 million referred to above was an offer from the Wintersilks company to purchase ten million dollars worth of Pat's group's silk products over the next five years. Except for the big wet sponge of a silkworm egg procurer, her project seemed to be picking up a big head of steam. Her Newsletter # 7 mentions that, since the offer from Wintersilks, they had "been working to put together a management team that would plan, organize, control and finance a cottage industry service here in Wisconsin to knit and weave the products requested by the company and other buyers." It looked like sizable donations were getting ready to pick up, too. My feeling as I sift through these old newsletters, other documents and associated correspondence more than 10 years later, is that they would make interesting and suspenseful reading if put into book form. They portray beautifully a story of one person's courage and persistence in seeking a very creative solution to a huge problem. [Maybe quote some sentences from Jane Fyksen's article]

My contact with Pat became irregular and much reduced after mid-1988. I was apparently still considered a member of the Board of Advisors as late as August 24, 1989 when I was notified of an upcoming meeting to be held on September 6th. I also wrote her a letter on August 24:

Dear Pat,

Enclosed is the Thailand silkworm information. We might get farther here than with the other two addresses. I've enclosed the letter containing those addresses also.

I surely hope you aren't taking undue risks in going back down there [Colombia] at this particular time.

Gene

My worries were apparently well warranted. I quote the first two paragraphs of Newsletter # 14 (September-October, 1989):

Pat and Kerry Return From Monthlong Trip to Colombia

There was a big question as to whether or not we'd be able to continue with our project in Colombia. It was difficult to send money down to buy the silk; our representative there resigned; and the recent violence around the drug war had

everybody worried. Also, one of our friends and co-workers was killed by the right wing death squads in July, and the local community was still in a state of shock and despair.

We decided it was essential to make our trip as planned, so we left September 21st. It was sad and scary at first, as we visited our friend's grave, and met with the eleven different co-ops that have been struggling to continue to spin our silk yarn. But our visit brought a sign of hope and progress, and within one week of our arrival, we purchased \$7,000 worth of silk cocoon products. Thus it appears that our non-profit import-brokerage service is back on track for that Colombian community.

My last letter from Pat Conway was dated August 13, 1990, thanking me for agreeing to help prepare a training program for Colombian visitors. The project was sponsored by U.S.A.I.D. An important component in the training was dealing with the early stages of silkworm rearing. I was supposed to coordinate with Dr. Andrew Hopkins of Alverno College in Milwaukee in order to avoid duplication in training materials. She asked me to contact Carolina Biologicals egg expert, Lawrence Wallis, for ordering eggs – so we apparently still had an egg problem at that time. The specific egg problem, which I believe I have not mentioned here as yet, was that the eggs underwent a 60-day diapause (hibernation); we had been trying to find a source of eggs which did not have this characteristic.

Pat's project, newly named the Silk for Life Project was going big-time by 1991. The also renamed newsletter, The Silk for Life Newsletter, Volume 1, No. 2 (September/October 1991) front-paged "An Open Letter to Vice President Dan Quayle" alongside a photo of Pat and Dan shaking hands:

Dear Mr. Vice President,

Here is a photo of us meeting at the Air Force base in Milwaukee, last October. You're congratulating me on work well done. You said you knew all about our program of crop substitution in coca country, Colombia, and had discussed the Silk for Life Project with President Bush.

You said you would help us obtain Federal funding for the struggling farmers in Cauca, who are ready to tear out their coca plants and plant mulberries in their place for raising silkworms.

Indeed, through your efforts, the House and Senate Appropriations committees passed a unanimous resolution to allocate \$200,000 to the Silk for Life Project for fiscal year 1991.

Well, Mr. Quayle, fiscal year 1991 has come and gone, and we have not received a cent of that money earmarked for those farmers.

Despite all of the rhetoric of our politicians, we simply don't believe our government is committed to finding and implementing viable alternatives for coca farmers.

Thus, we are inaugurating our SEND COCOONS TO CONGRESS campaign.

We want our Federal Government to know that we mean business. We know that the silkworm business generates three times more money than the cocaine business for the farm families in Cauca.

I gave you one of our silk scarves when I met you at the airport. Now I hope that you'll receive thousands of silk cocoons, with the message: WE WANT AMERICA TO HELP COCA FARMERS "RAISE COCOONS, NOT COCAINE."

Please help us obtain the \$200,000 allocated by Congress.

Sincerely,
(signed)
Pat Conway
Director, Silk for Life Project

The same issue of the Newsletter reported a trip to Washington by Pat Conway. The next issue (January/February 1992) reported on the urgent need to support the Cocoons to Congress Campaign; they were planning to use bumper stickers, radio ads and a 900 number among other things to publicize the effort. My last contact from the project was Volume 2, No. 2 (June 1992) sent to me, with the lead article, "Fumigation begins in Colombia." [Try again to contact Pat or to find out what happened to her and the program]

Thailand and Nepal

The earliest surviving mention of either Nepal or Thailand in my food files is a memo from Ken Shapiro dated August 28, 1987, Re: Your Nepal Research Proposal. The first sentence of the memo said: "The Travel Grants Subcommittee of the International Agricultural Programs Committee has recommended funding your proposal subject to several suggested revisions." I don't remember writing a proposal, but the last paragraph of Shapiro's memo gives a clue in saying, "We will need a letter from Professor Neupane inviting you to visit Nepal to work with him . . ." Fanindra Neupane, a Nepalese national had recently returned to a position at the Tribhuvan University Institute of Agriculture and Animal Science (IAAS) in Nepal after completing his PhD studies in the Entomology Department at the University of Wisconsin. He and I must have had some discussions about the prospects of insects as food or feed before he left (confirmed in later correspondence). The position he had returned to was Professor of Entomology at the IAAS in Rampur, and I wrote to him December 4, 1987:

Dear Fanindra:

Dr. Milton Sunde and I have recently had further discussions on the feasibility of attempting to harvest the giant cricket, *Brachytrupes portentosus*, as a cheap high-protein source for poultry in Nepal. We suggest that you contact the appropriate poultry production scientists there at the Institute as to their interest in a possible project, and, if they are agreed, planning could begin immediately. To familiarize your poultry specialists with the probable protein quality of *Brachytrupes*, we have enclosed several reprints of our research on two related

cricket species. Professor Sunde will be more than happy to respond to any questions regarding crickets in poultry nutrition.

Assuming that there is sufficient interest by both entomologists and poultry scientists at the Institute, the International Agricultural Programs (IAP) Office here at the University of Wisconsin has offered to fund a trip to Nepal so that we could further investigate the practicality of large-scale cricket harvest using light traps. As discussed during your stay in Madison, such a trip should probably be scheduled to take place during the major April/May flight period. In addition to testing the effectiveness of various light traps, enough crickets could presumably be harvested to provide samples for biochemical analyses and ample stocks for feeding trials.

The IAP will probably provide limited funding for designing and fabricating several prototype low-cost light traps. Professor Gordon Barrington and Mr. Mark Allington of our Agricultural Engineering and Entomology departments, respectively, have agreed to cooperate in this endeavor. Also, if there are any biochemical analyses (proximates, amino acids, minerals, etc.) that cannot be readily conducted in Rampur, the IAP will furnish such funding as necessary for conducting the analyses in Madison. It would be necessary for the Institute to furnish any funds necessary for student labor (tending light traps, sorting trap catches, feeding and weighing chicks, etc.) and local transportation during my visit there.

Frankly, we are quite excited about the possibilities of *Brachytrupes* as a cheap, locally available, high-protein feedstuff in Nepal. Certainly, people involved there in poultry research and production will be the determining factor, so we are hopeful that they will be as interested as we are in undertaking this project.

Any queries intended directly for Professor Sunde can be addressed to him as follows:

Professor Milton L. Sunde
Department of Poultry Science
#1056 Animal Science Building
University of Wisconsin
Madison, Wisconsin 53706

Sincerely,

Fanindra responded favorably, dated January 15, 1988, having talked to the poultry nutritionist, Dr. N.P. Joshi and the Dean of IAAS, Dr. K.N. Pyakuryal, both of whom were glad to launch a cooperative endeavor with UW-Madison. The IAAS would bear local costs such as student labor while Madison would need to handle biochemical analyses. I again wrote to Fanindra, date February 24, 1988:

Dear Fanindra:

I received your letter of January 15 and am responding TELEX as you suggested. I was glad to hear that we will have the cooperation of Dr. Joshi and the support of your Dean.

We have not made much progress yet in designing cheap light traps, so some changes will be necessary in our original protocol. I am still basing our plans on a cricket flight period extending from approximately early April through late May, and tentatively planning to be there approximately in the middle of this period or between April 20 and May 10, three or four days of which would be spent making contacts in Katmandu. The international Agricultural Programs Office is furnishing one battery-operated black-light trap which I will have air-shipped to you about mid-March. Treat it with tender loving care because it's costing \$365 plus \$207 to ship it by air. It operates for about one week between rechargings. Although we will have only one light trap, it is state-of-the-art, and we can use it as the standard of comparison for later cheaper models. Also, by operating it for the full flight season we should be able to get plenty of crickets for the chick feeding trials, samples to bring back for proximate, amino acid and minerals analyses and some good information on the species composition of the trap catches throughout the season.

I suggest the following tentative procedure for consideration:

- 1) Begin operation of the trap when the first crickets appear, sorting by major species and drying each night's catch. For each trap catch, we need to get total dry weight and proportion of that weight contributed by each major species, probably the five cricket species and the scarabaeid. These data will give us at least a rough seasonal profile of the major species, samples of each of which I will bring back for analysis.

By also having average dry weight of each major species (separately for males and females) we can nutritionally interpret seasonal changes in proportion of the different species collected and also collections from other localities where species compositions may be different. If we had plenty of money, we would want to take a series of samples of each major species throughout the season for biochemical analysis but this time we'll have to make do with one each.

As you know, the light trap has a metal collection container, so it is probably advisable to improvise a small-mesh wire (hardware cloth) or burlap bag container of some sort that will permit more air circulation and thus prevent deterioration of the catch before drying begins.

Another piece of information that we should try to get is the diel periodicity. For example, if the crickets, etc., fly mainly in the crepuscular period or early part of the night, there is no need to operate traps all night. The trap we are sending is equipped with a photocell and adjustable on/off switch.

Let me know what you think of the above suggestions and anything else that we should take into consideration.

I am planning to bring Lou (my wife) along on this trip. In my 37 years of professional life, she has never accompanied me on an overseas trip so maybe it's about time. She will be helpful as part of the labor pool. She knows about crickets, having helped me on a couple of field trips to Colorado a few years ago

on Mormon crickets—I hate to admit, but she stood up under the heat, high elevation and long days better than I did!

Sincerely,

Fanindra responded:

Dear Dr. DeFoliart,

I received your letter (probably dated 26 Feb.) and learnt about our proposed project. I am hopeful that the light trap that you are sending to us would arrive here on time. I will start it as soon as the crickets appear and follow your directions.

Now, about the light trap: Our customs department will demand heavy duty and we have to have a license to import it. Please do the following: Enclose a letter inside the packing stating “Strictly for Research use. Donated by University of Wisconsin to IAAS, Tribhuvan University, Nepal.” Declare the valuation less than \$100.00. In the packet write the following name & address. A copy of the letter may also be sent to the same person.

Udaya Raymajhi
IAAS—USU Project
GPO BOX – 984
Phone: 4-13682
2-15313
Kathmandu, Nepal.

After dispatching it, please notify us. The best airline would be North West Orient which would hand it over to Thai International. Because Thai International has a good service in Nepal.

I am glad to know that Lou is coming along with you on this trip. Welcome to both of you.

Let me know your schedule in advance so that I could reserve you a hotel in Kathmandu and a guest house in Rampur.

Please meet Dr. Coppel before you come here. He has promised to give me some slides on Bio-control. Please bring these for me.

Kindly convey my regards to Barb and other friends in your lab.

Sincerely,

I hadn't counted on such an expensive light trap (Boy! \$365 plus shipping) but the next relevant communication received by Dr. Neupane was a copy of a letter from P.A. Wyman of Old Boys Enterprises, Inc. (Madison-based manufacturers and distributors of “black light” insect survey traps), dated March 24, 1988 and addressed to Customs Officials:

Dear Customs Officials:

This letter is to inform you that the enclosed "Black Light" Insect Survey Trap has been donated by the University of Wisconsin to the Institute of Agriculture and Animal Science, Tribhuvan University, Nepal.

This trap is strictly for research use. Its value is \$97.75.

If you have further questions please contact: [address given]

Sincerely,

There. Done as directed. I heard from Fanindra April 10th, "Udaya has been working with the Customs dept."

Having presented some of the preparations for the Nepal part of the trip, the trip itself, including several days in Thailand, is probably best described by copy of my report, dated June 14, 1988, submitted to the UW International Agricultural Programs:

To: Dr. Kenneth Shapiro
Director, International Agricultural Programs
From: Gene R. DeFoliart, Department of Entomology
Date: June 14, 1988
Re: Summary of Trip to Thailand and Nepal (April 23 – May 17, 1988) Relative to Insects as
Food and Animal Feed

April 23: Left Madison

April 25 – 27: In Bangkok, Thailand

A major contact in Bangkok was Ms. Pongpit Dulyapach, Chief of the Farm Women Extension Program in Thailand (Department of Agricultural Extension, Ministry of Agriculture and Cooperatives). Her agency is cognizant of the great variety of insects consumed by the Lao and Eison (Thai) people in the northeastern part of the country, and she was very helpful with other contacts. A meeting which she attempted to schedule for me with a Mr. Bonnet, who has done research on edible insects, could not be arranged in the short time available, but she will send copies of his reports.

Another major contact in Bangkok was Mr. Pongtorn Sungpuag, Institute of Nutrition and Research Center, at the new Salaya campus of Mahidol University. Mr. Sungpuag (concurrently working toward a PhD at Mahidol) and colleagues have published several papers on edible insects, including one in 1983 with Dr. Prapasri Puwastien (PhD from England, now located up north) containing proximate, mineral and vitamin analyses, and seasonal occurrences of 10 of the major edible species. Mr. Sungpuag and Dr. Prapaisri P. Sirichakwal (PhD, M.I.T.) are currently completing amino acid analyses of these species. As edible insects are widely used in the north and northeast, where there is a protein deficiency problem, the Mahidol group is interested in continuing this work if funding is available. Research connections exist between Mahidol University and Kohn Kaen University (in the northeast, and where other researchers on this subject are located), and it would be possible to develop joint projects. An entomologist at Kasetsart Agricultural University in Bangkok has provided taxonomic

identifications for the Mahidol group, and samples of food insect species are deposited at the Ministry of Agriculture.

A hoped-for meeting with Dr. Chawalit Suntikitrungruang, Chief of Nutrition Deficiencies Control Section, Division of Nutrition, Department of Health, Bangkok, did not take place as his response to my original letter did not arrive in Madison until after my departure. Dr. Suntikitrungruang, however, supplied the names of currently active researchers at Khon Kaen University and several journal articles and government bulletins relevant to the subject. These and other recent reports that are in the Thai language are being translated through the good graces of Dr. Jan Robyn Weisman, a former Peace Corps Volunteer in Thailand and presently Lecturer in Thai Languages at the University of California, Berkeley, and Dr. Robert Bickner, UW Department of South Asian Studies. (Note: Before the trip, The Inventory of Edible Insects Used in Thailand, prepared by the UW Food Insects Research and Development Project, stood at approximately 40 species based on 10 papers examined dating from 1865 to 1983. I will send a copy of the Inventory as soon as information from the most recent Thai language reports has been incorporated.)

Dr. Robert Barn, Director, Program of Science and Technology, USAID, Bangkok, expressed interest in future developments and suggested that a project proposal might be originated from either Khon Kaen University or Mahidol University. He mentioned that grasshoppers are sold, fried, on the streets of Bangkok at various seasons during the year, and that he has tried them. He also mentioned that several kinds of insects are on the menus in the good restaurants up north. In this connection, conversations with people having no special interest in the subject indicated that Bangkok Thais are very familiar with the Patanga (generic name) grasshoppers which are eaten roasted or fried all over Thailand. The large palm grubs (probably Rhynchophorus) also are apparently widely liked in the urban areas. Our tour guide on a trip to the Floating Market mentioned to our group offhandedly that up north where she was from, a certain ant is used for sour flavoring when lemons are not available.

I contacted the Peace Corps office in Bangkok, and, in the absence of Mike Zwack, Agricultural Program Manager who was up-country, talked to Mr. Vance Hyndman, Development Officer. Mr. Hyndman expressed interest in the possibilities and wishes to be kept informed, along with Zwack, of future developments. He also mentioned the wide use of grasshoppers, and that many PC Volunteers have sampled a variety of the insects that are used as food in the country.

Suggested Follow-up:

There is a high level of awareness in Thailand of the nutritional importance of edible insects among the rural populations of the north and northeast. This is evident from the ongoing research at least two of the universities, interest by at least two government agencies, and even from our conversations (although very limited) among the general populace in Bangkok. From discussions with Mr. Barn and Mr. Hyndman, both AID and the Peace Corps will be interested in future developments.

Follow-up might include querying the individuals and agencies involved as to whether a work conference, probably in Bangkok or Khon Kaen, would be of value in setting research and development agendas for the future. I believe that such a conference,

in addition to any value it might have for Thailand, could be of value as a prototype organizational model for other countries in Asia, Africa, and South America where insect consumption is high among rural populations.

Thai researchers and agencies are best able to judge the potential value of such a conference and what the focal points should be. In most countries where food insect use is traditional, much more information is needed on such questions as the taxonomic identity of edible species, the specific nutrient contribution of specific species relative to other available (and affordable) foods, seasonal availability relative to other foods of comparable nutrient contribution, current and potential quantitative use, possible methods of prolonging seasonal supplies, the biological suitability of particular species for more efficient harvest or controlled mass-production, possibilities for expanding urban markets as a source of additional income in rural communities, etc., etc. Until translations of the recent work become available, I will not know the full extent of information on questions such as these in Thailand, but there is undoubtedly more information for Thailand than for most places. Thus, I believe that it could serve as an excellent model of the types of information needed, how the information can best be exploited, and the role of different institutions and agencies. If such a conference is organized, in addition to the groups mentioned above, entomologists at Kasetsart University and/or elsewhere with a knowledge of the bionomics of the edible species should certainly be included in the list of participants.

April 28: Left Bangkok; arrived Rampur, Nepal (about 6 hours from Kathmandu).

April 29 – May 11: In Rampur.

Two projects getting underway at the Institute of Agriculture and Animal Science (IAAS), Tribhuvan University, are of interest. Both offer the possibility of providing high quality protein supplements for poultry and pond fish production at costs well below those for soybean meal and imported fish meal. This cost comparison would be especially true for small farms. The first project is aimed at developing economically practical methods and strategies for harvesting the cricket, Brachytrupes portentosus, plus the local scarabaeid beetle complex and miscellaneous other pest insects that are highly attracted to light. The project simultaneously offers the possibility of reduced crop damage as the cricket is a major pest of corn and tomatoes and a variety of other plants. Ninety-five percent of corn farmers' complaints at field days pertain to this species; also, a few days before our arrival in Rampur, a Peace Corps Volunteer came to the University, complaining that Brachytrupes was ruining her reforestation project. A few first-hand biological observations were possible on Brachytrupes, although the first winged (adult) crickets didn't appear until May 2nd, a month behind schedule, and the population appeared to be unusually low (probably because of the unusually hot, dry spring). Tests were initiated on the attractancy of black vs fluorescent and incandescent light, and catches made during these tests (which will continue for the remainder of the flight period) will be used in chick feeding trials. Much remains to be learned about the most efficient trap designs and the harvest-relevant biology of Brachytrupes, but the density of nymphal burrows (and a dry weight of nearly 1.0 gram per cricket) suggests that there may be a metric ton of these crickets per hectare in some localized areas.

The second project is based on the assumption that the castor plant, a plant adapted to poor soil, can withstand a considerable amount of defoliation without reducing bean and oil yields. Thus, the excess foliage can be used to mass-rear the wild silkworm, Anthrea sp., producing cocoons for silk products and pupae for high-protein poultry feed. Even the silkworm frass (excreta) may prove suitable for charging fish ponds. A question that needs to be answered immediately in this project is whether the probable presence of a high level of cyanogenic glycosides in the castor leaves is likely to result in pupae that are toxic to young poultry and/or fish hatchlings.

IAAS faculty associated with one or both of these projects include entomologist Dr. Fanindra Neupane (PhD, Wisconsin), Mr. Resham Thapa (leaving for 3 years, however, for doctoral studies in the Philippines), and Mr. Meghanath Parojuli (sic); poultry nutritionist Dr. Nanda Joshi (PhD, Michigan State); and fish culturist Mr. Jah. Numerous discussions were had with these individuals, especially Drs. Neupane and Joshi. I prepared a rough draft of an AID preproposal and a full proposal outline which served as a basis of discussion and planning during a final pre-departure meeting of the full group on May 10th. Samples of dried crickets, scarabaeid beetles, mustard seed cake and seeds were brought back to Madison for proximate and amino acid analysis, the results of which will enable Dr. Joshi to prepare experimental chick rations and proceed with feeding trials.

Other activities at Rampur included a meeting with Dr. K.N. Pyakuryal, Dean of the IAAS, and presentation of two seminars. The first (given on very short notice) was on organization and research at Land Grant universities in the United States and was attended by 50-60 faculty and students. The second, "Insects as a Food and Feed Resource," was attended by 70-80 persons and spawned some excellent discussion afterward. An interesting discussion was had with Dr. A.K. Srivastava, Dean, College of Basic Sciences and Humanities, Rajindra Agricultural University, Bihar, India (at the IAAS on a visiting administrative assignment), who was aware of the past and present research on food/feed insects in India and has a faculty member interested in the subject. We plan to maintain contact.

May 11: Arrived in Pokhara. Visited the Entomology Museum, but the Curator, Dr. C. Smith, was on leave, ill, and the assistant curator had returned to the United States.

May 12: Arrived in Kathmandu.

May 13-15: In Kathmandu.

My two main contacts were Entomologist Samudra Joshi (Ministry of Agriculture, National Agricultural Research and Service Center), and Senior Entomologist Mrs. R.B. Pradhan (Department of Agriculture). A sericulture project involving the silkworm, Bombyx mori, is just getting underway and is of interest because of the pupal byproduct which it will yield (poultry feed). The project leader was on an extended trip to study sericulture in India, but details of the project will be sent later. I gave a seminar, "Insects as Food and Feed," which was well-received by the 50-60 people in attendance.

Peace Corps headquarters was in the process of moving to a new location, and I was unsuccessful in contacting the Agricultural Program Officer (who apparently is soon

returning to the United States anyway). I was similarly unsuccessful at AID as both Robert Thurston, Chief of the Kathmandu office, and the Agricultural Program Manager were in the field.

Although the focus of my trip to Nepal was on insects as poultry and fish feed, it was interesting to learn (since there are no published records) that bee brood is widely consumed by Nepalese and that, following grasshopper invasions from India, fried grasshoppers are sold on the streets of Kathmandu and elsewhere. Also, in the hill country toward the border with Tibet, giant earthworms are collected during the monsoon season, held in water overnight to void ingested soil, then dried and stored as provisions which last for several months.

Suggested Follow-up:

The first need is for about \$1,500 for proximate and amino acid (including tryptophan) analysis of the samples brought back to Madison. As soon as the results of these analyses are available, Dr. Joshi can proceed with chick feeding trials. Despite the below-normal Brachytrupes cricket flight this spring, Dr. Neupane will be able to harvest a sufficient volume for the feeding trials. Experimental work will resume during the smaller flight that occurs during September-October.

Another immediate need is to resolve the questions about cyanogenic glycosides in castor-fed Antharea silkworm pupae. Dr Rick Lindroth (UW Department of Entomology) has agreed to conduct the necessary analyses if they cannot be conducted at Rampur. Final resolution of this question will then await feeding trials in Rampur.

As mentioned above, the group at the IAAS, i.e., Neupane, Joshi, Parojuli (sic), and Jah, are very much interested in submitting a preproposal to AID. As the next deadline for preproposals is not until February 1, 1989, however, and funding, even if successful, could not be obtained by that route before April 1, 1990, we want to explore other possible sources of interim funding that would permit these projects to continue progress. UW collaborators will be identified as project needs become more precisely defined.

GRD:lam [End of report]

[There is also a first draft preproposal dated May 8 which might want to copy but probably not]

I also did a hand-written note to Dr. Shapiro on June 14, the first part of which is shown below:

Dear Ken:

Enclosed is a report on my trip to Asia. I felt it was a very worthwhile trip and some good things could result from it.

The October 1987 call for proposals from IAP mentioned there might be seed-money for following up "promising prospects," and my immediate question is whether there might be \$1500 available for followup in Nepal as described on

the last page of the report [I had hoped to get the necessary analyses done as freebies from people I knew but found it would take too long].

On the next day, I wrote to Dr. Nanda Joshi, the poultry expert at Rampur (IAAS) telling him it might take awhile to get the proximate and amino acid results to him. On June 23, I telexed Dr. Neupane that I was going to have the analyses done by the Raltech Company and would pay for them myself. On July 5, I wrote a bunch of people, not a bunch actually but three, including Mrs. R.B. Pradhan and Mr. Samudra Lal Joshi at the Ministry of Agriculture in Kathmandu thanking them for giving me such a warm reception there. To Joshi, I also wrote: "Beyond that, your services as 'guide' during the weekend certainly made the visit to Kathmandu much more enjoyable for both Lou and I than would have been possible otherwise. Lou had done a lot of reading about the religious shrines before we left, so she was particularly grateful to have the benefit of a local 'expert' in seeing them." Also sent, as part of a much longer letter detailing analytical woes, were expressions of appreciation to Fanindra: "Lou and I both want to thank you for a memorably pleasant stay in Rampur. Please say hello to everyone for us and tell them how much we appreciated the warm hospitality we found there. In fact, we were very much impressed with the friendliness of the people in general. Tell Lol we miss his cooking!" Lol and his wife not only took care of the kitchen and the cooking, but also the rest of the campus residence where we were housed.

We heard from Fanindra, dated September 5, thanking us for the present (a flashlight), telling us they had enough crickets (*Brachytrupes*) collected for the poultry experiment and were anxiously awaiting the results of the analyses so they could proceed, asking us to please get the identifications on the scarabaeid beetles and the predatory wasp of *Brachytrupes*, and finally telling us that the earthquake which had hit on August 21st was the worst earthquake in Nepal since 1934. I wrote to Fanindra on October 12th:

Dear Fanindra:

I enjoyed reading your letter which arrived a week or two ago. We were certainly glad to hear that none of you in Rampur and none of your relatives in the eastern region were hurt during the earthquake. The quake got a great deal of press coverage here in the U.S., so we were hoping to hear that all was well with you.

Enclosed are copies of the proximate analyses on the samples I brought back. I thought I would go ahead and send these now, and then when the amino acid results are ready I will TELEX them to you. We have had unbelievable difficulty in trying to get those AA analyses done. When it became apparent that no one on campus was really set up to do them (that would do them for us free, or at reasonable cost), we arranged for Barb to learn the procedures by working with a technician in the Dairy Forage Center. They do amino acids over there but not methionine, arginine or tryptophan, which are three that we need. So Barb has spent much of the past 5-6 weeks getting all set-up over there to run them herself and, barring further unexpected delays, we hope to have the results in about two or 2 ½ weeks.

Regarding the slides, I will try to pick out an assortment soon. I have some reluctance to distribute the slides of Mexico that were given to me by Dr.

Conconi without having her permission, but she has not answered our last two letters.

With best regards.

Sincerely,

As one of the faculty who had received a Title XII grant, I heard from Ken Shapiro on October 28, 1988, as follows: “The US Congress wants to know whether the Title XII has been effective in mobilizing US universities for international development. Would you please send me a brief note on the impacts that your Title XII support has had on your work and how that has been related to international development.” I responded to Dr. Shapiro on November 29th:

Dear Ken:

The Title XII Support given to me for a trip to Nepal and Thailand was extremely valuable in establishing a cooperative endeavor with scientists at the Institute of Agriculture and Animal Science (Rampur) aimed at harvesting the indigenous cricket, Brachytrupes portentosus, as a high-protein source for poultry production in Nepal. If this project is successful, it will reduce dependence on the high-cost fish meal now imported for that purpose from India. The contact made possible by Title XII support also provided reinforcement for another project at Rampur aimed at mass-rearing a wild silkmoth caterpillar, Antharea species, as a source of cocoons for silk products, pupae as a high protein source for poultry, and caterpillar excreta for charging fish ponds.

Unfortunately, the cricket project has been held up for nearly six months for lack of \$1500 for amino acid analyses that are essential before chick feeding trials can begin.

Personal contacts made during a short stop-over in Bangkok, Thailand, could lead to important cooperative efforts in the future, although no specific plans currently exist. Insects are considered of nutritional importance to human populations in the north and eastern parts of the country.

Let me know if more information than this is needed. Also, there is additional information in the memorandum I sent up on June 14th.

Sincerely,

Finally, on February 6, 1989, I wrote a long-awaited letter to Dr. Neupane:

Dear Fanindra:

At long last, we are sending the data you've waited so long for. I really regret that this happened – for the lack of \$1500 we've been held up for eight months. About the only good thing that can be said about it is that Barb Nakagaki was forced to learn how to do amino acid analyses, which she wouldn't have done otherwise. Her note regarding the analyses is enclosed.

Your Nepal specimens that I brought back and Steve Krauth [Curator of the Entomology Department Insect Collection] sent for identification obtained

faster service than we might necessarily have expected. Unfortunately, none of the beetles could be named beyond the genus. We will get the specimens in the mail next week. Steve has kindly agreed to pack them for shipment, so that will relieve your mind of any worry that might be there if I were doing the packing. I hope they do arrive safely. I have kept one specimen of each species for which there were two or more. Hope you don't mind. The label data on all of the specimens kept were Rampur, Nepal; F.P. Neupane; 5-5-88, or 5-6-88.

Totally, enclosures include:

- 1) Note from Barb
- 2) Proximate and amino acid analyses of Brachytrupes males
- 3) “ “ “ “ “ “ “ “ females
- 4) “ “ “ “ “ “ “ scarabaeids
- 5) “ “ “ “ “ “ “ whole mustard seed
- 6) “ “ “ “ “ “ “ mustard seed cake
- 7) Insect identifications

The beetle analyses, incidentally were the mixed material from the traps which included a few winged ants and an occasional moth, etc.

Again, I apologize for the inconvenience this has caused, but hope that the information will prove useful.

Relative to the Food Insects Newsletter, could you send me the addresses for Nanda Joshi, Parajulee, and Thapa. So far, we have sent their copies in care of Neupane, but would like to have individual addresses for the directory.

With very best regards.

Sincerely,

Held up for eight months for lack of \$1500? What a waste! You've heard the old saying, "A day late and a dollar short." In our whole history with this subject, it seems like we were almost always a dollar short. What might have been accomplished if we hadn't been perpetually on a shoestring? So much time spent often trying to dig up only a few dollars. This Nepal case was a good example; in fact, I feel constrained to go into more detail on it to show how time could be expended without getting anything accomplished. In my June 15th letter to Dr. Joshi, poultry nutritionist at the IAAS, I stated, in part:

I'm not sure just how soon I can get the proximate and amino acid results to you. As I mentioned, I was going to try to get them done for free through one of my former grad students who recently became director of nutrition research at Alpo Company. Unfortunately, he doesn't control the lab where the analyses are done, so, although he will try to get them done, it could take two or three months to get the results back.

As noted above, I had written to Dr. Shapiro a day earlier (June 14) asking for the \$1500, but I learned from him several days later that International Agricultural Programs was out of money for the next three or four months. Also, as noted above, I had telexed Dr. Neupane on June 23 that "to get things moving," I was going to have the analyses done

by Raltech in Madison and would pay for them myself. My July 5th letter to Neupane explains what happened there:

Just when it looked like we were at a dead-end on the amino acid analyses, there is new hope. I had given up trying to get them back in any reasonable length of time from the Alpo Company and had decided to send them to Raltech here in Madison. The last time we had AA samples done at Raltech, the cost was a little over \$200 each, with cysteine and tryptophan included. Much to our surprise, we found last week that the price is now well over \$300 per sample. That being out of the question I started calling friends, even including some I don't know very well. The good news is that Dr. Alfred Harper who is "Mr. Protein" in the United States is going to try to run them for us in his laboratory (Department of Nutritional Sciences). He is set up only for the fluid analyses and will try to find someone for the hydrolysis. Also, he'll be gone for nearly a week, thus a further slight delay, but at least it looks like we'll finally get them done. I'll fire the results back to you the day they become available to us.

I have no record of further contact from Dr. Harper, so it fell to my graduate student, Barb Nakagaki to learn how to do the analyses. She encountered some difficulties. Her letter to Dr. Neupane (February 1, 1989):

Dear Fanindra,

Here are the analyses at last. I hope that they are still of some use to you. I had no end of trouble doing the analyses, primarily because of lack of experience. The data for the mustard seed and meal look ok, but some of the numbers for the insects may be slightly low. This was due to the very high percentages of protein in the samples. The large amounts of branched-chain amino acids, particularly leu and ile, tended to wash out my standard norleucine. I have tried to correct for this, but the next time I would just run a smaller sample. All the amino acids are presented in % as is.

Once again, I apologize for the enormous delay. I hope this letter finds you and your family in the best of health. Although we have a new president, everything in Madison is the same.

Yours,
(signed)
B. Nakagaki

I heard from Fanindra, dated March 21st that everything mentioned in my letter of February 6 had arrived safely and that Dr. Joshi was formulating the chick diet and getting ready to conduct the feeding trial.

This story has a surprise ending. Joshi never conducted the chick feeding trial. I never heard a specific reason, but Neupane wasn't too happy about it. He later asked Barb to set up simple protocols from which he could conduct the trials himself, but I never heard whether he was successful. On a brighter note, Megha Parajulee, a bright young man on

Neupane's staff, and I initiated discussions that eventually brought Megha to Madison where he obtained his M.S. degree on insects as food. Because of my retirement, he undertook doctoral studies and successfully completed them under another professor.

Miscellaneous Shorter Visits and Trips

The following short item, titled "Japanese Scientists Visit U.S. and Canada on Fact-Finding Mission" is reprinted from *The Food Insects Newsletter* of November 1991, Volume IV, No. 3:

(Editor: At the specific request of the two undersigned, the item below is published as received. The session in Madison was interesting, enjoyable and of mutual benefit. It is encouraging for the world that an official agency of a technologically advanced nation is taking a serious look at the potential of insects as food.)

The Japanese Ministry of Agriculture, Forestry and Fishery is planning a research project in which various insect functions are analyzed so that the results will be utilized by industries. In this connection, we, a group of six, including two entomologists, Dr. J. Mitsuhashi (Tokyo University of Agriculture and Technology) and Dr. K. Umeya (Food and Agricultural Research and Development Association) visited the United States and Canada this past August. On the trip, we visited Emeritus Prof DeFoliart at Wisconsin University, to talk about insects as food. We confirmed the idea that insects are the most valuable food source which has been left unutilized on the earth. Based on this idea, we discussed selection of species suitable as foods, methods of large scale production of insects at low cost, ways of reforming people's hatred for insects, and other matters. Through this talking, Prof. DeFoliart gave us deep impression with his gentle personality and enthusiasm on food insects. As he pointed out the realization of insect foods has many difficult problems. In the United States as well as in Japan, it will be a long time before the government takes this problem seriously. However, a world-wide deficiency of protein sources will continue to occur in the future and this will turn the people's eyes to insect foods.

Professor DeFoliart also showed us his collection of food insects. Among them, a lollipop containing an insect. The name was **Hot Lix**. We obtained this candy later in San Francisco. The insect was found to be a mealworm, a larva of *Tenebrio molitor*. When we visited Prof. DeFoliart we brought cooked Japanese grasshoppers, "Inago," and a can of wasps as gifts for him. He opened the bag of "Inago" on the spot and enjoyed it with us.

We hope that Prof. DeFoliart is in good health for a long time and can continue his activities, including *The Food Insects Newsletter*.

Dr. J. Mitsuhashi
Dr. K. Umeya

[Probably won't want to include these, but have a bit of info on them:
The Congo (Brazzaville) proposal by Nkouka and Moussa. I wrote a 3-page letter that
might be copied. Jane Homan played a strong role here.
Visit to Madison of CIAT scientists. I had a short proposal.
Larry Meiller and University of West Indies possibilities]

Chapter 8. The Food Insects Research and Development Project

Along about the middle of 1986 I decided that it might be advantageous to be able to do more name-dropping in promoting this subject. By that, I mean I was thinking it might be helpful to create a loose network of UW faculty with special strength in the nutritional and other food sciences who would be willing to be listed as advisors and collaborators. My first approach to the Ag College administration was a letter dated July 3, 1986, to Associate Dean Neal Jorgensen, stating: "I have been giving a considerable amount of thought in the past month to directions that should be taken in the insect protein project and believe that now is the time to elevate it from its currently humble position to a higher status [right about here, Dean Jorgensen probably lifted a skyward glance and uttered something like "Oh Lord"]. I would like to explore the idea with you of creating a 'Food Insects Research Center' under the auspices of the CALS." It occurs to me in reading that letter 15 years later that it certainly didn't have the tone of a letter coming from someone who was on a 10-year losing streak in trying to obtain outside funding for said project. I was not thinking of the "Center" in terms of research only. I mentioned in the letter to Dean Jorgensen that there might be at least two or three one-credit courses or seminars taught on aspects such as "Food Insect Production: Biological Considerations"; "Food Insects: Processing, Storage, Marketing, Home Preparation"; and "Food Insects: Assessing Nutritional Value for Humans and For Meat-Producing Animals." Of course, I enclosed with my letter to Neal one of my patent multi-page background documents, totaling 30 pages, plus three appendices bringing the pages to 52, but not counting the attached CV's of a number of listed participants. In revisiting this scene from many years later, I must say that I have become amazed at my ability to pop out voluminous background documents at the drop of a hat. I'm sure that many of my colleagues, especially administrators, noticed this amazing ability long before I did.

I again wrote to Dean Jorgensen, dated August 12, still in 1986:

Dear Neal:

Enclosed is a revised draft of "A Proposal For Expansion of the Food Insects Research Program at the University of Wisconsin-Madison." Without exception, the people contacted regarding their interest in being involved as collaborators in the program have responded favorably. As a result, the Program Advisory Committee will number 15-20 individuals (from at least nine departments), which is somewhat larger than I had originally planned. A tentative listing of program participants is enclosed.

The Department of Entomology has been formally requested to assign 600 sq. ft. of laboratory space to the Program, part of which will need to be renovated as controlled environment space for rearing sufficient volumes of insects to meet the experimental needs of all collaborators. A copy of my letter to Professor Stanley Carlson (Chairman of the Department of Entomology Research Committee) relative to this additional space is enclosed. Acquiring this or equivalent space will be critical to further efforts to launch the Program as now conceived, and to initiating efforts to obtain outside funding.

Assuming that the Department of Entomology acts favorably on the space request, I would like to ask the College to provide a one-time grant of

approximately \$30,000 as of October 1, 1986, to be used for making the necessary space renovations (to controlled environment) and several months' salary for the two staff positions described on pages 18-19 of the Proposal. This would enable us to get rolling right now rather than suspending everything until outside funding materializes.

If both the Department and the College act favorably on this, I expect to be submitting applications for outside funding before the end of October. Frankly, the College's investment, if approved, will be a gamble. I have not the slightest idea how quickly outside support can be obtained. It will be a case of hunting in new territory and trying to sell the merits of a product that nobody has tried to sell before. Nevertheless, I think we'll be successful—it's merely a matter of when and where.

I would appreciate the opportunity to meet with you and the other Deans at your convenience, and will be glad to furnish any additional information that you may want.

Sincerely,

I must admit, before somebody else raises the point, that two successive sentences in the above letter were not entirely true. They are: "I have not the slightest idea how quickly outside support can be obtained. It will be a case of hunting in new territory and trying to sell the merits of a product that nobody has tried to sell before." Anyone who has read this far knows that I had been trying to sell the idea for a long, long time, without even coming close to having any success.

Regarding the space question, I wrote to Dr. Stanley Carlson, Chairperson of the Entomology Department's Research Committee, the departmental committee with responsibility for assigning space. The letter was dated August 12, with copies to Wyman and Jorgensen:

I should like to formally request that the Department of Entomology assign the #240 laboratory complex in Russell Laboratories (including Rm. 242) for housing facilities of the newly created Food Insects Research Program (see attached document describing the Program).

A total of 15-20 UW professors, including four from the Department of Entomology, are involved as collaborators in the program. The #240 complex will serve as the "nerve center" (see pages 19 and 23 of attached Proposal) and Rooms 242 and 240(d?) will be renovated as controlled environment space for rearing insects to supply the needs of research collaborators. Hopefully, if the Department acts favorably on this request, the #240 space could be made available as of October 1, 1986.

A request has been made to the CALS administration for a one-time start-up grant that would enable the program to get underway while outside funding is being sought. The enthusiasm level of the CALS Deans will depend in part on whether the Department is willing to commit space for this new program.

This space assignment should be considered as long term and subject to termination or renegotiation only by an event such as termination of the program,

my retirement, etc. Actually, the #240 complex is of minimally adequate size (600 sq. ft.). The former Bee Laboratory complex (#436-444) (1350 sq. ft.) would be much better for our needs, and I would be happy to apply for that space instead, if that should be the preference of the Department.

I thank the Research Committee for your consideration of this request. I will be glad to meet with the Committee and/or to furnish any additional information desired.

I again wrote to Dean Jorgensen, dated September 8:

There is now assembled what I believe to be an excellent panel of advisors and collaborators for the proposed Food Insects Research Program (revised listing attached). If we find as much interest outside as I have found among food scientists of every stripe within the University, outside funding (from a variety of sources) should not prove to be a great problem. The rationale and proposed organization of the Program were outlined in the Proposal itself. I would like to outline how I believe that the Program can get its foot in the door in the outside world. First, what the Program can and cannot do:

- 1) It cannot, initially at least, know precisely how food and feed insects might be utilized in different specific cultural and economic situations. That will come only over time.
- 2) It can do all of the basic experimental work necessary to completely evaluate the food quality of candidate food species. When the results start coming in, I think it will become apparent that few food classes are able to match the versatility of our insect candidates (and others yet to be identified) as a source of high-quality protein, high energy, unsaturated fat, and certain minerals and vitamins content all rolled into one package. How this information may be acted upon by private food interests and the public here or abroad cannot be ascertained at present. Like anything else, our product will stand or fall on its own merits. I believe, though, that the Program will reveal that we have a superior product.
- 3) We can do the basic experimental work necessary for devising mass-production and harvest systems. What modifications of these basic systems may be required to adapt them to different specific agricultural and economic situations, is of course not foreseeable at this point.
- 4) Once our existence is known, we can probably be of assistance in various ways to countries where insects are already of more significance or potential significance in the local food and feed picture than is the case here in the U.S.
- 5) By its very existence as an authentic food research organization with the goal of possibly promoting certain insects as food, the Program raises a host of research questions that should be highly

competitive for funding. For example, with Acheta crickets identified as a food candidate species by the Program, many questions become valid as subjects for outside research grant applications, for example:

- a) Are there Salmonella risks associated with Acheta cricket production? (If nobody is considering Acheta as food, who cares?)
- b) What is the lipid quality of the Acheta cricket? (Again, unless Acheta is being seriously investigated as a food, nobody will invest in research to answer the question.)
- c) What is the nature of Acheta fiber?

As I see it we have organized to explore the validity of attempting to open a third food frontier, potentially equivalent in future scope to those of edible plants and domestic meat animals. We have everything to gain and nothing to lose. If nothing in tangible food benefits results, we will have answered a valid question. If tangible food benefits do result, then Wisconsin will get the credit for having been there first. If we are going to talk about certain insects as food, then their merit or lack of merit as food should be addressed by food scientists, while entomologists supply the raw materials and address the biological problems of economic mass-production. This is what I believe creation of the Program would accomplish and it would be a first in agriculture, in food science and in entomology.

If the Program is formally recognized by the College and adequate space committed by the Department, I believe that the next move should be preparation of an article describing its objectives, how it is organized, the types of food candidate insects we are working with currently, and some of the research questions raised by the undertaking. Such an article would have broad enough interdisciplinary implications for submission to Science. If not accepted there, it can go to the Journal of Alternative Agriculture, the Bulletin of the Entomological Society of America or some other appropriate outlet. I believe that the existence of the Program per se would constitute convenient reference for Program scientists in preparing research grant proposals on specific aspects of food insects.

Sincerely,

Jorgensen replied September 17, raising some questions and indicating several requirements that must be met before a “Center” or “Program” might achieve approval:

Dear Gene:

We have reviewed your proposal “A Proposal for Expansion of the Interdisciplinary, Food Insects Research Program.” As indicated to your earlier, the following is important for approval of new Centers or Programs.

1. The department must give approval to the proposed program and supporting letters of such need to accompany the proposal.

2. Space in which to house the program must be available or a proposal provided on how, where, and when such space will be available.
3. Budget source to cover cost of the program must be proposed. Is the Graduate School supportive of the proposal, or would any of the competitive granting agencies support the proposal?
4. Once 1-3 above are approved; we usually have requests to support centers or programs presented to the Academic Planning Council for their approval. In this case, a peer review process may be suggested.

As to the proposal, is there support by cooperative individuals and/or departments? Do the human nutritionists support the concept? Does the concept have practical application for Wisconsin or the U.S.?

Gene, as to budget, we are unable to provide support for the project. Our Hatch and State budgets are extended beyond the limits of available funds. Thus, departmental approval with department resources will be needed if the project is to be started in the near future.

We would be happy to discuss this in greater detail, and are willing to explore options to the proposal.

Best regards.

Sincerely,

Regarding the Dean's question about support by cooperative individuals and/or departments, and specifically, "Do the human nutritionists support the concept?," I had been working on that in filling out the roster of Advisors/Collaborators. The list, as included in the revised background document titled, "The New Interdisciplinary Food Insects Research Program at the University of Wisconsin – Madison, 63 pages, dated February 1987 was as follows:

Department of Agricultural Economics
No representative as yet

Department of Agricultural Engineering
Barrington, Gordon P.
Buelow, Frederick H.
Cramer, Calvin O.

Department of Agricultural Journalism
Gallepp, George W. Science writer
Gonzalez, Hernando V. Marketing public relations
Powers, Richard D.
Pelzmann, Margaret L. Science writer

Department of Anthropology

No representative as yet

Department of Entomology*

Beck, Stanley D. Insect physiology and nutrition

DeFoliart, Gene R. Food insects

Goodman, Walter G. Insect biochemistry and developmental biology

*In addition, several professors representing entomological specialty areas such as aquatic, social, forest insects, etc., are familiar with Program objectives and organization and serve as resource persons when needed. They include Wendell E. Burkholder (stored products insects), B. Jane Harrington (Hemiptera taxonomy and distribution), William L. Hilsenhoff (aquatic insects), David B. Hogg (forage insects), Robert L. Jeanne (social insects), Kenneth F. Raffa (forest insects), Jeffrey A. Wyman (vegetable crops insects), and Daniel K. Young (Coleoptera taxonomy and distribution). Any of these may become active collaborators in the event that research is initiated on food insect candidates within their areas of interest.

Department of Food Microbiology and Toxicology

Clover, Dean O.

Department of Food Science

Hartel, Richard W. Food processing engineering

Lindsay, Robert C. Flavor chemistry, lipids composition, taste panels

Lund, Daryl B.

Mennes, Mary E. Experimental foods (home food preparation, recipes)

Srinivasan, Damodaran. Protein functionality; food processing chemistry

von Elbe, Joachim. Canning processing

Department of Horticulture

Tibbitts, T.W. Space farming; liaison with NASA-funded UW space travel project

Department of Nutritional Sciences

Benevenga, Norlin J. (also Animal Sciences)

Greger, Janet L. Human nutrition with emphasis on mineral metabolism

Marlett, Judith A. Human nutrition: methods of analysis and mechanisms of action of dietary fiber

Ney, Denise M. Lipid and lipoprotein metabolism

Sunde, Milton, L. (also Poultry Science)

International Agricultural Programs

Homan, E. Jane. Tropical animal health and production and veterinary public health

Shapiro, Kenneth H. (Director, IAP) African livestock, international food issues

School of Veterinary Medicine

Yuill, Thomas M. (Assoc. Dean) Liaison with the Steering Committee, Animal Health and

Production, AID Title XII Strengthening

Outside Advisors/Collaborators

Dr. J.R.E. de Conconi, Instituto de Biología, Universidad Nacional Autónoma de México, México, D.F.

Dr. E.H. Erickson, Director, Carl Hayden Bee Research Center, USDA, Tucson, AZ 85719

(Collaborator on the Bee Brood Project)

Dr. M.D. Finke, Beatrice Pet Products, Hanceville, AL 35077: Finke is the first Ph.D. recipient

for research conducted on this subject, has an M.S. in Entomology (studies on food conversion

efficiency in insects) and Ph.D. (1984, UW-Madison) with joint major in Nutritional Sciences/

Entomology (protein quality of insects, including *Acheta* and *Anabrus*), followed by a short

postdoctoral appointment at UW. He has had food industry experience with Ralston-Purina, St.

Louis, Missouri, and Beatrice, and has served as a consultant to several other food and pet food

companies.

Dr. R.W. Howard, Department of Entomology, Kansas State University, Manhattan, KS (termite

biology)

Dr. M.-T. Hsia, Department of Environmental Chemistry and Biology, MITRE Corp. – Washington Center, McLean, VA (pesticide toxicology)

Dr. Fanindra Neupane, Institute of Agriculture and Animal Science, Rampur, Nepal

Among several Advisors/Collaborators added later in 1987 were Jack Kloppenburg (Rural Sociology) and Sid Staniforth (Agricultural Economics). Steve Lawry, Specialist in the Land Tenure Center was a valuable resource person for possible contacts in Africa and would have been on our list but was leaving the UW soon. He and Kloppenburg had both seen mopanie worms (widely eaten caterpillars in Africa) when they were in Botswana, and Jack was aware that they are used also in Zambia and Zimbabwe and stated that they are probably eaten in Mozambique, Malawi and Angola (which they are). I wasn't successful with some in the social sciences. I extended written invitations to, but never heard from, Jan Vansina, Chair of the African Studies Program, Russell Middleton (Sociology), T. Douglas Price, Chair of the Department of Anthropology, and I'm pretty sure that I never heard from Edward Jesse, Chair of Agricultural Economics.

I began getting interesting feedback from some of the people who had been recruited. The following letter from Ken Shapiro (International Agricultural Programs), August 27, 1986, was one of the first:

Thank you for sharing your proposal with me. I would like to respond to your discussion of the use of insects for direct human food versus for animal feed. As you may know, much current discussion of human nutrition problems has shifted away from the earlier focus on protein shortage. Nutritionists now seem largely to agree that if calorie intake is sufficient, protein intake is likely to be also. This seems related to FAO's "eliminating" the protein problem by slashing their published protein requirements. Whatever the merits of fads in human nutrition, the current consensus may make it harder to sell your proposal with a human food emphasis.

Concerning animal feed, I wonder if there might be interest for poultry. It seems that in every African country I visit there is talk of a commercial poultry demand that can't be satisfied because of inadequate feed and health care. Whether demand is high enough to cover the costs of insect feed, I'm not sure. As you know, Tom Yuill, Jane Homan, and others will be investigating the livestock situation in The Gambia this Fall, and they may have useful findings for you.

Please keep me posted on the fate of your proposal. Who are you sending it to? I have some livestock contacts at the World Bank who may be interested, but I doubt they could help with funding.

I sent a memo dated September 29, 1986 to the Entomology faculty:

As discussed at the Faculty Meeting last Friday, the department must give approval before the Deans take the proposal [Food Insects Research Program] to the Academic Planning Council. Some of you saw an earlier draft of the proposal. The attached is a revision that contains some additions and deletions, and which I believe is better organized. You are welcome to keep the copy if you wish. Copies that are returned can be redistributed to the Advisory Committee. My xeroxing bill has been astronomical lately.

In the Entomology Department there was one professor, who, as far as I know, never was known to have passed up an opportunity to be critical of whatever it was I might be doing. Maybe he didn't like the raises he got during my stints as department chair. It didn't bother me – he didn't like a lot of other people either, and the feeling was nearly always mutual. We all know one or more people who seem always to be their own worst enemy. To avoid revealing his identity, I'll simply call him Professor Double zero (00) although that may be a dead giveaway for anybody who knows him. Anyway, Double zero, after reading the proposal referred to in the September 29th memo apparently decided he shouldn't pass up the opportunity to critique the proposal. He directed his missile, titled "Comments on Food Insects Research Proposal" to Entomology department chair Jeff Wyman and associate deans R.L. Lower and N.A. Jorgensen of the College of Ag. He didn't copy his memo to me, the subject of his criticism, but that wasn't surprising as he had a long history of sending letters anonymously. Double zero's memo, a little over three pages long and dated October 6, was as follows:

Since I was given a copy of this proposal to review, I thought it only fair that I put my comments in writing so there is no misinterpretation of my position. I hope that my thoughts will be passed on to the Academic Planning Council.

I have an open mind in reference to research, however because of my Extension responsibilities I frequently am asked to comment on, or justify why certain things are being done, or not being done on the Madison Campus. It is from this perspective that I'm making my comments.

That insects utilize as food, substances that have little or no nutritional value for vertebrates is not factually correct. That insects have a higher food conversion efficiency is misinterpreted. This will be elaborated later. Recycling organic wastes and other under utilized substances need to be further explained. It's not true that no production system for recycling exists. Recycling is governed by economics. This can be illustrated with many common examples such as salvaging metals from sold wastes at a municipal land fill, generating methane from poultry manure, feeding cannery wastes to cattle and hogs, etc. If the price were right, poultry litter probably could be fed to ruminant animals such as goats, sheep, camels, and cows, etc.

That poultry manure presents a disposal problem is not questioned. The basic problem is not the manure, but its concentration and location. It's often next to cities or metropolitan areas where dust, odor, and flies cause problems. The costs associated with recycling it is the removal from chicken houses, and hauling to a suitable site. Poultry manure would be a valuable commodity were it not for the fact that it's in the wrong place.

The calculations (p. 14) illustrate what one can do with numbers if one chooses to ignore the real world. "Assume no cost of the manure" is misleading and makes the calculations meaningless. A comparable situation occurs with youngsters exhibiting a calf at the Country fair are asked how much did this calf cost, and the most frequent response is nothing "we raised it at home on the farm". I can understand this kind of response from a nine or 10 year old, however in a serious project proposal is another matter.

The arithmetic converting 1 million pounds of chicken manure to broilers through crickets is undoubtedly correct, however it's even beyond wishful thinking and quite far from reality; and from my perspective deserves no further comments. To "top off" the feeding program with a manureless diet for 2 days, and then withhold feed for another 24 hours can easily be done in the laboratory, not in an underdeveloped country and possibly not even in U.S. on most farms.

The cricket food conversion comparisons to conventional meat animals is misleading. While I haven't reviewed the cited references, it's standard entomological practice to rear insects in small numbers in environmentally controlled conditions. To validly compare the insect figures with steers for example, it seems reasonable to me that one needs to compare "animal equivalents". How many crickets are equivalent to a 1,000 pound steer? The crickets then should be held in a comparable physical environment, and not in an environmental chamber.

As with chicken manure, cannery wastes have values and costs associated with their utilization. They will not be cheap as implied on Page 19.

I have no argument with the arithmetic in calculating product costs, other than that the cost of electric or solar heat (and cooling) needs to be factored in. I know of no place on this world where the temperature is at $34^{\circ} \pm 1^{\circ}$ C year around, at least not where chickens are raised. Therefore to even come close to reality one needs to factor into the production costs units to heat and cool the cultures, and the cost of operation. Keep in mind the crickets must be kept from freezing in the north and roasting in the south. Therefore these calculations are meaningless.

The section on honeybee brood as food is well written and quite impressive, especially if one is not too familiar with the facts associated with the practical aspects of beekeeping. Training in Entomology does not preclude knowledge of beekeeping technology.

To add brood for food production as another way to enhance income generated from honey production and pollination services is simply irrational. It's the adult worker bee that produces honey and does the pollination. To state that one can remove 20% of the workers prior to emergence, and not stress the colony or affect the productivity is illogical and contradicts well known facts developed at the Bee Lab at Madison by Farrar, Moeller, Detroy, Harp, and others, over perhaps a 20 year period. The limiting factor in productivity is the number of adult bees, and this can be partly argued [sic] by introducing a 2nd queen and operate the hive as a two queen colony, now one accepted practice.

The current price of honey at \$.50/lb. is wrong. The ASCS paid \$0.68.5 for 1985 crop in approved containers, either 60 lb cans or 600 lb drums.

As stated in the proposal, brood production per colony is estimated at 250,000 (workers and drones). This assumes the queen lays at a constant rate of 1,500 eggs/day for 166 days. These are theoretical calculations, not field measurements. Every beekeeper knows the normal queen does not lay at a constant rate. Egg laying begins (in Wisconsin) about mid-January, at a rate dependent on the size of the cluster, space available, and availability of pollen. It takes one cell of honey and one of pollen to produce one bee. Egg laying dramatically increases at the end of March and into April and then continues until the beginning of honey flow (July 1). Up to July 1, every bee counts and in no way can worker bees be harvested without affecting the productivity of the colony. In fact Farrar, documented the fact that production increased, not in a straight line linear function with the number of bees, but increased dramatically with each additional increment of bees above a certain minimum number. I agree one could remove brood beginning perhaps mid-July and not dramatically affect honey production, however moving into mid-August and September, the colony begins preparing for winter, and again every bee counts. Even such simple operations as trapping pollen from a colony affects its welfare, as documented by Moeller about 15 years ago. So I agree its theoretically possible to harvest some workers during July and of course all drones, without damaging the colony, but no where near the numbers calculated.

In reference to Galleria (wax-moth larvae). Apparently the writer is unaware of the fact that there is already a viable hobby and cottage industry doing quite well raising wax worms for fish bait. I routinely receive about 25 calls per

year asking specific questions about production or cultural problems. I know everyone doesn't call me, so I have no way of knowing actual numbers. The diet (Page 29) has been modified in about 1967 to include any kind of prepared cereal, and since then it has been widely used. I know there are a number of large scale operators located in Wisconsin, Illinois, Michigan, Indiana, and Kentucky, because I've consulted with them over the phone on specific problems. I also know that this industry is secretive, because there are no patents, so each operator is quite protective of his operation. I've never been invited to visit a plant. To illustrate the size of their operation, one business buys honey in lots of 6 or 7 - 600 pound barrels at a time, another discontinued a mink business and went into wax worm business. These large operators do mail order business as well as supply the bait shops. I know I'm not the only Extension person in contact with these people, so what's true here is probably comparable in many northern states where fishing is a viable sport industry. So the technology to raise wax worms has been around for over 20 years, and I feel confident the industry could supply ample quantities for people to eat when someone creates a demand.

I'm not opposed to researching innovative and novel ideas, however the person preparing this proposal ought to do the homework to determine whether the ideas are viable, and what is the likelihood of success and adoption using real figures.

As a tax payer supported institution, we have an obligation to think twice before committing money. Whether we know or believe it, "the public is watching." Finally we have a giant surplus of dried milk, butter, cheese, corn, soybeans, and possibly other commodities, and the farm economy is in financial distress. To fund such a proposal in the present state of the economy borders on being irresponsible.

Someone, probably Jeff Wyman, gave me a copy of the Double zero critique, and I responded with my own memo to Deans Lower and Jorgensen, dated October 9:

Although not provided a copy of the critique by Professor [Double zero], I was privileged to see a copy. There may indeed be some erroneous assumptions in the proposal, but, unfortunately, Professor [00's] rambling commentary was not helpful in detecting any of them.

For information and advice on honey bee biology, beekeeping, honey production and brood production the FIRP relies primarily on Dr. E.H. Erickson, Director of the former USDA Bee Investigations Laboratory in Madison, now located at the USDA Bee Laboratory in Tucson, Arizona. For advice on poultry production and poultry manure, the FIRP relies primarily on Professor M.L. Sunde, UW Department of Poultry Science. Relative to *Galleria* (wax moth) larvae, we are aware of the fish-bait suppliers and also the price they charge. For information and advice on *Galleria* production the FIRP relies primarily on Dr. S.D. Beck, W.A. Henry Distinguished Professor of Insect Physiology, who, incidentally, devised the first published diets for *Galleria*.

Only a few days later, October 15th, Entomology chairman Jeffrey Wyman reported to Dean Jorgensen the department's position on the proposal:

Recently you received a copy of a proposal to establish a *Food Insects Research Program* (FIRP) in CALS which was prepared by Dr. Gene DeFoliart of our department. Now that you have had sufficient time to review the proposal and assess its importance to the college, I would like to indicate the strong support of the Entomology Department for this program. Following program review and discussions the faculty voted (16 for, 2 against), to support the establishment of the FIRP as outlined by Dr. DeFoliart and to allocate the 845 suite of rooms in Russell laboratories (845, 845A, B) to it to ensure immediate initiation upon approval by CALS.

It is Dr. DeFoliart's intention to seek outside funding for the program and he has already contacted several foundations in this regard. Although extramural sources will provide all of the continuing support dollars for the FIRP and no financial commitment from the Entomology Department or CALS is involved, I would urge you to give favorable consideration to Dr. DeFoliart's request for a small start-up package. The FIRP is supported by faculty throughout the college and would add an excellent resource in the area of Human and Animal Nutrition. Insects are among the most successful and abundant animal life forms on this planet and, given their extremely high food conversion efficiencies, the potential for their use in the conversion of underutilized substances and organic wastes into high protein/energy food is tremendous.

I urge that you support this program and present it for approval to the CALS Academic Planning Council.

I heard from Dr. Erickson (USDA Bee Lab, Tucson) December 15, 1986:

Please forgive me for being so slow in replying to your letter and proposal. I am only now beginning to clear away the backlog of work following our move.

I have read your proposal and find it to be interesting, and quite accurate with regard to the honey bee section. I feel compelled to reply to Dr. [00's] comments as they are for the most part misleading if not inaccurate and you may want this information in the future.

1. My suggestion that 20% of worker brood could be removed without harming net colony productivity is an estimate – one that needs to be tested in research. That's what your research is all about! My estimate does not contradict Farrar and Moeller (Detroy and Harp did not publish on this). They were looking at spring buildup prior to the honey season and did not examine the issue of compensating reproductive mechanisms either during buildup or population downswing. This is a case where Dr. [00] is trying to use apples to describe bananas. To my knowledge no one has developed data on this aspect of honey bee population dynamics.

2. In recent studies we have been unable to confirm the colony productivity results of Farrar and Moeller on a “per/bee” basis. Certainly more bees in a hive produce more honey per hive but even Dr. Moeller was never able to effectively rationalize the economics of the practice (dollar return on labor investment, etc.).
3. Farrar’s and Moeller’s data were applicable only to Wisconsin and near surrounds. Your proposal is worldwide in scope where beekeeping practices vary greatly.
4. Honey bee brood is consumed routinely in underdeveloped countries which also produce honey.
5. The wholesale price of honey has averaged between 50 and 55cents/lb for the past 5 years or more. Dr. [00] cites the highly inflated USDA price support return for honey on loan to the government. This program is in the process of being phased out if the administration has its way.
6. Egg laying rate is seasonal but Dr. [00] fails to note that in some climates honey bees produce brood and drones year round.
7. There is no data to support Dr. [00’s] contention that every bee is essential to the productivity of the colony. Many apiculturists like myself believe that any given colony has a “reserve force” of “unproductive” bees which is called in to action in cases of ‘emergency’ for example to compensate for the loss of a field force due to natural disaster.
8. Dr. [00’s] diatribe on *Galleria* seems pointless. Sure people are raising them but under what conditions? Are they suitable for eating? Certainly, with your objectives in mind this aspect requires further research.

On November 3, 1986 I wrote to Dean Jorgensen:

Dear Neal:

Thanks for your letter of September 17, 1986 with questions regarding the proposal for a Food Insects Research Program. I have attempted to respond to those questions in this letter and I believe that it is now appropriate, based on the proposal document (as per latest revision) and information in this letter, to request approval of the Program by the College of Agricultural and Life Sciences.

- 1) Departmental Approval. As part of our search for suitable new space, the Food Insects Proposal was considered consecutively by the Department of Entomology’s Research Committee (responsible for recommending new space assignments) and Long-Range Planning Committee. The favorable recommendations for new space by each of those committees was passed without dissenting vote by the

departmental faculty. A subsequent vote by secret mail ballot on departmental support for the Program found 16 favoring, two opposed. Following these actions, Professor Jeffrey Wyman, department chair, wrote a letter of October 15, 1986, to you expressing the department's strong support for the Program.

- 2) Space. As a result of the departmental actions in (1) above, the Department of Entomology has committed approximately 700 sq. ft. in Russell Labs for the Program. This space is described on pages 33-34 of the Proposal.
- 3) Potential Budget Sources. A request for outside support has been sent to the Kellogg Foundation (copy of letter attached) and similar requests for "core support" will be sent to several other foundations within the next few weeks and months. Several proposals for outside support for specific projects within the scope of the core program are in the planning or preparation stages and it is expected that such efforts will gradually proliferate. References to the types of projects and types of funding that hopefully will be spawned by the Program can be found in the Foreword and on pages 21, 26, 28 and 37 of the Proposal. I have not as yet approached the Graduate School, pending administrative approval by the College.

Additional questions in your letter of September 17 were the following:

Is there support by cooperative individuals and/or departments? Cooperating faculty (about 25) from 10 departments are listed on pages 48-50 of the Proposal. We are only at the beginning in learning how to most effectively use this rich pool of talent that has been assembled.

Do the human nutritionists support the concept? Both of the human nutritionists in the program (J.L. Greger and J.A. Marlett) have indicated willingness to undertake projects in their specialty areas if funding can be found. There are some particularly interesting possibilities relative to insects as a source of trace minerals. Research on the quality of insect fiber is also needed, so it is expected that both human nutritionists will be actively involved in Program-related research as well as being available in an advisory capacity on matters of human nutrition in general.

Does the concept have practical application for Wisconsin or the U.S.? The projects on bee brood (pp. 22-27 of the Proposal) and Mormon crickets (pp. 27-28) have direct practical application for the U.S., and the former for Wisconsin. The concept of food insects in general also has potentially great, if more indirect, practical ramifications relative to pesticide use on food crops in the U.S. (p. 4 of Proposal). The greatest potential application, however, is on a broader scale as a food source with possibly unique advantages in availability for many Third World situations (Foreword and Appendix I of Proposal). Any food resource that can improve the nutrition and possibly the cash income of people in the rural areas of the Third World, thus helping to keep them on the land, and

thus possibly helping to slow the migrations to the cities and across borders, should be encouraged and promoted. Insects have long been a significant dietary factor in many poorer regions, and I believe that it is time that western science recognized the fact, and begins to build on it rather than to discourage or ignore it.

In an earlier letter (August 12, 1986) I said it would be nice to have about \$30,000 in start-up funding, so that we could get underway while looking for outside support. I can certainly appreciate the fact that Hatch and State budgets are already extended beyond the limits as you mentioned in the letter of September 17th. Let me simply say that if even \$13,000-\$14,000 can be squeezed from somewhere, we could get this program, if approved, underway. The above amount would ensure the Insect Culture Specialist's salary for six months (pp. 34, 43 of Proposal), and provide \$3,000-\$4,000 for supplies and rearing units for Controlled Environment Room #1 (p. 43). The supplies budget would also permit a few essential biochemical analyses, lack of an adequate number of which has been a major source of inefficiency in the past.

I very much appreciate the assurance in your letter that the administration is willing to explore options relative to the Proposal, and I will be glad to try to respond to further questions that may arise.

Sincerely, (signed)

Dean Jorgensen responded to my letter of November 3 on December 3, inviting submission of a Hatch proposal:

Dear Gene:

This letter is to acknowledge receipt of your revised research proposal related to "Food Insects", in your November 3 communications. While the proposal has been discussed, no approval for funding has been granted. There are two basic reasons for this: 1) we do not yet know what our final Hatch budget will be for 1986-87, thus we do not have funds available for release to qualified projects; and 2) if we are to use Hatch funds, we will need the proposal submitted in accordance with Hatch proposal requirements. I would suggest that you provide us with a Hatch write-up for the proposal. If approved at all levels, we can start ahead of the October 1, 1987 funding date.

The date of submission of the Hatch proposal was January 9, 1987. That was also the official date of submission of a Hatch proposal by Professor Stanley Beck, with the title, "Nutritional Requirements of *Acheta domesticus*." Stan and I had had several discussions about the need for such studies on the cricket, and I was pleased, of course, that he had decided to prepare the proposal and submit it as a supporting study under the broader FIRDP. He requested a Hatch budget of \$36,497 for the first year and slightly more for each of the two succeeding years. This was a much larger Hatch budget than I had ever asked for, but I presumed that physiologists probably needed more and were probably used to getting more. I was one of three faculty members (the other two were from

Nutritional Sciences and Biochemistry, respectively) asked by the Ag College Research Review Panel (letter of February 23, 1987) to review Beck's proposal. The nutritionist was appointed chair of the committee. Some of the discussion got a little rancorous between the biochemist and me – maybe rancorous is too harsh a word – but it was spirited. I wasn't convinced (rightly or wrongly, and maybe I was wrong) that American bias wasn't a contributing factor in the proposal's being given a rating of 3 by the committee. The committee report to Dean Jorgensen was dated March 9, 1987. A rating of 3 means the "project needs major revisions and must be reviewed before given further consideration." The only worse rating is 4, meaning "rejected, should not be funded." On April 6, the same committee was asked to review a revision of Beck's proposal (I can't find, at least temporarily, our report on that one).

By letter of April 28, 1987, from Dean Jorgensen I received a copy of reviewer's comments on my umbrella proposal, "The University of Wisconsin-Madison Food Insects Research Program." I had achieved what Beck could not – a rating of 4 – complete rejection. As the Dean said, though, "The reviewers comments, as to how the proposal was prepared, suggest it has quality and that you should seek outside support." The reviewer's comments were short and are shown below:

The author of the proposal should be commended for a thoroughly reviewed and well prepared research proposal. It is one of the best that the reviewers have seen.

Potential usefulness: The potential for the use of insects for human food seems so far from social acceptance in the U.S. (and acceptance by the Food and Drug Administration) that it does not appear to be appropriate for Hatch support. In addition, the production of insects as an agricultural enterprise does not appear to be economically feasible. The use of insects as animal feed is also of doubtful economic value because of the food energy losses generated by inserting insects into the food chain.

Evaluation of objectives and research approach: The objectives and research approach are appropriate for the concept of the project. However the objectives do not appear to be appropriate for a Hatch project. The Research Review Panel had no suggestions for other approaches that may have greater payoff.

Other staff cooperation: The staffing of the project appears to be satisfactory.

Rating: The consensus rating is 4 – should not be funded.

Suggestion: The Panel encourages funding from outside sources since the project has merit as a potential source of research information.

Below is partially duplicated a letter written May 5th to Dean Jorgensen by Entomology Department Chair Jeffrey A. Wyman. I was very appreciative of Jeff's support:

Dear Dean Jorgensen:

I am writing to propose a possible solution to an impending problem with funding for two Entomology Hatch Projects. I hope that we can discuss these prior to our final budget meeting and reach some kind of agreement since both projects were submitted by outstanding scientists with many years of extremely productive research at the UW. I refer to Dr. Beck and Dr. DeFoliart who both received negative reviews of their proposals relating to the insect/food program.

In discussing the reviews with Dr. Beck, I am convinced that reviews of his new project were negative relative to the subject of the research, vis insects as food, rather than to the scientific merit of the proposal. These aspects could be pursued, but . . . [Wyman proposed, instead, because of recent important research findings in Beck's current Hatch project on the black cutworm, that funding for that project be extended one year]

In regard to Dr. DeFoliart's request, I feel that we are dealing with a very special case. Dr. DeFoliart has been consistently the most effective competitor for outside funding in the Department of Entomology. His record in this regard is outstanding, and he had in fact only sought Hatch support in 9 of his 28 years at Wisconsin.

His proposal for some seed money for the food insects program was rated as "one of the best that the reviewers have seen" in terms of preparation. Again, the point of contention appears to be differing opinions on the usefulness of insects as food. Dr. DeFoliart is prepared to debate the opinions of reviewers as to potential, but in the interests of time I have asked him to consider scaling down his request somewhat. He has done this and is proposing a reduction in support from 4 years to 3 years and a downscaling of the request from a Program to a Project. I believe that he currently has a graduate student on board who would be used to provide experimental materials to several groups in other cooperating departments if funded. The details of what may be possible will need to be discussed, but the department has made a strong commitment in terms of space and there seems to be much support from the cooperators listed in CALS. Dr. DeFoliart is currently seeking outside funding actively and some support from CALS may help in this endeavor. Gene's track record is excellent in this area.

I will be happy to discuss both of these requests with you in the near future. Entomology is undergoing some exciting new developments these days, and I think that some of our recent faculty changes will provide us with a little more flexibility than we have been accustomed to in recent years.

Thank you for your consideration.

Sincerely,

I heard from Dean Jorgensen May 29th briefly reiterating that Ag Administration would not be able to provide funding for the umbrella project; note that we had started calling it a "project" rather than a "program" for reasons that are explained in my next letter to the Dean, dated June 4, 1987. It's tempting to not mention this letter, 2 ½ pages long, as it is obvious that by now I was wallowing in self-pity:

Dear Neal:

I was very disappointed to hear that the College does not plan to fund my Hatch proposal for the Food Insects Research and Development Project. It was a particularly bitter pill to swallow, coming as it does on the heels of a similar rejection by the Grad School of an RA on the bee brood project. The two actions together not only leave me without the 50% Specialist and supplies for the Insect Culture Lab, but with no support for a continuing second-year graduate student as of July 1. I had in fact planned to ask the College for temporary use of the Specialist funds for the RA support since he will be harvesting bee brood this summer for experimental use by the nutritionists in the project.

I want to make one last effort to convince the administration that this proposal, humble as it may seem, is one of the most important that the CALS has been asked to consider in recent decades. I have the feeling that the college is concerned that too many of its clients will consider this endeavor nothing more than a nutty idea from far left field. Most truly revolutionary ideas, however, have initially had to buck the “prevailing wisdom” and the status quo. This one is no different. While it is necessary to buck the status quo in this country, I want to point out as forcefully as I can that for millions of the rural poor in the Third World, insects as part of the diet is the status quo. I propose not some hair-brained scheme good for a paper or two, but to bring some scientific focus upon a legitimate food resource that is already reality to millions left untouched by the Green Revolution.

I am aware of the College policy calling for only one Hatch project per investigator, so let me clarify the relationship of the current proposal to the Hatch project that I already have. The latter is a conventional research project now in its ninth year. Considering that the subject of my Hatch grant bears no relationship whatever to my mainline research program, the Hatch project has been reasonably productive, with eight publications in refereed journals (2 in the J. Econ. Ent., 2 in Poul. Sci., and 4 in the J. Nutrition). More importantly, however, it has provided a solid base for the expanded effort now proposed which is intended to move this new field into the realm of practicality. The new proposal is not intended to support research in my lab, but to provide a mechanism whereby needed research by other disciplines can be brought to bear on a resource of potentially great magnitude. This difference was recognized by the peer review committee in suggesting that the proposal was not suited to normal peer review and should be an administrative decision.

The above point becomes very clear if one looks at the budget package (attached) that I am ready to push in efforts to find outside funding. Of the more than \$200,000/year being solicited, more than \$100,000 is for research in which I will have no direct involvement. Approximately half of the funding is intended for faculty in CALS departments other than the Department of Entomology. I have spent a sizable chunk of time the past year in assembling the relevant research capability in the CALS and will spend another sizable chunk of time this year in searching for outside funding. The Department of Entomology has made a strong commitment by assigning nearly 700 square feet of space for the Insect Culture Laboratory, a facility which is essential for serving the needs of the food scientists who will be involved.

Even without funding or much intraproject communication as yet, we are beginning to see beneficial interaction resulting from this organizing effort. Through Gordon Barrington, the Ag. Engineering shop, in spare moments, is fabricating the metal cages for the prototype cricket production unit. This unit will do double duty by providing research material to the food departments while we work out the remaining details of efficient mass-production. Jim Converse in Ag. Engineering is doing some analytical work on the cricket fecal byproduct, and Bob Lindsay in Food Science some lipids analyses on cricket and tropical roach samples. To top it off, Gordon Barrington assigned “cricket production” as a topic to two seniors in his Equipment Design course 500 during the Spring Semester, and they promptly came up with a watering system principle that will reduce the labor costs for cricket production by more than 50%. We’re getting cost-competitive! This is an excellent example of the kinds of breakthroughs that will occur once the appropriate expertise is focused on the subject. This is why the Project has been created with as much interdisciplinary breadth as possible. Considering that billions of research dollars have been spent on plants and animals as food, it seems not at all out of line to push for a few dollars on insects.

The next two years will be critical. The necessary organization is now in place and primed to move, the specific research directions to be pursued have been determined, and I think that we are finally ready to intensively seek outside funding. We should know within two years or less whether outside funding sources are going to be receptive. For this reason, I would be willing to reduce my request for College support to two years. I believe that within that short span of time, the Project will have demonstrated either that it was a good investment and can fly on its own power, or that it should be abandoned. To protect the College’s credibility with clients who may consider the whole idea impractical, I have converted the proposed “Program” to “Project” status. As merely one of hundreds of projects, less input of College resources is implied.

In addition to the intrinsic merits of the proposed undertaking, there are some personal reasons that make this the appropriate time to move. My “bread-and-butter” research program on mosquito-borne arboviruses is assured of funding at a level of \$70,000 to \$80,000 per year (direct costs) through mid-1990 at which time I reach 65 years of age. Thus I can afford the time and attention that a new project of this scope will require, without abrogating other responsibilities. Finally, I have asked for Hatch support in only the past 9 of the 28 years I have been here. Requests to the Graduate School have probably been even fewer. My ratio of external to internal funding for those 28 years has been somewhere between 10 or 15:1, far higher than any other professor in the Entomology Department, present or past. The proposed project is unique, I think it is important, and my research time is no longer unlimited. For an extremely modest price tag, \$27,000 over two years, the University of Wisconsin has a great deal to gain and nothing to lose by being the first to attempt a full and critical assessment of these important possibilities. Considering the scope of the proposal, the possible payoff is astronomical compared to the majority of Hatch projects. With all of the machinery now in place, it is a case of now or never.

Sincerely, (signed, with copies to Dean R.L. Lower and J.A. Wyman)

(At the end of my copy of this letter, there was a penciled-in P.S. saying, "How about only \$8400/yr for two years, instead of the \$13,600/yr.?")

The Dean responded quickly, June 9th, giving me a sort of verbal fatherly pat on the head (even though I'm older than he is), and reassuring me that I was indeed an appreciated member of the university community:

Gene, we do not question your productivity, ability as a scientist, or contribution to CALS. You have one Hatch project. With no increase in Hatch funding the past few years, in fact a decrease of 4.9% last year, plus significant increases in the RA stipend which has necessitated reallocation of Hatch funds, has reduced our ability to create new project funding for scientists with current Hatch support.

We will provide funding of \$8,400 for support of your proposed project if we get an increase in Hatch funding for October 1, 1987. Without an increase in funding, we do not have the flexibility to provide support.

Best regards.

I responded on June 12th:

Dear Neal:

Responding to your letter, my concern has not been that you question my productivity, ability as a scientist, or contribution to CALS. My record in those areas speaks for itself. My concern has been that the CALS Deans may not be taking the subject of the Hatch proposal seriously. Insects as food is not what I would call a current bandwagon in U.S. science. I mentioned my outside-to-inside dollars ratio in case there might be Brownie points for having drawn relatively lightly on CALS budget resources over the years. Anyway, if the money isn't there, it isn't there. Thanks for holding out the possibility that the proposal will be partially funded if Hatch funds increase in October. Regards.

Sincerely,

[Decide whether to include the letter about Ibingira mentioned in Dec. 10 letter to Jorgensen]

Going back to my letter of June 4th to Dean Jorgensen, the third paragraph from the end has important revelations; it reveals that, despite lack of any direct funding from the umbrella project, a few things were getting underway that involved collaborators from outside Entomology, things that in fact had been initiated by those outside collaborators. A letter from R.C. Lindsay (Department of Food Science), January 8, 1987, shows how one such initiative had been launched by a new collaborator:

It wasn't possible to put anything together in terms of a project proposal in response to your early November communication, but it brought to mind that

some preliminary data would be useful for any future thoughts about a possible proposal.

We have the capability of lipids analysis on a continuing basis, and it would be interesting to look at the fatty acid composition of any candidate insects that may be available on campus. It only takes a couple hundred milligrams of fat to run fatty acid profiles, and we would be able to extract the fat from intact insects. If live or non-dried insects were available, I suppose 25 gm would be enough to make some initial trials with them.

I hope you can arrange for some samples as I would like to get going on some fatty acid profile analyses. I will look forward to hearing from you.

My grad student, Barb Nakagaki, and Lindsay's grad student, Carol Karahadian, handled the first transfer of materials, consisting of samples of the cricket *Acheta* and the tropical roach *Blaberus*.

In the March 1991 issue of *The Food Insects Newsletter* there was an article titled "Insect Fatty Acids: Similar to Those of Poultry and Fish in Their Degree of Unsaturation, but Higher in the Polyunsaturates." No author was listed, but the first paragraph of the article (enclosed in parentheses) was as follows:

(Note and acknowledgements: The editor was unable to find a lipids specialist who would have the time either now or in the immediate future to prepare a short article comparing insects and vertebrate domestic animals as sources of dietary fatty acids. The next best option was to prepare a draft which could be quickly scanned by experts. I wish to thank the following University of Wisconsin colleagues for reading the original draft and suggesting improvements: Dr. Denise Ney, lipids specialist in the Department of Nutritional Sciences; Dr. Joanne Csete, specialist in Third World nutrition, Dept. of Nutritional Sciences; Dr. Robert Lindsay, lipids specialist in the Department of Food Science; and Dr. Karla Ritter, insect lipids specialist presently located in the Clinical Science Center.)

Well, how much solid backup could you want if you had to write an article on the nutritional value of insect lipids? There was quite a bit of activity behind that one short paragraph and I will report it in order to let you know how nice it was to be able to call on human nutritionists and other nutrient scientists when you were trying to bring authenticity to the subject of insects as a human food resource. This was one more beautiful example of how the Food Insects Research and Development Project was supposed to work. I had written to Denise Ney about doing an article originally on May 2, 1990:

Dear Denise:

Enclosed is the latest Newsletter. As you can see, it has an article on factors affecting cholesterol levels in insects. You may remember the November issue had an article on chitin. I wonder if you would be willing to do an article of more or less similar length on the probable nutritional quality of insect fats for humans compared to other sources. Most of the talk about insects concerns their

high protein content, but the fatty acids are pretty highly unsaturated, apparently somewhat similar to fish, and I think such an article would be of interest. I have enclosed a good recent paper on fatty acid and lipid analyses of the cricket, *Acheta domesticus*, and could furnish several other papers.

I will give you a call in a few days to see if you think you might have the time to do this.

I talked to Denise on May 21, and although she told me she was very busy with tenure right then (aren't all assistant professors!!), she would try to do a lipids article for the November Newsletter. It gradually became apparent that the pressures of tenure would preclude her getting to the article by November. I couldn't find anyone else with the time, either, thus I decided to try to do it myself and then would ask all of these experts to look it over and make it into a real article on lipids.

Based on the clustered dates of responses from the people listed in the Newsletter paragraph above, I must have finished the first draft of the manuscript and sent each of them a copy sometime around mid-January, 1991, asking for their comments (and probably by as soon as possible). I heard back from Dr. Ney via hand-written comments on yellow pad paper dated January 26: "I meant to mail this from the Chicago airport but, alas, security has closed all of the mail boxes at O'Hare. Greetings from sunny Calif.!" She continued with three or four general statements. Accompanying these notes was her copy of the manuscript itself. Every paragraph but two had one or more markings of some kind. I was obviously going to learn a lot before I was finished with this manuscript. But that's what I wanted, wasn't it – complete nutritional accuracy when talking about the nutritional value of edible insects.

A letter dated one day later, January 27, accompanied by the manuscript, was received from Dr. Ritter. She started off: "I didn't notice any incorrect information in your article about fatty acids. However, in order to help your readers understand why insects are high in unsaturated fats, and so are a good alternative food, I would change the emphasis of the discussion a little." Only one paragraph of her copy of the manuscript was marked up, but in her letter she used most of the page in making her points A, B, C, and D.

I heard from Dr. Joan Csete in a letter dated January 30th which I duplicate below because her points are probably better understood by the non-lipids specialist:

Dear Gene:

I don't have much to say about this article, which basically looks good to me. I'm not up on the latest developments in lipids, but what you've written about the various fatty acid families seems to me to be fine.

It's a small point, but I find the opening paragraph a little confusing in that it leaves me unsure whether your focus in the rest of the article is to be the needs of the developing world or the needs of North Americans. I would suggest that the sentence about the developing world be stated as follows: "The malnutrition problem in much of the developing world is the result, however, not principally of a deficiency in protein or protein quality, but rather of a deficiency in total calories." I can't frankly imagine that insects, no matter how unsaturated their

fatty acids, will be a very sought after fat source for North Americans, though I'm sure your point of view on this is different.

I don't think the degree of saturation of fatty acids is much of an issue in developing countries, at least not in places where undernutrition is most severe. Meeting essential fatty acid requirements in the diet and also attaining enough calorie density in general, particularly in certain seasons and for children whose stomachs can take only so much bulk, are much more important. In that sense, I wonder about the promise of insect fatty acids in meeting the need for calorie dense foods that young children, in particular, can ingest in adequate quantities to make a difference. Since so much of the insect body would be indigestible but would fill the infant's stomach, I would fear that trying to contribute to calorie density of marginally nourished children's diets through insect ingestion would not be very effective. I don't think this matters particularly for this paper, but it might be a little misleading to set this material in the context of addressing the problem of fat deficiency in malnutrition. If the point is that the composition of fatty acids is similar in insects to that of other animals, that's fine, but the question of the bulk that would be associated with insect fats should be addressed if you want to bring this back to third-world problems.

Thanks for the chance to look this over.

I have not been able to find Bob Lindsay's comments on the manuscript, but there were some, because he is included in my "thank you" letter to Ney, Csete and Ritter, dated February 12, 1991:

I want to thank all of you for reading and returning the manuscript so quickly. It largely passed inspection as far as technical accuracy, but my hearing that the polyunsaturates were not quite the hot items I thought they were compared to the monounsaturates necessitated a slight recasting of the title and the end of the paper. Also, there were several more general comments and a question which I've incorporated as informal "personal communications," mostly toward the end of the paper. And a Table 2 now replaces the vertebrate data formerly in Table 1.

In sending this around once more, I mainly want to be sure that the "personal communication" inclusions are all okay. No need to respond to this if you see no problems. The Newsletter will go to the printer probably late next week. Again, thanks for helping on this.

I close this chapter by describing what maybe was never more than a dream – how to use the sterling faculty talent I had assembled, not only potentially in research, but also in educational outreach. By letter of November 16, 1987, I submitted to Dr. Gene Summers (CALs Curricular Revitalization Project) "A Proposal for Support of One-Semester Pre- and Postdoctoral Fellowships at the University of Wisconsin-Madison for Studies on Maximizing the Nutritional Contribution of Indigenous Food Insect Resources in the Third World." Copies of the letter and proposal were also sent to Dr. Buelow:

Dear Gene:

Enclosed is a proposal for a one-semester fellowship program relating to insects as food. Even though these stipends are for Third World individuals holding a B.S. or higher degree, I think there is a definite relevance to many of the specific goals and objectives of the Curricular Revitalization Project, and for exposure to the kind of educational experience that the Project is seeking for UW undergraduates. The ratio of cost to relevance (and uniqueness) may be more than the committee can bear, but I want to nevertheless float it by you.

Professors listed in the tentative course outlines have not been contacted, so the outlines are very tentative. All of the individuals are, however, involved as advisors/collaborators in the Food Insects Research and Development Project and aware of its objectives.

I will be submitting this later to several outside sources who might be interested in funding one or more fellowships. In the meantime I would appreciate hearing whether the Program may be of enough interest to the Committee to warrant consideration of funding one or two Fellowships per semester over a two-semester stretch.

I will call you in a few days, after you have had a chance to scan the material.

Sincerely, (signed)

A PROPOSAL FOR SUPPORT OF ONE-SEMESTER PRE- AND POSTDOCTORAL FELLOWSHIPS AT THE UNIVERSITY OF WISCONSIN-MADISON FOR STUDIES ON MAXIMIZING THE NUTRITIONAL CONTRIBUTION OF INDIGENOUS FOOD INSECT RESOURCES IN THE THIRD WORLD

Background: Edible insects are an important source of nutrition in much of the developing world. The insects are not used merely to ward off starvation. They are a favorite and traditional food of many indigenous populations in central, eastern and southern Africa, southern and southeastern Asia, and northern Latin America (see pp. 1-6 of enclosed Project Background Document). Nutritionally, insects have been shown to be high in protein, high in energy, and high in many vitamins and minerals (see pp. 6-13 in Background Document). Many indigenous populations at risk from protein-energy malnutrition (PEM) have traditionally preferred insects to meat. They should not be denied the benefits derivable from research on this resource simply because insects are culturally unacceptable as food in the western world.

From the ecological standpoint, recognition of edible insects as a wholesome, nutritious, and respectable part of the food resource base would carry potentially beneficial implications for tropical forest preservation, reduced use of pesticides, more efficient recycling of organic wastes, energy conservation, and sustainable agriculture. The food conversion efficiencies of many insects are several times higher than that of beef cattle, and from significantly to somewhat higher than those of swine, poultry and pond fish. From the standpoint of

technology transfer, greater utilization of insects will require no expensive or sophisticated equipment.

In 1986, the Food Insects Research and Development Project was organized at the University of Wisconsin with the aim of establishing cooperative ties with, and communication and mutual support among, Third World scientists and others interested in undertaking the research and extension programming necessary to maximize the nutritional benefits derivable from their indigenous food insect resources. If there is to be any lasting change in the status quo, the main impetus must come from the local people. During the past year it has become evident that these cooperative efforts could benefit tremendously if integrated with opportunities for short-term study and training here at the University of Wisconsin. Thus, we propose the one-semester fellowship program described below.

The Fellowship Program: Except as otherwise stipulated by sponsoring organizations, applicants must be Third World nationals and at the pre- or postdoctoral level. The program is designed to provide one semester of intensive study at the UW-Madison during which each Fellow will develop a comprehensive plan for integrating indigenous food insects as part of the recognized nutritional base in his/her home country. Successful completion of the Plan will carry five graduate credits (Ent. 990). Formal instruction will consist of a series of four 1-credit seminars as listed below and as described in the attached course outlines:

- Ent. 375. The Human Use of Insects as Food and Animal Feed
- Ent. 299/699a. Food Insect Biology, Nutrition, and Production
- Ent. 299/699b. Insects as Food: Relevant Principles of Human and Animal Nutrition
- Ent. 299/699c. Food Insects: Processing, Packaging, Safety Considerations and Marketing

The instructional staff is interdisciplinary, drawn from nine University departments. In addition to the formal seminars, Fellows will have ready access to the University's libraries, consultation with the wide range of relevant expertises on the Madison campus, and opportunity for intellectual cross-stimulation and exchange of ideas with Fellows from other developing countries with similar food, agricultural, economic and environmental problems.

Relevance of the Fellowship Program to Graduate Studies Leading to the Master's and PhD Degrees at UW-Madison: For students focusing on food insect resources and wishing to enter a graduate program leading to a Master's or PhD in entomology, the described seminar series will ordinarily be included in the first semester of study. Thesis research will focus on specific food insects and it is expected that semesters in Madison will ordinarily be scheduled around those seasons when field research in the home country can be most productive. The

graduate course work selected will support the focus on developing food insect systems and, in addition, enable the student to return home at the completion of the degree program as an entomologist well-trained in the concepts and techniques of integrated pest management, environmental protection, and sustainable agriculture.

While graduate degree-seeking students may hold one of the Program Fellowships for one semester, continuing support must be obtained from other sources.

Relevance to Undergraduate Education at the UW-Madison: The seminars will be open to undergraduates and non-Fellowship Program graduate students, although enrollments will be held to a limit of approximately 15 students per seminar in order to retain the advantages of small-group dynamics. This will provide the opportunity for first-hand contact with Third World nationals in the process of creatively addressing nutritional problems in their home countries. A term paper addressing some aspect of food insect utilization will be required of each undergraduate and non-Fellowship Program graduate student. In conducting their detailed literature searches for biological information of relevance, critical and creative thinking will be required of students in attempting to redirect and adapt existing information toward meeting completely new objectives.

Program Time-Frame: It is anticipated that the program can be operable beginning with the Fall Semester 1988. Support is currently solicited for 4-5 Fellowships for the semester plus 4-5 Fellowships for the Spring Semester 1989. This two-semester experimental period should reveal strengths and weaknesses of the Program and whether and in what format it should be continued.

Budget: Requested Fellowship stipends are pegged to the expected level of 1988-89 UW Research Assistantships. Fellows will be responsible for all living expenses while in Madison and for university registration fees.

Stipend: \$980/month (4 months)	\$3920
Fringe benefits (6% university-mandated)	236
Tuition remission (22% university-mandated)	863
Roundtrip airfare from country of residence (maximum)	1000
Program fee (supplies and course materials)	<u>181</u>
Total	\$6200

ENT. 375: THE HUMAN USE OF INSECTS AS FOOD AND ANIMAL FEED

Credit: 1.

Prerequisites: A course in biology or consent of instructor

Course Instructor: G.R. DeFoliart, Department of Entomology

Offered: Each semester.

Capsule description: Use of specific insect species as food by various cultural and economic groups in each country where such use is widespread; discussion of life cycles, seasonal patterns, general bionomics and primitive harvest methods used

for species of insect families of major food importance. For trainees on Food Insects stipends, term papers required in this and the following seminars will be integrated to form a final term paper presenting, “ A Preliminary Plan for Maximizing the Nutritional/Environmental Contribution of Food Insects in (native country of student or Fellow).”

- 1) Overview; introductions to orders and families of major food insect importance
 - 1) Food insect use in Europe and North America north of Mexico
 - 2) Use in Latin America
 - 3) Use in Central and southern Africa
 - 4) Use in North Africa and Middle East
 - 5) Use in Asia, including Indonesia, the Philippines and Japan
 - 6) Use in Australia and the South Pacific
 - 7) Food insect biology: Orders Coleoptera, Diptera
 - 8) Food insect biology: Hemiptera, Homoptera, minor orders
 - 9) Food insect biology: Hymenoptera, Isoptera
 - 10) Food insect biology: Lepidoptera, Orthoptera
- 12-15 Student reports (oral summaries of term papers)
Term paper: The indigenous food insect resources in (native country of the student or Fellow) (title and subject somewhat flexible)

ENT. 299/699a: FOOD INSECT BIOLOGY, NUTRITION, AND PRODUCTION

Credit: 1.

Prerequisites: Ent. 357 or concurrent enrollment, or consent of course coordinator.

Course Coordinator: G.R. DeFoliart, Department of Entomology

Offered: Irregularly, depending upon demand.

Capsule description: Discussion of biological considerations and technology of potential use in developing new and improved methods of food insect mass-production and harvest.

- 1) Overview; relevance of the food insects concept to reduced pesticide use and other principles of integrated pest management (IPM) and sustainable agriculture (DeFoliart, Entomology).
- 2) The developmental biology of insects (Goodman, Entomology)
- 3) Principles of insect nutrition (Beck, Entomology)
- 4) Diapause and the manipulation of diapause (Beck or Goodman, Entomology)
- 5) Biological considerations in the mass-rearing of insects (Goodman or Beck), Entomology.
- 6) Economic considerations in the mass-production of insects as food/feed (DeFoliart, Entomology)
- 7) The potential of light attraction and chemically baited traps for food/feed insect harvest (DeFoliart, Entomology)
- 8) Pheromones and other behavior-altering chemicals in insects (Burkholder, Entomology)

- 9) The potential of fast action/short residual insecticides of low mammalian toxicity in the mass-harvest of food/feed insects (Raffa, Entomology)
 - 10) The potential of food/feed insects as waste-recycling agents (DeFoliart, Entomology)
 - 11) The role of extension in sustainable agriculture (Koval, Entomology)
- 12-15 Student reports (oral summaries of term papers)
 Term paper: Potential manipulations for enhancing availability of food insects in (native country of student or fellow) (title and subject somewhat flexible)

ENT. 299/699b: INSECTS AS FOOD:
 RELEVANT PRINCIPLES OF HUMAN AND ANIMAL NUTRITION

Credit: 1.

Prerequisites: Ent. 375 or concurrent enrollment, or consent of course coordinator.

Course Coordinator: G.R. DeFoliart, Department of Entomology

Offered: Irregularly, depending upon demand.

Capsule description: The course will familiarize students with current nutrient requirements and sources, and with deficiency and quality problems in adequately supplying specific dietary nutrients; also, with sample criteria for biochemical analyses, feeding trials, and studies on metabolic interactions.

- 1) Overview; history of studies on the nutritional value of insects (DeFoliart, Entomology)
 - 2) Problems on international nutrition (Shapiro, Internat. Agric. Programs)
 - 3) Proteins in human nutrition; experimental methods (lecturer, to be selected)
 - 4) Vitamins and minerals in human nutrition; experimental methods (Greger, Nutritional Sciences)
 - 5) Lipids in human nutrition; experimental methods (Ney, Nutritional Sciences)
 - 6) Fiber in human nutrition; experimental methods (Marlett, Nutritional Sciences)
 - 7) Poultry production: nutrition and management (Sunde, Poultry Science)
 - 8) Swine production: nutrition and management (Benevenga, Meat & Animal Science)
 - 9) Freshwater fish production: nutrition and management (lecturer to be selected)
 - 10) (Subject and lecturer to be selected)
 - 11) (Subject and lecturer to be selected)
- 12-15) Student reports (oral summaries of term papers)
 Term paper: The potential nutritional role of food insects in (native country of student or Fellow) (title and subject somewhat flexible)

ENT. 299/699c FOOD INSECTS:
 PROCESSING, PACKAGING, SAFETY CONSIDERATIONS AND
 MARKETING

Credit: 1.

Prerequisites: Ent. 375 or concurrent enrollment, or consent of course coordinator.

Course coordinator: G.R. DeFoliart, Department of Entomology

Offered: Irregularly, depending upon demand.

Capsule descriptions: Acquaints students with processing and marketing options as they may pertain to food insects produced as items of commerce.

- 1) Overview; the sources and physical forms of food insects as raw products (DeFoliart, Entomology)
 - 2) The food processing industry in the United States (Lund, Food Science)
 - 3) FDA regulations pertaining to insects and insecticides in foods (Cliver, Food Micro. & Toxicol.)
 - 4) Safety considerations in producing insects as food: allergens, toxic chemicals, sequestering of plant toxins, infectious pathogens and parasites (Cliver, Food Micro. & Toxicol.)
 - 5) Food processing engineering (Hartel Food Science)
 - 6) Food processing chemistry (Srinivasan, Food Science)
 - 7) Canning processing (vonElbe, Food Science)
 - 8) Flavor chemistry (Lindsay, Food Science)
 - 9) Marketing public relations (Gonzalez, Agric. Jour.)
 - 10) Food pricing structures (Staniforth, Agric. Econ.)
 - 11) Communicating with writers and influencing publicity (lecturer to be selected, Agric. Jour.)
 - 12-15) Student reports (oral summaries of term papers)
- Term paper: Processing and marketing options for food insects in (native country of student or Fellow) (title and subject somewhat flexible)

Obviously, in looking at the above line-ups, we had assembled a slate of instructors who would be applying an abundance of interdisciplinary expertise in addressing our subject when the time came. Unfortunately, the time never came.

Chapter 9. Getting a Course Approved - It Wasn't Easy

On August 13, 1987, I submitted a proposal for a one-credit course, to be taught on an experimental basis as Entomology 375 under the title, "The Use and Potential Use of Insects as Human Food and Animal Feed." That was a rather long title and it got shorter as time went on. I submitted the proposal to Gene Summers, a professor of Rural Sociology who was serving as chair of the Agriculture, Technology and Society (ATS) Committee of the CALS Curricular Revitalization Project (CRP). Chair of the CRP was Fred Buelow, a professor of Biological Systems Engineering, which, in the old days we called Agricultural Engineering. These two gentlemen could not have been more helpful in the effort to get edible insects represented in the curriculum of the University of Wisconsin. They reacted throughout as if, or gave the appearance anyway, that there was nothing unusual about a university course on eating insects. Aside from the procedures for getting approval of an experimental course, the CRP twice came to the rescue with badly needed funding help.

The New Course Proposal sent to Professor Summers is shown in its entirety in order to give our original thinking on how a course in the subject should be organized and some of the associated problems such as a need for translations to English of a sizable number of books (parts of) and papers containing relevant information:

Introductory Explanation

The proposed course is an outgrowth of the interdisciplinary Food Insects Research and Development Project (FIRDP) organized during the past year at the University of Wisconsin. The course will be the first of its kind (on this subject) to be offered anywhere. Insects have traditionally been, and continue to be, an important source of nutrition for ethnologic groups of non-European origin in the Third World. Despite this, the subject has received essentially no attention from western science. The goal of the FIRDP is to assume an advocacy role for exploring ways in which food insects can make an even greater contribution to human nutrition. A supplemental benefit, in some cases, would be a reduction in the use of pesticides. The course will be taught from these perspectives. The agricultural, nutritional, ecologic, and economic implications of this new food frontier are numerous and important especially in the developing world.

A large mass of published materials relating to food insect use, nutritional quality, and biology is currently being gathered as part of the Project. These same materials are essential for any course that would be developed on the subject. The proposed budget has to do with this literature gathering and assimilation effort and obtaining English translations of the large number of foreign-language papers involved. Without the requested funding, this process could not progress rapidly enough to permit offering the course initially in Spring 1988 rather than at some significantly later date.

The following is arranged according to the July 27th Memorandum from the ATS committee.

1. Topic

Course title: The Use and Potential Use of Insects as Human Food and Animal Feed.

Credits: 1; offered Spring semester 1988 and alternate years; preferred course level, Ent. 375.

Capsule description: Insects have played an important role in human nutrition, and they continue to be of dietary importance to ethnological groups of non-European origin in the Third World. Where insect use is traditional, the insects are a favorite food and are incorporated as a regular part of the diet, not used merely to ward off starvation. The course examines the potential for enhanced use of this food resource.

2. Objectives

A) Students will gain an awareness that insects are a traditional and nutritionally important food among ethnic groups of non-European origin throughout the developing world. B) Gain an awareness that from the standpoints of existing use, nutritional quality, food conversion efficiency, environmental soundness, and all-around compatibility with the principles of low-input sustainable agriculture, this food insect resource warrants far greater research and developmental attention from entomologists and other food and agricultural scientists than it has received in the past. C) Within this setting, a chance to examine from several angles the wisdom and implications of American attitudes and policies on insects as food and insects in food, in view of the environmental costs and food residue problems that result from the intensive, and sometimes excessive, use of insecticides for largely cosmetic purposes. D) In conducting a detailed literature search for biological information of relevance in developing more efficient methods of food insect production and harvest, students will have the rare experience (for undergraduates) of knowing that they are making a genuine and original contribution to science and to human welfare. E) Also as part of the term paper, original, critical, and creative thinking will be required in attempting to redirect and adapt existing information toward meeting completely new objectives. F) Hopefully, the course will generate the same excitement and enthusiasm in students that the subject has generated in the instructor for exploring the possibilities in this potentially vast new food and agriculture frontier.

3. Methods of Instruction

Instruction will be basically by lecture, but very informal (see tentative course outline, Appendix I). It is expected that lectures will generally transform into discussions as the result of questions. Limited use will be made of guest speakers to help cover certain aspects of human and animal nutrition and of

insect nutrition and physiology. The exact nature of guest speaker utilization will not be decided until course organization is further along.

4. Method of Evaluation

The course grade will be based on a written term paper and a 7-10 minute oral presentation of conclusions, with emphasis on content rather than manner of delivery. The standard term paper will involve an intensive literature search on the relevant biology of a genus (if small) or a particular species of food insect, with an assessment of manipulations and needed research that might allow greater utilization, either through large- or small-scale controlled mass-production or more efficient methods of harvesting wild populations. For pest species, ramifications relative to harvest management versus pesticide use as part of IPM programs will be considered. Other special term paper topics will be permitted, depending on the background and interests of a particular student. The range is nearly limitless, but, for example: an ethnological analysis of a region comprising one or more countries; hazards posed by certain insects as ingestant or other allergens, as sequesterers of plant toxins, or as carriers of infectious helminths, Salmonella or other microbiological agents; an assessment of synthetic pyrethroids or other insecticide classes of short residual and low mammalian toxicity as knockdown agent for African migratory locust harvest; etc., etc.

5. Budget

Personnel (30% of a Specialist's salary and fringe benefits for 6 months)
\$3,470

Other (English translations of foreign-language papers)
\$5,000

Total
\$8,470

6. Budget Justification

We are currently involved in a rather massive literature compilation which can be divided into Category I (papers dealing directly with insects as food, i.e., existing use and/or experimental studies on nutritional value for humans or for fish, poultry, or other livestock) and Category II (papers which, although not concerned with insects as food, are nevertheless relevant in elucidating food insect biologies or updating taxonomic relationships. Although we are working on both categories simultaneously, attention is currently concentrated on Category I which is necessarily antecedent to Category II.

The requested budget is intended entirely to support Category I activity. The pertinent literature is widely scattered in anthropological, entomological

and occasionally nutrition journals and books, and much of it is old. We have found, however, in soliciting information from entomologists, anthropologists, former Peace Corps volunteers, and others in a position to have up-to-date information that little has changed regarding insect use in much of the rural Third World (see Appendix II). The old records, therefore, remain largely valid for today, and for some countries they are the only source of published information.

The major problem is the large number of papers in languages other than English (see Appendix III). Of the 550 titles now on file, 152 papers and two fairly short books totaling approximately 1426 pages are not in English. In addition, 21 lengthy papers and books will require scanning by a translator to determine the pages that are relevant. Typed translation of reliable quality for Spanish, Portuguese, and French can be obtained at \$4 per printed page. Thus, the requested \$5,000 would allow English translation of about 1250 pages. Although no estimate is available as yet for translation from German, the cost per page is expected to be similar. We plan no immediate effort to do anything about Japanese translations. These translations are essential in completing food insect inventories now being prepared individually for more than 60 Third World countries. They will place food insect use and biology within the context of the local ethnology, ecology, agriculture and economics. These single-country summaries will serve as the backbone of the course, and student term papers will contribute toward their completion.

Attempting to find and xerox a complete copy or the pertinent parts of most of the 550 papers referred to above is temporarily taking a significant part of the work-week of a Specialist who is budgeted on non-related funding. To correct this situation and permit continuance of the necessary library work, \$3470 is requested with which to pay 30% of the Specialist's salary and fringe benefits for a period of six months, beginning hopefully by October 1, 1987. The Specialist will also be directly involved with students, serving as a source of help for those encountering difficulties in conducting their literature search.

7. Personal Background

My research and teaching are in the field of medical/veterinary entomology, with a strong research focus for the past 20 years on the transmission, vector biology, and epidemiology of mosquito-borne arboviruses. Throughout my 28 years at Wisconsin I have taught the 3-credit course in Medical Entomology (Ent.-Zool.-Vet. Sci. 371). For the past nine years, I have conducted a sideline research project on the nutritional value of insects as a mass-producible high-protein source, primarily for poultry. During the past year, this effort has been expanded to form the so-called Food Insects Research and Development Project which involves approximately 25 UW faculty and staff as resource persons and potential collaborators. This is still largely a "paper organization" without outside funding, but contacts around the world are rapidly being established and the Project is increasingly in a

position to assume a strong advocacy role for bringing research to bear on the subject matter of this course.

8. Curriculum Vitae

Attached.

Appendix II

Recent published studies (past 15 years) on food insect use in the developing world are available for only a few countries, i.e., Mexico (which has a continuing research program), Colombia-Venezuela (1973), Angola (1976), Zaire (1980), Zimbabwe (1976), and Papua New Guinea (1973). We have been updating information on the current status of use in these and other countries via personal communication, a sampling of which follows:

K. Ruddle (pers. comm. 1987), U.S. anthropologist now based in Japan and engaged primarily in Third World aquaculture and coastal fisheries research: "...As is well known to you, insects are widely consumed here in Asia. Despite great modernization and the like they are widely eaten here in Japan - often as a snack to accompany alcohol. Consumption rates are high in Southeast Asia, particularly among the Thais, Laotians, Burmese (the market in Vientiane is full of stalls with edible insects) and the Kampucheans... I know that the Malawians consume plenty of a wide variety of insects. I was also thinking about the possibilities of raising insects as cheap supplementary fish feed on small farms... Certainly, to address your points, finally, I do believe that insects can make a potentially enormous contribution to solving problems of human nutrition; this would be facilitated by applied research and extension (extension would also help overcome the respectability problem - government approval of a traditional foodstuff, etc.); and certainly insects could be an important source of local income generation."

R.J. Phelps (pers. comm. 1987), U.S.-trained medical entomologist at the University of Zimbabwe: "...As far as the harvesting of termites goes, there are certainly no recent developments in this country. The traditional methods are still used widely, but plenty of alates escape to provide possible new colonies. I am sure that there would be plenty of opportunity to develop new harvesting methods. One difficulty is that many species produce alates only once a year, so things need to be geared to a very short period in the year... As far as your proposal to try to stimulate [scientific] interest in insects as food/feed goes, I think that the time may well be ripe in this country... Certainly dried caterpillars of saturnid moths are sold on the local market, and consumption of termites, locusts and tettigonids by the vast majority of the population continues in spite of the presence of western cultures. In fact, many people of European background eat termites here, although not in the quantities that the local people do..."

G.S. Ibingira (pers. comm. 1987), former Ambassador to the United Nations from Uganda: "... The more I see both people and chickens getting 'crazy' over these insects when they are in season here, the more I remain convinced that we are on to something of great significance for many African societies... Specifically, I particularly commend to you [for development] two insects: winged termites and cone-headed grasshoppers. They are great delicacies among many tribes in Uganda and other Eastern and Central African countries. I am ready to assist and participate in any way I can to a feasibility study on one or both insects to develop workable systems for commercially breeding, harvesting, packaging and marketing them. I would wish very much to establish the first viable operation in Uganda. I am almost certain, I can also enlist the interest of the Uganda government, with which I have excellent relations, in assisting you to use Uganda as a base for such study..."

It wasn't long before I received from Professor Summers a letter dated September 10, 1987, which began as follows: "It is my pleasure to inform you that the ATS Committee accepted your proposal to develop a new course on 'The Use and Potential Use of Insects as Human Food and Animal Feed', as outlined in your memo of August 13, 1987 and has approved the budget request of \$8,470." This happy beginning gave no hint of the troubles that lay ahead before the course would be a formally approved part of the UW curriculum; this approval was good only for an experimental offering of the course.

One of the brightest spots about this ATS approval was its approval of the budget for translations. I had been extremely lucky to have made any progress at all in getting translations up to this time. So lucky in fact that it was one of the reasons why I had come to believe that this project had a green light somewhere among the powers that be. Heloisa Scholl, the wife of one of my medical entomology graduate students, Phil Scholl, was from Brazil originally and fluent in Portuguese, but the important thing, she was also fluent in Spanish. A lot of published information on insects as food, especially in Latin America, was in Spanish, and Heloisa, bless her, had translated a huge amount for free. One would think that that was enough good luck for one project. But, no. Dianne Landry, the wife of another of my medical entomology graduate students, Steve Landry, was fluent in French. A lot of information on insects as food, especially in Africa, was published in French, and Dianne, bless her, too, translated a lot of it, also for free. With the ATS grant, it would now be possible to pay Heloisa and Dianne a little for additional translations, not anywhere near what they were worth, but at least a little. Despite some payment in the later stages, the project's remaining indebtedness to these two young women is enormous.

Along in April, I heard from Patricia A. Morton, Guide Coordinator, Department of Zoology, that: "Your name and/or course has been selected to be included in the U.W.-Madison Guide to Research and Study in the Tropics. This guide will help direct students and faculty to academic resources related in some way to the tropics." This group, The Tropical Studies Group was supported by funds from The Institute for Environmental Studies. I don't think I heard anything more from them, but, when you are swimming upstream you tend to notice anything that suggests you have respectability.

The first offering of the course, under its experimental designation Entomology 375, was in the Spring Semester, 1988. Only nine students showed up; the six who finished each got an A. The Summary Report copied in part (a few paragraphs below) explains why we lost the other three.

The CRP provided one other bit of financial support, placing \$240 at our disposal to pay \$20-30 per student for computerized literature searches. The students' grades in the course would be largely determined by the term papers resulting from these literature searches.

At the end of the semester, I had a greater than usual interest in what the student evaluations of the course would reveal. The course evaluation sheets are scaled as follows: 5 = excellent, 4 = above average, 3 = average, 2 = below average, 1 = unsatisfactory. The Lecture Summary is based on responses to eight questions, and the course mean was 4.10. The General Summary is based on five questions (examples: The quality and challenge of this course compared favorably with others of this level; The course stimulated interest in the subject; etc.), and the course mean was 3.96. The mean for the Overall Summary was 4.05. The second part of the evaluation consists of open-ended comments on any aspect of the course. I was especially interested in this as I hoped it would show what the students thought about the subject matter of the course as well as what they thought of the instructor and the instructor's approach to the subject. The five individual comments received are copied below:

Material became very repetitious toward the end. Do not know how to avoid this. Project was ambiguous. The anthropological aspects were very interesting. Class could be organized to give equal weight to different aspects of subject such as rearing, collecting, preparing as opposed to many weeks of lists of insects from different countries.

This course was very interesting. The sheets with genera and species listings for each location would be much more helpful with old taxonomy listings included if possible. I think it would have been fun to have a final class period where we could try some of the insects we learned about. I would have liked to learn more about the food-insect research program here on campus. It might be helpful to extend the class period a little bit more, since some days it seemed like we really didn't cover as much as should be covered.

It is very interesting and I learned a lot about searching for literature in the library. The work was flexible and encouraged to meet my own schedule especially since there were no exams to study for, I could use this time for research or outside reading. At times I found the research and writing overwhelming due to the amount of material and at times frustrating due to the lack of material. The instructor has been very helpful in making up missed lectures and made taking this class possible when all others were not due to my compromised health at the beginning of the semester.

This course may be offered a little earlier, because most materials have not been arranged in a very good order. However, this course is pioneer to get into this field. As the experiences and material being assembled, this course will be most exciting and interesting.

It is somewhat difficult to evaluate the content of this course since it is the only course of its kind anywhere. I definitely enjoyed coming to lectures and doing the literature search etc. I learned much more about doing research, tracking down sources and esp. the problems involved in doing research than any other class. Dr. DeFoliart was very understanding of these problems (unavailable journals, foreign language etc.) and offered support and good suggestions. Some of the things I learned may play an important role in the future of the world. Other aspects were rather amusing as well. Definitely a worthwhile topic to study.

On June 20, 1988, I sent the following letter and summary report on course 375 to Gene Summers:

I was in Asia the latter part of April and much of May, thus the delay in forwarding this summary. I surely appreciate the great amount of help I have received from the ATS Committee in trying to organize and offer this course. Also, in connection with this report, I want to express our appreciation to the Steenbock Library staff who did an excellent job of helping students with term paper literature searches.

GRD:amd
Enclosures

- 1) The course, Ent. 375 "The Human Use of Insects as Food and as Animal Feed," (1 credit) was taught as an experimental course the past spring. I currently plan to submit a new course proposal (same title and at the 300 level) and offer the course again next spring and probably each spring thereafter.
- 2)
 - a) Course Syllabus: The only "Syllabus" available at present is the course outline posted last spring (copy enclosed). When revised for the next course offering, the topics covered will be essentially the same, but there will be changes in order of presentation and inclusion of considerably more non- biological information than was possible this time. About 25 handouts (enclosed) were distributed to serve as background for lectures.
 - b) Reading assignments: No outside reading was assigned to the class as a whole, but each student did a considerable amount of independent outside reading in connection with term paper preparation.

c) Writing assignments: Each student conducted a computerized literature search on a specific group of insects, studied as many of the pertinent papers as could be found, and then wrote a term paper focused on the food--relevant biology.

d) Laboratory assignments: None

e) Copy of all examinations: No exams given. Grade was based on the term paper.

f) List of guest speakers: Dr. Stanley D. Beck, Professor of Insect Physiology, gave one lecture.

g) Field trips: None

h) Of the 9 students who started the course, one, senior Food Science major (who was carrying 20 hrs.), dropped the course, fearing an inadequate background in entomology. A senior anthropology major converted to an audit for the same reason. A junior entomology major who switched from Ag to Letters & Science midterm dropped the course because it didn't qualify under the 100-credit rule. (This student by the way was a member of the University's forensic team and won a number of interstate debates during the spring using the subject matter of the course).

Of the six students who completed the course for credit, one was a sophomore pharmacy major, another a junior in secondary education, and 4 were entomology majors, 3 graduate students and one senior.

i) Summary of student evaluations: Copy attached.

j) My assessment of the course:

I was very pleased with the "mix" of diverse academic backgrounds of the students who originally enrolled. The fact that one student dropped and that several from L. & S. who inquired about the course but did not enroll because of the 100-credit rule suggests that an effort should be made to qualify the course before it is again offered. Also, to keep the desired mix, every effort should be made to keep the entomology background needed to a minimum. I regretted losing the food science and anthropology majors, but as an audit the anthropologist was a valuable contributor throughout the semester.

Before the next offering of the course, a great amount of additional information will have been incorporated on the culture and ecology of the indigenous populations in which the use of insects as food is important. Inclusion of more information in the biology of the insects used will permit much more focused examination of biological manipulations that might be used to increase the supply and nutritional contribution of these traditional foods and will help to determine the types and level of

technology that can appropriately be applied. We will also be able to examine with more precision the nutritional role of insects within the existing agricultural milieus that exist in different regions.

The new block of knowledge that is being assembled and organized relative to this course has in the estimate of this instructor great implications for the rural Third World and necessitates integrated examination of agricultural and ecologic alternatives in relation to the social fabric traditions and economic condition of indigenous populations. Only against that background can the impact of different levels of technology be assessed. For example, certain caterpillars, termites and other insects are among the favored traditional foods of indigenous populations in much of central and southern Africa. These foods in many cases are preferred to beef. One can ask what the ecological and nutritional maps of Africa might look like today if more effort had been directed toward developing some of these caterpillars, termites, and other food insect resources. In other words, what are the comparative prices of beef, goat, dog, fish, poultry, caterpillars, grasshoppers, etc. in village markets and what are the ecological costs (deforestation, etc.) in supplying these various sources of animal protein. Edible insects come out looking very good in such comparisons which raises questions concerning the negative influences of western acculturation and the impact of policies that focus on increasing agricultural exports rather than feeding the local populace.

I believe that this course, which is in fact exploring the desirability of recognizing a new agricultural discipline, will soon provide an excellent framework within which students from various disciplines in the University “can interact in exploring the linkages of agriculture, technology and society.”

The New Course Proposal form for Entomology 364, “The Human Use of Insects as Food and Animal Feed,” bore July 22, 1988 as the date of preparation. Copied below is the last item called for in the form, Description of Course Content:

Certain insects are among the preferred foods of many indigenous populations in Africa, Asia and Latin America. More than 500 species are known to be used in one or more life stages, i.e., eggs, larvae, pupae or adults, and the actual number is probably far greater. They are prepared and used in a variety of ways, boiled, roasted, fried, raw, as a main dish, side dish, relish, appetizer, mixed with other foods, and as between-meals snacks, especially by children. In many localities they are the most affordable and available source of “animal proteins” and fat with which to supplement the staple vegetable diets of rice, maize, bananas, cassava, etc. They are prominent in the rural village markets, and some are found on the menus of the finest restaurants in the cities, thus increasing rural incomes.

The course is basically divided into geographical regions (see course outline), and information is summarized separately for each country in which food

insect use is traditional. Questions addressed for each country, insofar as possible, include the taxonomic identity of edible species, the specific nutrient contribution of specific species relative to other available (and affordable) foods, seasonal availability and complementarity with other foods, current and potential quantitative use, possible methods of prolonging seasonal supplies, the biological suitability of particular species for more efficient harvest or controlled mass-production, possibilities for expanding urban markets as a source of additional income in rural communities, etc., etc. Material is discussed suggesting that, from the standpoints of existing use, nutritional quality, food conversion efficiency, ecological soundness, and all-around compatibility with the principles of low-input sustainable agriculture, this food insect resource warrants far more research and developmental attention from entomologists and other food and agricultural scientists than it has received in the past. The course also offers an opportunity to examine from several angles the wisdom and implications of American attitudes and policies on insects as food and insects in food, in view of the environmental costs and food residue problems that result from the intensive, and sometimes excessive, use of insecticides for largely cosmetic purposes.

The proposal was submitted to Fred Buelow, Chair of the CALS Curriculum Committee by letter dated August 22. What had gone before in dealing with the ATS Committee hardly had prepared me for what was to come. The story can probably best be told by simply scanning the correspondence which went back and forth and back and forth, and back and forth, between the committee and me, the committee now being the Natural Science Subcommittee of the Curriculum Committee of the College of Agricultural and Life Sciences. It had six members plus the Chairman, Professor Marion Greaser of the Muscle Biology Lab in the Department of Meat and Animal Science. By letter of September 6, Professor Buelow forwarded the proposal to Professor Greaser and his committee. Professor Greaser sent me the following letter dated September 27:

Dear Gene:

As I mentioned in our phone conversation, I am sending the attached list of comments from the Natural Science Subcommittee concerning your proposed new course “The Human Use of Insects as Food and Animal Feed”, file #8054-NS-343. Please respond to the concerns so that we can come to a decision about the course.

Comments from the Subcommittee on
The Proposed Entomology 364 Course

1. Edit capsule statement – remove “The course examines” from first sentence.
Approve
2. Course level too low – should be 500-600.
Should require Nut Sci 332 or Mas 311 prerequisite.

Should get letters from Nutritional Science, Food Science, Meat and Animal Science, Poultry Science.
Little substance to this course and the potential for misleading students.
Serious reservations

3. A specialty course that should require some nutritional background. Prerequisites should be 1 yr biology plus 1 semester of nutrition. Can't see how students can put course into proper perspective without some background.
4. Doubt that course will sustain sufficient enrollment to be taught every year – alternate years or taught as special topics instead?
Little in syllabus on nutrition – this is the real issue; the overwhelming emphasis on geographical breakdown is misplaced.
Approve, with some reservations
5. Fascinating subject, but do not believe it is of sufficient depth to warrant assigning a full course entitlement.
What do Food Science and Nutritional Science think about course?
Perhaps should be a special topics course or incorporated into another course.
Disapprove
6. Remove “The Human” from course title.

I responded to the comments by letter dated October 3rd.

Dear Marion:

I believe that many of the reservations about my proposed course, “The Human use of Insects as Food and Animal Feed” may stem from misconceptions about course content. In rereading the Course Description, I think that two phrases in the second paragraph were carelessly worded and misleading: “...the specific nutrient contribution of specific species relative to other available (and affordable) foods, seasonal availability and complementarity with other foods...” These two phrases were unfortunately overstated and I want to assure the committee that this is not a case of an entomologist trying to teach a course in nutrition.

We spend most of our time in the course establishing the cadre of insect genera/species that are used as food in different geographic areas, specific life stages used, recognizing the important differences in groups and species that exist between different geographic regions, and assessing the biological attributes that determine whether a species is suitable for more efficient harvest from nature (large-scale or small-scale) or possible controlled mass production. None of this is nutrition, but it certainly has to do with food.

I have enclosed a sample of course handouts that illustrate some of the other aspects as food that are addressed in the course. Handout #1 summarizes palatability as viewed by the Pedi of South Africa. Handouts #2-4 show quantitative use in Zaire and southeastern Colombia, respectively (probably significantly underestimated in both cases). Handouts #5 and 6 give very specific information on the seasonal availability of 35 species of edible caterpillars harvested in Zaire. Handout #7 is a rather generic presentation of the seasonal relationship of food insects to vegetable and other animal foods of the Bemba in Zambia. The data are old but they make one of the points as to where we hope to go eventually with this subject. They show that caterpillars were the only major source of animal proteins during the so-called "hunger months" of December and January, when fish and game were not plentiful. Eventually, I hope to mesh such precise seasonal data as in Handout #5 with equally precise seasonal data on other foods in specific geographical areas, and, here, we will start to verge on nutrition. The best studies currently that do this meshing (including insects) are from Thailand and in the Thai language. We have copies, but they have not yet been translated.

Finally, in Handout #8, we get somewhat nutritional. In making data such as these available to students, I do not attempt to second-guess the conclusions of the investigators as to the value of the insects within the dietary milieu of the particular human population studied. Actually, there are modern data such as these for only 7 or 8 other countries, and I probably spend, totally, no more than 30 minutes of class time on studies such as summarized in Handout #8. Except for protein quality, there are few data on bioavailability of insect-furnished nutrients; as a result, I do mention now and then that there is a need for more in-depth studies on the nutritional quality of insects.

In view of the above, I see no need or justification for Nut. Sci. 332 or MAS 311 as prerequisites. I have also refrained from requiring Introductory Entomology (302), the rationale being that I can get the desired interdisciplinary mix of students by keeping the entomology straightforward and avoiding unnecessary jargon. In the first offering of the course (experimental) last spring, we lost a Food Science senior and an Anthropology senior because they feared inability to handle the entomology involved. The anthropologist audited the course, however, and was a valuable contributor to the discussions. For the same reason, wider access by students who are curious about the subject, I would favor leaving the course at the 300 level. The best-researched term paper last spring was by a sophomore.

In summary, one of the major goals of this course and of other associated educational activity is to make Americans aware of the fact that insects are important as a food resource among many Third World rural populations. One of the results of this should be that insects will eventually be given appropriate attention in the real nutrition courses on this campus and elsewhere that address international nutrition issues.

I hope that this may help to clarify some of the major questions that were raised, as well as my approach to the subject matter. I have enclosed six sets of

this letter and the handouts for distribution to the committee. Please let me know if there are concerns that remain yet unresolved.

On October 5th Professor Greaser sent the following memo to the Natural Science Subcommittee:

The response from the Natural Science Subcommittee on proposal #8054-NS-343, a new course in Entomology entitled “The Human Use of Insects as Food and Animal Feed” was mixed. I prepared a brief summary of your comments and concerns and asked Gene DeFoliart to react to these. He has sent me the enclosed letter. Would you please re-evaluate this proposal and let me know your final views? I need to have this information by the afternoon of Tuesday, October 11, so I can make a recommendation at the CALS Curriculum Executive Committee Meeting. You may call me at 2-1456 if there is not time to send back a written form.

MG:ng
Enclosures

Additional concerns raised after Dr. DeFoliart’s letter of 10/3/88

1. The course overemphasizes material that would be considered anecdotal. There is minimal science base to the material presented.
2. The reason for the subject being taught is the personal crusade of the instructor, not because there is curricular, economic, scientific, or social justification for the subject matter. If Dr. DeFoliart wants to champion the idea of insects being used for food and feed, he should write a book or prepare a television documentary to affect a wider audience. The university classroom is not the proper place for this.
3. The DeFoliart letter did not address all of the concerns on the original list sent to him.

On October 31, Professor Greaser wrote as follows to his Natural Science Subcommittee and to the CALS Curriculum Executive Committee:

The majority of the Natural Science Subcommittee voted against approval of the new course from Entomology entitled “The Human Use of Insects as Food and Animal Feed”, file number 8054-NS-343. The curriculum Executive Committee decided to ask Dr. DeFoliart and the Natural Science Subcommittee to attend the next meeting of the Executive Committee to discuss the concerns regarding the course before final action is taken. We will deal with this at the beginning of the meeting. The curriculum meeting will be held on November 8 at 2:30 p.m. in room 212 Agricultural Engineering Building. I’ve attached copies of the concerns raised by the subcommittee and Dr. DeFoliart’s response letter.

MG:rg
Enclosures

On October 31, I wrote to Professor Greaser:

[maybe copy four additional letters, etc, cited in my letter]

Dear Marion:

I was surprised to hear that the Subcommittee recommended disapproval of my proposed course. From the first round of comments, it seemed to me that the major underlying concern was that there might be too much nutrition in the course, and my response was directed mainly to that concern. Thus, I am increasingly at a loss to understand what the committee perceives as the problem.

I will be glad to attend the meeting on November 8th. In the meantime I am enclosing additional information on the subject matter of the course and to save time duplicate sets have been sent directly to the other members of the committee:

- 1) Colombia: Taxonomic Inventory and Chronological summary of reported uses. About 60 such summaries have been prepared, some longer, some shorter, for establishing the specific identity of the species used, the specific life stage or stages that are used, and specific patterns of use in specific cultures. Here in the U.S. it would be pointless to study the subject without first establishing that insects are indeed extensively used as food and the cultural and ecological milieu in which they are used. This is partly the reason for the geographic orientation of the course. Another reason is the cadre of insects in South America is completely different from that in Africa, which, in turn, is distinctly different from that in Asia. These summaries bring into focus for each region the species for which biological information is needed, and which we are accumulating (about 500 species in all). From the biological characteristics, it can then be determined which species are potential candidates for greater exploitation either through the development of mass-production systems or more efficient methods of harvest from nature. The summaries also reveal which species are appearing in local village or urban markets, thus contribution to rural economies (an additional indicator of which species warrant strong development efforts).
- 2) Latin America: Food-Relevant Biology; Rhynchophorus palmarum. This is one of approximately 500 "food-relevant" biologies being prepared, some of which are used in the course. With the biological information in hand, we can draw hypotheses on what kinds of manipulations, from very simple to technologically sophisticated, might be successful in increasing supplies within the locally existing cultural, economic, and agricultural framework. Such a hypothesis is discussed under "Potential

Manipulations for Food Production” at the end of this summary. This particular one envisions the added food production as part of integrated pest management of Rhynchophorus and red ring disease control in cultivated palms, which are an exceedingly important crop throughout the tropics. In all cases, such hypotheses must be drawn specifically in relation to the biology of each insect species under consideration.

- 3) The Human Use of Insects as Food and Animal Feed, pp. 2-3, 10-11, and 22-34 of a 42-page manuscript accepted in June as a feature article in the Bull. Entomol. Soc. Amer. Pages 10-11 cite a few additional examples of existing use, intended to help convince the committee that this whole subject is not simply a figment of my imagination. Pages 22-34 outline in broad terms several strategies for increasing harvests; in the course, these are discussed in greater detail in relation to the biology of the appropriate target species, as was illustrated above with Rhynchophorus.
- 4) The Food Insect Newsletter. This provides a few additional examples of the scope of existing use and attitudes in different geographic regions. (Anyone who wants to keep a copy is welcome to it; otherwise I would like them returned at the meeting as the original printing of 500 copies is running low.)
- 5) Term paper instructions. The enclosed copy was used last spring. It will be slightly revised before re-use. Most students, starting with a Steenbock computerized literature search, will do a paper on biology as outlined. A Nutritional or Food Science major, however might want to do the paper on insect lipids or fiber, for example, interpreting their probable nutritional quality for humans. A Food Micro major might want to do the paper on the hazards of insects as inhalant, ingestant or dermal allergens, or as disseminators of bacterial or other pathogens. A botany major might want to do the paper on insects as sequesterers of plant toxins, while an anthropology or ethnobiology major might want to do an analysis of entomophagy in relation to tribal affinities in northern Amazonia, or some region of Africa or Asia. Although the course as taught is 85% entomology, which is my area of expertise and the discipline in which the most innovativeness will be required, the subject interfaces with all of these other disciplines as well as with other broad issues of environment and agriculture. That is why I want to attract students with different disciplinary backgrounds to the course. Creating just such interdisciplinary mixes is also one of the objectives of the Agriculture, Technology and Society Committee, under which this course was initially developed and offered.

I hope that this letter and the enclosed materials will give committee members a better idea of course content and objectives. My own ideas are far from jelled and constantly subject to revision as additional information accumulates. I am aware

that the subject seems a strange phenomenon to many Americans, but it is real and therefore a legitimate subject for study. And certainly, in my opinion, the breadth and potential depth easily warrant one credit at the University of Wisconsin. Finally, as an indication that there is cross-disciplinary professional interest in the subject outside the UW, and in my approach to it, I have enclosed recent comments from the Bulletin of the ESA, from Professor David Pimentel of Cornell University who has published extensively in Science and elsewhere on broad issues of environment and energy use in agriculture, from Dr. Darrell Posey, Directory of Ethnobiology at the Emilio Goeldi Museum in Brazil, and from Katharine Milton, Professor of Anthropology at UC-Berkeley.

Sincerely,
Signed
Gene R. DeFoliart
Professor

Enclosures
Xc: Members of Natural Sciences Subcommittee
CALs Curriculum Committee

I followed only four days later, November 4, 1988, with the following letter to Professor Greaser:

Dear Marion:

After sending out a second batch of explanatory materials to the committee, I received the second round of comments. There was no mention this time of nutrition per se or a need for nutrition prerequisites, so I presume that issue has been settled to the satisfaction of the committee. The issues this time, as stated by two of the members, are that the course is too much "anecdote" and too little science, or in the words of the second commentator, "The reason for the subject being taught is the personal crusade of the instructor, not because there is curricular, economic, scientific, or social justification for the subject matter."

The above statement by Commentator #2 crosses the line and is nothing less than an impugment of my credibility and judgement as a scientist. I can assure the committee that my credentials are quite in order. NIH has supported my mainline research for 23 consecutive years. My graduate students, colleagues and I have published 130-140 papers in refereed professional journals, some of which have had substantial impact on research around the world (example from *Science* enclosed). I have written review articles, the most recent in the 1987 *Annual Review of Entomology* (copy enclosed). I can assure Commentator #1 that I do not operate on "anecdote," and I know good science when I see it about as well as the next person. My second mailing was not yet in the hands of the committee when Commentator #2 warmed up for his/her second round of criticisms, but the completely negative tone of his/her comments has all of the earmarks of someone whose cultural bias has obliterated scientific objectivity.

By now, more than enough evidence has been placed in the hands of the committee to completely refute any arguments that there is no social or economic

justification for the subject matter. The fact (belabored in my second mailing) that insects are extensively used by populations that are nutritionally hardpressed is the only economic and social justification needed. Another obvious fact is that, up to now, Commentator #2 has been no better informed on this subject than is the average American, which more than takes care of his opinion that there is no curricular justification for the subject.

Scientific justification? The fact that there is social justification is enough to warrant a closer look by scientists. The science base in the proposed course will be no different in principle than that in other applied science courses in the College of Agriculture. Except that our goal is to increase the availability of certain insects rather than to reduce populations, we will rely largely on the same battery of technologies and will do the same kinds of biological research as other entomologists on when, where and how to apply them most efficiently in order to attain the desired objectives. The applied part of entomology is divided into a number of subdisciplines, each responsible for a discreet complement of insect pests and vectors, i.e., vegetable crops, fruit, forage, forest, stored products, insects of veterinary and public health importance, etc. If you are interested in working on vegetable crops insects, you don't go to the library and check out a book on forest entomology. For the same reason, it is essential that we build the necessary base of knowledge on the taxonomy, biology, ecology, physiology and behavior of the insects used as food. Only then can we begin to make good decisions on which lines of research should prove most rewarding.

Commentator #2 accidentally made one good suggestion, that efforts should be made by writing a book or television documentary to affect a wider audience. I am writing a book, a much-needed book. Other educational efforts to affect a wider audience include editing *The Food Insects Newsletter*, articles in professional journals (examples of both were included in my second mailing to the committee), and a press release (results as summarized in the next Newsletter enclosed). The Newsletter has already been requested by a number of libraries including the British Museum (Natural History) and the Rodale Press (sustainable agriculture). No documentary yet, but I have been contacted by CBS Television-New York regarding a possible segment on their Saturday morning children's educational program.

Sincerely,
(signed)
G.R. DeFoliart
Professor

GRD:lam
Enclosures
cc: Natural Science Subcommittee
Professor Fred Buelow
Professor William Thiesenhusen

The publications referred to in paragraph 2 of the above were:
Watts, D.M., S. Pantuwatana, G.R. DeFoliart, T.M. Yuill, W.H. Thompson. 1973.
Transovarial transmission of LaCrosse virus (California encephalitis group) in the mosquito, *Aedes triseriatus*. *Science* 182: 1140-1141.

DeFoliart, G.R., P.R. Grimstad, D.M. Watts. 1987. Advances in mosquito-borne arbovirus/vector research. Annu. Rev. Entomol. 32:479-505.

I made some revisions on the New Proposal form, but not many, dated it November 14, 1988, and on November 17 sent 20 copies to Professor Greaser and one copy to Professor William Thiesenhusen, the new chair of the ATS Committee. I subsequently learned via the minutes of a December 6th meeting of the CALS Curriculum Committee that they had approved my course, now known as Entomology 324, on November 8 even though they had not received the revised proposal until November 23.

Well, glory be. I received a letter dated March 14, 1989 from Chuck Koval, chair of the Entomology Department, as follows:

Congratulations! Your course was unanimously approved by the Biological Sciences Divisional Committee on January 27 and approved by Dean Leo Walsh on March 7, 1989.

The course should be in the fall timetable.

Finally, victory over Commentators 1 and 2!

For the Spring 1990 offering of the course, enrollment was again disappointing with only six students showing up. Only four finished, with three getting an A and one an Incomplete which was later converted to an A. My course evaluations by the students, both the summary statistics and their comments, were somewhat better than in 1988. The mean for the Lecture Summary was 4.60, for the Textbook and Outside Reading 4.00, General Summary 4.15 and Overall Summary For Course 4.42. Individual comments by the students were as follows:

ENTOMOLOGY 324
Dr. Gene DeFoliart

Spring, 1990

1. Since the course was new and textbook preparation was under way, we faced some problems. But the professor provided the necessary material by Xeroxing all stuff. The work load is so much that the credit load should be two credits instead of one credit.
2. This subject may need to be a three credit course meeting twice a week. There is too much to cover once a week. I have enjoyed this class a lot and have expanded my knowledge of entomology, nutrition, and geography.
3. Although I have very limited background in the area, this class was very interesting and was relatively fun. Professor DeFoliart shows his vast knowledge of the subject and has made learning about edible insects worthwhile.

4. I liked the idea of a research paper—going off into my own special interest, learning to creatively search for information, and learning in detail about a special topic(s) in this general subject was great. I found the subject matter new to me and quite refreshing. Classes like these are valuable for they offer new insight to things usually thought of in only one way by our culture.

A letter from Gene Summers dated December 10, 1990 arrived, saying that the Curricular Revitalization Project's ATS Committee was developing a certificate program in the area of Agriculture, Technology and Society and asking if I would permit my course, Entomology 324, to be included in the program offerings. I replied that I would be "more than happy to have the course included if it is again taught." I told him to go ahead and list it, my intention was to teach it (Spring 1992), but with my retirement impending (July 1, 1991) and funding all drying up, nothing was certain.

As it turned out, I did teach the course again, in the Spring Semester 1992. Again, enrollment was a disappointment. Six students started, six students finished, five with an A, one with an I. Again, course evaluations improved somewhat over those for the preceding offering, both the summary statistics and the students' comments. The mean for the Lecture Summary was 4.69, for the Textbook and Outside Reading 4.33, General Summary 4.79 and Overall Summary For Course 4.71. Individual comments by the students follow:

This was a very enjoyable class. The slides were very well used as they were an excellent way to show us exactly what kinds of insect are eaten, what types of habitats they are found in, how they are prepared, and who eats them. The global perspective is wonderful—it lets us know how different types of ecosystems support people in different ways—since some areas are sparsely provided (as far as "our" type of food goes) for, insects are then able to be utilized. The handouts were very well organized—by continent. It is unfortunate that we were not able to cover Asia and Australia as much as we should have, but the areas we did cover, we covered as thoroughly as possible. It is also unfortunate that we could not eat any insects! Thank you for continuing this course. Any true entomology student should love this different perspective that we never would have had in intro. classes. And even a non ento. student would enjoy this class. Could also be used as a topic in a survival course...

We did not have exams in this course, but it does require term papers. Dr. DeFoliart exposed us to the history of insects used as food in different nations of the world. All different bits of most edible insects in the world. Very good handouts - because of the limited information I can use these handouts for any future study as a direction for my literature sources.

Nice slides were shown regarding the subject.

In some way I became adapted to study insects relative to this course and recheck them at home to prepare a list about the available ones.

In general, it was a general course and I liked it.

This course was great for stimulating an interest in entomology. The broad angle that one could choose made outside reading more interesting because it could apply to any other interests we had. This class was worthwhile and I would recommend it to friends.

I definitely believe that Dr. DeFoliart should continue teaching this course, it's important for others to know that insects as food is a valid way to supplement our diet, especially in malnourished areas. I wish we had more time in lecture to cover all the countries using insects as food, especially in the Asian countries. Dr. Foliart is a very personable person, and I'm very happy with his teaching and the course.

I would like to have seen at least a general quiz once in a while. Also a few more reading assignments with an anthropological bent. Otherwise, it was a very enlightening course.

The last formal communication that I had relative to Entomology 324 was a letter to Gene Summers, dated January 27, 1993, telling him that I would be unable to offer the course again.

It seems obvious from the three sets of student comments now available on this course that university students find the food potential of insects a mind-expanding subject for study. I hope the student comments may help inspire other teachers of biology to think about working a section on edible insects into their courses. Quite a lot of information is now accessible on the Internet and in books and articles referred to there. One doesn't have to be an expert in this particular aspect of entomology to make it interesting to students. I have loaned materials to several colleagues in the UW Entomology Department who wanted to give their classes an introductory exposure to the subject. The following note from Professor Dan Mahr is rather typical of how it usually turns out: "Gene, thanks very much for the loan of the slides and proposal. The 'Insects as food' section was the highlight of the morning!"

Chapter 10. Starting The Food Insects Newsletter

The birth of *The Food Insects Newsletter* can probably be most accurately described by using the same words we used in describing it on the first page of the first issue in July, 1988, when everything was still fresh in mind. It shared the first front page with a boxed-in announcement of the First International Congress of Ethnobiology, which would be held in Brazil. Here reprinted is the first article, less than one page long, titled "EDITOR'S CORNER: What is the Food Insects Newsletter?":

The "Editor's Corner" is located front and center in this first issue in order to explain why you are receiving *The Food Insects Newsletter*. In correspondence during the summer of 1987 with a number of people who have conducted research on insects as food in tropical countries, I asked whether such use continues to be widespread or is rapidly diminishing in the face of acculturation, environmental alteration, and agricultural progress (using the term "progress" somewhat loosely). The individuals contacted (and countries where their studies were conducted) were Dr. Julieta Ramos-Elorduy de Conconi (Mexico), Dr. Francois Malaisse (Zaire), Dr. John Phelps (Zimbabwe), Dr. Darrell Posey (Brazil) and Dr. Kenneth Ruddle (Colombia).

A second question asked was whether a periodically issued newsletter might be a useful tool in establishing better communication among those of us who are interested in this subject, including insects as animal feeds. A third question was whether it would be a good idea to begin thinking in terms of organizing an international symposium on insects as human and animal food, to be held in the not-too-distant future. Assuming a favorable response to the second question, I offered to serve as editor of the newsletter for at least a year or two.

Responses to the first question plus recent information from other sources reveal that edible insects are indeed still widely used as food throughout the rural tropical world. In fact, the prevailing opinion among those most knowledgeable about the situation in specific regions is that edible insects not only continue to be nutritionally important but could make an even greater contribution to human nutrition if supplies were increased or better distributed seasonally. Responses regarding the newsletter and symposium were favorable. Thus this attempt to launch a newsletter.

A newsletter is only as interesting and informative as its readers make it. So please send in items that may be of use or interest to your colleagues in this subject area. Or, simply raise questions that are of interest to you. Someone out there may have an answer or useful information. Suggestions as to newsletter content and format are, of course, welcomed, and in fact, solicited. I anticipate that there will be three to four issues per year, depending on the supply of "news" from readers. Considering the relative isolation in which most of us have worked or thought in his subject area, almost anything will be considered news worth printing!

If you wish to receive future issues of the *Newsletter*, please return the form on page 7 with your name and address as you want it on the mailing list. It is anticipated that by early next year, the mailing list can be distributed to newsletter recipients for use as a "directory." Thus, it would be helpful if you would identify as briefly as possible the focus of your food/feed insects interest, e.g., "Insects as food in Zambia," "Insects as food for zoo animals," "Studies on nutritional value of insects," "Bioavailability of insect

minerals,” “Edible insects in general,” “Mass-production of saturniid larvae as food,” etc. etc. This first issue is being sent to the approximately 100 persons listed on page 6, plus a number of unlisted recipients in Madison. If there are others whom you think would like to receive future issues, please jot down their names and addresses on page 7.

Address mail relative to the *Newsletter* to:

Dr. Gene R. DeFoliart, Editor
The Food Insects Newsletter
Department of Entomology
545 Russell Laboratories
University of Wisconsin
Madison, WI 53706

With the Newsletter as with every other aspect of this subject, we soon had money problems. But I had a capital idea (no pun intended) that I presented to our readers via the Editor’s Corner in Volume 2, Number 1 (March 1989). I hoped that we could keep money a low-profile item, yet stimulate a little income. After opening with a “Thank you” for the many nice comments that had been received about the first two issues, I got right down to business:

A Unique Opportunity. The rapidly expanding mailing list and added cost of printing and mailing the comparatively bulky Newsletter Directory planned for July means that the currently invisible means of support for the *Newsletter* needs some form of augmentation. It would be nice to keep the *Newsletter* free for a while longer, and while it is always tempting to claim altruistic motives, the larger truth is that as long as the product is free it takes a lot of pressure off the editor. So we have hit upon an idea. For anyone who can be induced toward an impulse to write a check for \$5.00 to help defray *Newsletter* expenses, we have created the exalted status of SUSTAINING PATRON. Some will think, “But the *Newsletter* isn’t worth anywhere near \$5.00,” a thought that has occurred to the Editor. But that is not the point. Where else can you be listed as a SUSTAINING PATRON for only \$5.00? In making this fantastic offer we sincerely hope, however, that we will not be deluged with hundreds and hundreds of checks, because, so far, in doing research and engaging in other activities related to insects as food, we have not become accustomed to handling large sums of money. If a check is written (U.S. currency only, please), it should be made payable to Board of Regents-University of Wisconsin and designated for *The Food Insects Newsletter*. If things aren’t going well this year and you can’t afford PATRON status, you will still continue to receive the *Newsletter*.

One other important matter was reported in that same Editor’s Corner:

Good News and Bad News. The bad news first. Joyce Keesey, research specialist in the medical entomology laboratory, who has done an outstanding job in handling the layout and word processing for the *Newsletter* will be moving to Rockford, Illinois, in April. The good news is that Rockford is only 80 miles from Madison and Joyce plans to return often enough to assist with the *Newsletter* through the remainder of the year.

GRD

My offer of status for only \$5.00 did not start the hoped-for stampede of readers wanting to become Sustaining Patrons, so I tried to give them a little nudge in the closing paragraph of the Editor's Corner in the next issue (Vol. 2, No. 2, July 1989):

The **SUSTAINING PATRON'S CLUB**, founded (apparently with too little fanfare) in the last issue of the Newsletter, now has 14 members. The contributions from these individuals are very much appreciated, and we hope the club will become less exclusive. You can become a member by contributing \$5.00 to help cover the printing and distribution costs of the Newsletter. Make checks payable to Board of Regents, University of Wisconsin, and designate "Newsletter."

GRD

On a bright and sunny morning sometime early in 1992, I received a phone call; I don't remember actually whether the weather was bright and sunny, but after the phone call my mood was certainly bright and sunny. What had happened was the exact opposite of my usual financial experience when it came to insects as food. Usually, I asked for money, but got no money. This time, I hadn't asked, but got money anyway. Out of the blue. Some days it just pays to go to work. The call was from Jane Knowles, Acting Associate Dean, College of Agricultural and Life Sciences. My subsequent written response was dated February 28, 1992:

Dear Jane:

After you called awhile back to kindly offer a little help if needed on costs incurred in keeping The Food Insects Newsletter going, I held up to find what our costs were on the last mailing. They were just over \$1,000. There will be four mailings this year, three regular issues plus a Directory. Total costs, printing and mailing, for these four will run \$4,000 or more.

As I mentioned on the phone, Agrecol is now helping on some of our clerical, postage, Xeroxing, etc., in handling week-to-week correspondence and mailing of requested printed materials. We could sure use another \$50 per month though in meeting those expenses.

Thus, if the Dean's office could subsidize the four major mailings to the extent of \$1,000, plus \$50/month for monthly postage/clerical or \$1,600 totally, I'm quite sure we can finish in the black.

I can't remember whether you said the Dean's funding could go into my Multiple Donors Fund or would be a straight transfer to the Department. Please let Carol Scheele or me know which way it should be.

This help is certainly very much appreciated and I believe money well spent. Both the Newsletter and the traveling elementary school exhibit seem to be accomplishing some worthwhile educational goals.

Sincerely,
(signed)

A second letter followed on March 20th:

Dear Jane:

Thanks very much for the infusion of \$1,600 into the “Insects as a Food Resource Project.” It will help a great deal in keeping the financial wolf away from the door for the rest of the year.

I just returned yesterday from Kansas City – the Entomological Society of America, North Central Branch meetings – where I gave the lead-off paper in their opening plenary symposium. My title was “Insects as Food: History and a Modern Perspective.” This invitation was just one more indication of how rapidly the concept is achieving authenticity within the entomological community.

So, I believe the money is truly well-spent. Again, thanks.

Sincerely,
(signed)

I started thinking before the end of the year that maybe I hadn’t asked for enough. They gave me that \$1,600 so easily, maybe there was a lot more there for the taking. I remember having a later telephone conversation with Jane, and telling her how, for a bigger chunk of money, I could start my dreamed-of one-semester program-at-the-UW for young Third World researchers. We weren’t more than two or three minutes into the conversation before Dean Knowles said something like, “Down, DeFoliart, Down.”

It wasn’t long before we did, of course, start needing money again for the Newsletter. The following item appeared at the top of page 9 in the July, 1993 issue (Vol. VI, No. 2):

\$\$\$ Newsletter Treasury in need of cash transfusion

If you have never made a contribution in support of *The Food Insects Newsletter*, or haven’t in a long time, a contribution of \$5, \$10, or more would be most appreciated. Printing and postage costs are now running to more than \$1500 for each of the three mailings per year, and costs entailed in responding to hundreds of pieces of correspondence boost the annual total to well over \$5,000. During the past two years, two small grants, one from Agrecol Corporation and one from the UW College of Agricultural and Life Sciences have helped keep the *Newsletter* operating in the black. In the current year, as well as in past years, reader contributions have covered only about one-third of the costs. So, please think about writing a check today. Address on page 11.

As finances really were getting to be a serious problem, The Editor’s Corner in the November 1993 issue (Vol. VI, No. 3) used a whole page to review the past and set new policies for the future:

First, thanks to the many readers who responded to our call in the July *Newsletter* of “Help! Send money!” Many of the contributions were in the generous range of \$15 to \$25 or more (there were three of \$50). The all-time record single donation to the *Newsletter*, by the way, was \$100 by a Virginian in 1990. The downside is that most of those who responded have contributed before, while hundreds of others, some of whom have been on the mailing list for as long as three to six years, are not heard from. To be precise, only about 600 of the nearly 2700 currently on the mailing list have ever contributed financially to support of the *Newsletter*. Actually, voluntary contributions

from one of every 4 ½ probably isn't bad for a publication that is supposed to be "free," but henceforth the *Newsletter* will need financial input from a larger proportion of its readers.

A bit of historical perspective

The Food Insects Newsletter was initiated in July 1988 as part of an educational effort to make Americans and other Westerners more aware of the fact that insects are traditional foods in most non-European-derived cultures, that the insects play an important nutritional and economic role in those cultures, and that the well-known Western bias is counterproductive in meeting the world's food and environmental challenges. It was envisioned that the *Newsletter* might become a networking mechanism and communications link for researchers, educators and others, both here and abroad, who were, or might become, interested in this important subject. With re-education the goal, the *Newsletter* advertised itself as "free," while nothing that it welcomed financial contributions to help cover costs.

Costs weren't much of a factor the first years when names on the mailing list numbered only a few hundred. Both costs and time demands began escalating as *Newsletter* circulation passed the 1000 mark, then 2000, and now approaches 3000. For example, the billing for the July 1993 *Newsletter* was \$1,720 (\$855 for printing, \$230 for U.S. bulk mailing, and \$635 for overseas airmail postage). Multiplied by three, the annual bill for three mailings exceeds \$5,000. During 1992 and 1993, these exploding costs resulting from expanding circulation have been partially underwritten by grant of \$1,700 from the UW College of Agriculture and Life Sciences and a grant of \$2,500 from the Agrecol Corporation.

Requests for information have also increased exponentially. The *Newsletter* responds to hundreds of requests per year from students and teachers (from elementary to university level); museums, zoos, nature and science centers; environmental and other public interest organizations; Peace Corps Volunteers and Third World agricultural managers, educators and researchers; and last but not least, mass-media people and free lance writers who in turn produce magazine and newspaper articles, radio programs and TV documentaries. The informational packets sent usually consist mainly of several *Newsletters* and one or more article reprints. Although back issues are technically priced at \$1.50 each, I would estimate that for each one sold, at least 10 are given away in these informational packets. Additional costs involved in responding to this and other correspondence, e.g., \$5 per hour for typing (student hourlies), 5 cents per page for photocopying, and postage, run annual costs up to more than \$7,000. What's free? Not much these days. Ask any academic. But so far, we don't have to pay our phone bill, and the Department of Entomology covers the first \$280 of postage each year.

It should be understood that the *Newsletter* continues to be a strictly informal voluntary undertaking. Although contributors are asked to make checks payable to the Board of Regents, University of Wisconsin, the *Newsletter* has no formal standing in the Department of Entomology nor elsewhere within the University of Wisconsin. Formal recognition would presumably be granted if applied for, but, frankly, already two years into retirement, the editor isn't looking for longterm contracts.

The new policy

The situation is this. The July *Newsletter* mailing and correspondence handled since that mailing exhausted all funds on hand at the time. Contributions received since July will pay for the November *Newsletter*, but the cash drawer will then again be empty. Thus, stringent measures are necessary. Volume VII (1994) will be sent only to those who meet one of the following criteria:

- 1) Contributed at least \$5 during 1993. Or: last contribution was in 1992, contributions have totaled at least \$10; for 1991--\$15; for 1990--\$20, and for 1989--\$25.
- 2) The editor has been notified that making a contribution would pose a problem. (For example, it is difficult or impossible to send money out of some developing countries. Funds for purchasing resource materials can be tight at times for students, teachers, residents of countries with poor economies and sky-high inflation rates, or almost anybody at one time or another. Notify the editor.)
- 3) Public and institutional libraries and active Peace Corps Volunteers are exempt and will continue to receive the *Newsletter* at no cost.

Check your mailing label. The code on the upper right-hand corner has been revised to include a category "P". The first two numbers following the P designate the last year during which a contribution was received, the last two numbers show the total amount you have contributed, according to our records. For example, P9225 means that you contributed in 1992, your contributions have totaled \$25. All formerly used code designations, such as CM, D, and those starting with an M are no longer relevant and mean only that, according to our records, you have never made a financial contribution in support of the *Newsletter*.

We regret that we are probably going to lose a few hundred, maybe a thousand subscribers, but we see no alternative. We assume that some we've never heard from, after originally requesting the *Newsletter*, found it not what they expected, but never notified the editor to discontinue it. We hope to hear, however, from those who, like the editor, simply never do anything today if it can possibly be put off until tomorrow. And remember, when you do contribute to the *Newsletter*, you are not only paying your own way but are participating in what has become, we believe, a productive educational endeavor that is producing significant results. Contributions are tax deductible.

GRD

One year later (Vol. VII, No. 3) we were hammering on the subject of finances again:

Sustaining Patron Status Upgraded

For all of those years when the *Newsletter* was still "free," except 1993, we annually listed, under the title "Sustaining Patrons," those who had voluntarily sent a financial contribution of at least \$5 during the year in support of the *Newsletter*. When the listing began filling up a whole page each year, the practice was abandoned. Still, we like to say "thanks" to those who have not only paid their own way, but have helped over the years to underwrite the costs of *Newsletters* and other materials sent to students, libraries,

Peace Corps Volunteers, and a variety of other individuals and worthwhile organizations for whom, for one reason or another, payment is not so easy. In the near absence of institutional financial support the past several years, it is the people listed below (and quite a few others who barely missed the list this year) who have made this educational effort possible. We feel better when we get to recognize them for their help.

Gene DeFoliart, Editor

Sustaining Patrons

(total contributions of \$50 to \$99)

Dr. Roger D. Akre (deceased) Pullman WA)	Mary H. McDermut (Chicago IL)
Tim Bowers-Irons (Salt Lake City UT) Canada)	Gordon M. Nishida (Honolulu HI)
Jeanne Bowman (Glen Ellen CA)	Dr. Yves H. Prevost (Thunder Bay,
Dr. Sophie D. Coe (New Haven CT)	Sarah Randolph (Provincetown MA)
Richard Ehman (Simsbury CT)	Monica Russo (Arundel ME)
Dr. Mark D. Finke (Lehigh Valley PA)	Erich Schlaikjer (Radlett, England)
Charles Garth (New York NY)	Dr. Fred F. Sherberger (Atlanta GA)
Marjolaine Giroux (Montreal, Canada) CA)	Tom Skulan (Averill Park NY)
Dr. John A. Hawkins (Bethel AK) CA)	Dr. David A. Strange, MD (Petaluma
Hot Lix (Pismo Beach CA) Angeles CA)	Dr. Ronald I. Taylor (Yorba Linda
Woolf Kanter (Pacific Palisades AC)	Ellen and Lew Turlington (Los
Donald A Luttrell (San Jose CA)	Nahum J. Waxman (NewYork NY)

Super Sustaining Patrons

(total contributions of \$100 to \$299)

Dr. Edgar Dresner (Vernon CT)	Dr. Jun Mitsuhashi (Tokyo Japan)
Peter Menzel (Napa CA)	Dr. S.T. Seldon (Chesapeake VA)

Benefactors

(total contributions of \$300 or more)

Corporate Donors

(contributions of a corporate size)

Agrecol Corporation, Madison WI. (1992)

My harping about finances continued right up to the bottom of the last page of the last issue (Vol. 8, No. 2, July 1995) before relinquishing the editorship to Florence Dunkel at Montana State University, Bozeman, Montana. The shift in locations and editors was explained under the title, “*Newsletter* Subscription Information”:

Effective immediately, all checks and money orders for subscriptions, contributions, back issues, etc., should be made out to Montana State University (no longer to UW Board of Regents).

Please check your mailing code (to the right of your name on your address label). When the mailing list is transferred to Montana, only names with a mailing

code beginning with P (paid subscription) or F (free distribution) will be on it. Library and Peace Corps Volunteers automatically qualify for free subscription; others can be placed on the free distribution list simply by requesting it of the editor. Names with old-fashioned code designations such as CM, D and M (unless the four numbers after the M end in 95) will be deleted.

In evolving from an “all free publication” two years ago, the retiring editor has been, to say the least, slow, haphazard and indecisive in adopting sound, coherent billing and other business policies and procedures. I wouldn’t want to live with my system any longer, so it’s probable that adjustments and refinements will be necessary after the new editor has had time to see how things are working at the new location.

[Decide whether to put in transitions in the Masthead]

We had another idea, somewhat similar in its conception to Sustaining Patrons, about how to solve our language translation problems, but, for whatever reasons, it never quite made it into print. The typed draft, put together in 1993 or ’94, is self-explanatory:

Newsletter offers readers fabulous free opportunity for keeping language skills sharp

Awhile back, a reader wrote and generously offered to translate any Russian articles we might have; alas, as luck would have it, we had no Russian articles. I’ve been thinking ever since, however, that there might be other readers who would volunteer to translate one or two articles per year if they knew about the deplorable state of language skills here in the home office, and how many technical articles and miscellaneous other materials are always lying around which are in languages other than English. French and Spanish form the bulk of it, but some are in German, Dutch, Japanese, Thai, or you name it. Thus, a great idea was born. Why not a **Register of Translators**, all-volunteer of course. One would guess that among the Newsletter’s 2,000 subscribers, nearly every language is represented. This may be the best Newsletter idea since the concept of **Sustaining Patrons** was born four years ago.

It is a pleasure to explain why there hasn’t been much of a language problem until recently. The Educational Outreach Program on Insects as a Food Resource is the Newsletter’s non-profit parent organization. In the early days of this essentially fundless program, Heloisa Scholl and Dianne Landry (the wives of two former graduate students, Phil Scholl and Steve Landry, respectively) generously offered to translate articles in Spanish and French, respectively, which formed the major bulk of materials needing translation. At one point, the program even had a small grant which included some funds for translations, so I insisted on paying them something (they were reluctant to accept, and the rate per page was like “dirt cheap,” but I felt better). Also, if you have read the Newsletter for very long, you’ve seen Dan Turk’s English summaries of a book and several technical papers published in French. Dan, a PhD candidate in agroforestry at North Carolina State University, and currently in Madagascar, specializes on

entomophagy in Africa. Also helpful has been Dr. Jane Homan of the UW International Agricultural Programs who can, when an emergency warrants it, deliver an “on the spot” translation from either French or Spanish

To all of the foregoing, I want to express the great appreciation owed them by the Newsletter and its readers for the huge contribution they have made to the educational program. They are all very busy people, however, and, currently, none has much if any time to devote to the educational program.

I think I was going to add more to that last paragraph, which seems to end while still sort of hanging in mid-air, but since I’m recording history here, I guess we’ll just have to leave it like that.

There are many other things that the readers never knew about. Like our own cartoon. The following letter, dated June 5, 1992, arrived from Tim Eagan of Tim Eagan Cartoons:

Dear Mr. DeFoliart –

Please accept this cartoon as a token of my esteem (honest!) for the work of your dept. You are doing good work for all of us.

Feel free to use all or parts of the cartoon in your publication (with attribution of course).

Regards,
(signed)

The enclosed cartoon was clever and it carried a message (see if this can be included in the book).

Cicadas were another piece of unfinished business. In Volume III, Number 3 (November 1990), we reported on the big emergence in northern Illinois and southern Wisconsin. The story was titled “When Chicago Braced for the Onslaught of the 17-year Cicada,” and the last sentence said, “The next issue of the *Newsletter* will contain a short article on the identity, distribution, and predictability of cicada emergences in North America. There was no article of any kind on cicadas in the next issue, however, or in the next, or next. But the subject did come up again – five years later in the July 1995 issue (Vol. 8, No. 2). The story was titled, “While the editor slept, the periodical cicadas prepared to emerge.” I had learned belatedly of a big cicada emergence coming momentarily to a region extending from Pennsylvania to Virginia. The last paragraph of the article stated:

The thing that is frustrating about this is that, after the big Illinois emergence in 1990 (see the November 1990 *Newsletter*), we started and half completed a followup article that would summarize cicada broods and biology and describe how to tell when and where the next big emergence will be. Four years later, the manuscript sits here, still half-completed.

That last was true in general but not in detail. In writing this chapter, I couldn’t find in the old *Newsletter* files any half-completed manuscript on cicadas. I did find a short ms

titled, “Save Your Cicada Recipes – It won’t be 17 years before you’ll have another chance.” And it was all set to go into the March 1991 issue (Vol. IV, No. 1) starting on page 2, although for some unremembered reason it never made it into that issue or any later issue. In addition I had two articles provided by Karen Delahaut, Outreach Specialist in the Department of Entomology, that I had used to draw up some notes on how to predict future cicada emergences in your geographic area. The Save Your Recipes article is belatedly printed below:

According to Arnett (1985: 216-217), there are 22 genera and 166 species of cicadas (Order Homoptera, Family Cicadidae) in the United States and Canada. The periodical cicadas (*Magicicada* spp.), which receive so much press attention on occasion, form a complex of biological species that are found in the eastern part of the continent. There are six species (Alexander and Moore 1962), three of which, *Magicicada septendecim* (Linn.), *M. cassini* (Fisher), and *M. septendecula* Alexander & Moore, have 17-year life cycles, and three of which, *M. tredecim* Walsh & Riley, *M. tredecassini* A. & M., and *M. tredecula* A. & M., have 13-year life cycles. In the above order of listing, the 13-year cicada in each case is a sibling species of the 17-year cicada, and can be separated from it only by differences in life cycle type and distribution.

The 17-year cicadas are generally northern and the 13-year cicadas southern in distribution, but there is considerable overlap. The six species occur in 30 broods (18 of which are distinct; 13 broods of 17-year cicadas and 5 broods of 13-year cicadas) whose distribution and emergence dates have been plotted. The emergence of the larger broods is a striking event; as there may be more than one brood in an area, adults appear oftener than every 17 or 13 years, but never in as great numbers as the main brood. In Ohio in recent years, for example, the large broods appeared in 1973 (Brood XIII), 1974 (Brood XIV), and 1987 (Brood X).

The adult periodical cicadas are on the wing in late May and early June, as compared to the dog-day cicadas which have life cycles of four years or longer and appear each year in July and August. As the principal damage done by cicadas results from egg-laying by the adults, the predictability of the large emergences makes it possible to prepare in advance for the protection of young trees and nursery stock that might be killed or damaged. This predictability of emergences would also make it possible to plan locally well-publicized “cicada festivals” or “cicada-bakes” as part of any strategy for reducing numbers of cicadas and damage to plants. It is when the last instar nymphs come out of the ground and attach themselves to above-ground objects (such as tree trunks) for transformation to the adult stage, that they are most tasty and most vulnerable to harvest by children or others who can be put into a merrymaking mood. The songs of cicadas making it to adulthood would only add to the festivities.

But don’t despair if you don’t live in the eastern part of the country. There are many species of cicadas in the west, and they were among the foods collected by the Indian tribes of the Great Basin. The ethnographic record gives no clue to species used, but Sutton (1988) suggests several that, on the basis of their abundance, were probably used. Two of these are *Okanagana cruentifera* (Uhler), the bloody cicada, and *O. bella* Davis, the bella cicada. The former is 30-32 mm

long and has damaged fruit trees in Montana (Essig 1958: 201); it also has been reported in Colorado, Nevada and California. The latter species is about 24 mm long and widely distributed in the western United States and British Columbia.

Platypedia aerolata Uhler, the orchard cicada, and *P. lutea* Davis are two more species which are common in the Great Basin and may have been among the species used. The former is about 18 mm long and lays its eggs on the twigs of many kinds of deciduous fruit and olive trees (Essig 1958: 202). It occurs from California and Nevada north to British Columbia and east to Colorado and Montana. *P. lutea* is found in Montana, Wyoming, Utah and Arizona.

GRD

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Relative to predicting emergences of specific broods, I had made some notes from one of the papers Karen had loaned me. It was an Illinois Natural History Survey publication, Biological Notes No. 91 titled "The Distribution of Periodical Cicadas in Illinois," by Lewis J. Stannard, Jr. It was published in 1975, and, in it, Stannard provided a map showing the distribution of periodical cicadas in Illinois and a table showing the future emergences of the different broods in the state through the remainder of the Twentieth Century. So, using the map and the table together, one could tell ahead of time where and when cicadas would appear in Illinois. The tabular data are shown below. This was the kind of information I had planned to pull together for the whole country and publish in the Newsletter.

Year of Emergence	Brood	Cycle in Years
1976	Lower Mississippi River Valley Brood (Marlatt's XXIII)	13
1980	Iowan Brood (Marlatt's III)	17
1985	Great Southern Brood (Marlatt's XIX)	13
1987	Great Eastern Brood (Marlatt's X)	17
1989	Lower Mississippi River Valley Brood (Marlatt's XXIII)	13
1990	Northern Illinois Brood (Marlatt's XIII)	17
1997	Iowan Brood (Marlatt's III)	17
1998	Great Southern Brood (Marlatt's XIX)	13

Following are a few Letters to the Editor, mainly from students in the United States, several from students in other Western nations, and three or four which merely said very nice things about the Newsletter, which of course always made the Editor feel good. When I read these letters from students plus a lot of other letters from teachers and others and other stuff in the old newsletters, I have a hard time figuring out why we were unable to convince the UW Center for Biology Education that we had a very successful educational program going (see Chapter 13). The original Newsletter headings have been preserved below and they are pretty much in chronological order.

Peace Corps Volunteers in Congo (July 1992 Newsletter)

Laura Bissmeyer and Bruce Drury wrote as follows:

As we sit here eating yellow palm grubs, wondering and arguing about their nutritional value, we realize how nice it would be if we received *The Food Insects Newsletter*. We are Peace Corps volunteers in Congo, Central Africa, until December '93 and have eaten many insects we might otherwise have ignored. Why are insects so taboo in America?; they make quite tasty snacks. It would be appreciated if we could receive [issues at each of the addresses below] as we are located at different posts I look forward with anticipation to my first *Newsletter*. Much thanks in advance.

P.S. [We] are both fish extension agents and would be interested in using insects as a supplementary food source for *Talapia*, the subtropical fish we work with here. Termites and ants seem to be a favorite of these otherwise vegetarian fish – and are plentiful [but would insects be likely to increase or decrease growth rates?] Would appreciate any comments you might have.

More U.S. Cookbooks to include insects in the future? (July 1993 Newsletter)
From Amy Rosmarin of New York City:

This is the best newsletter I have ever seen. I'm putting together a cookbook – *Serving Odd & Elegant* – and now hope to include some insect foods. Thanks.

Ed.: We swear that we didn't print Amy's brief note because it contains a nice compliment for the *Newsletter*. We thought it of interest to readers that there may be a new U.S. cookbook that contains insect recipes. And, we know of at least two more that are underway.

From a student (fifth-grader?) in Delaware (July 1993 Newsletter)

January 22, 1993. Dear Dr. DeFoliart:

I just wanted to thank you for your time with my trend story on eating insects. I enjoyed reading *The Food Insects Newsletters* and the article you sent me. The story will be in the next issue of our school paper. (Although I haven't even written it yet, the teacher was so impressed by my sources that she wanted it

in soon.) I'll send you a copy as soon as it goes to print. Thanks again. Scott A. McLaughlin [signed], Hockessin, Delaware.

Ed.: The *Newsletter* hears from several dozen students per year. They are not only writing for school newspapers, but exploring insects as food in biology projects, Science Fairs, forensics and university term papers. Read on.

From an 8th Grade Science Fair Winner in Toledo, Ohio (July 1993)

Dear Dr. DeFoliart:

I sent you my finished report on 'Insects: The Inside Story.' Thank you very much for all your help. I learned a lot about this subject, and I'm also surprised that there are so many other interested people out there. The pamphlets helped me out a great deal, too. In fact, in one of the *Food Insects Newsletters* there was a recipe for worm fritters, and for the science fairs I went to, I cooked them for my judges. Only one judge would eat them, unfortunately. Also (just on a more curious note), at my school I realized that my famous worm fritters were eaten more by the little girls and older women. The older men shrunk at the very idea, and only about three boys tried the "infested" food for the mere purpose of showing off in front of the more timid girls that refused to even look at bugs. So, maybe if we introduce the idea of eating insects to women, they will agree and eventually, men will follow! (Okay, so maybe I'm jumping the gun!)

Seriously, though, I'm impressed by this whole idea, how insects can be good, nutritional, environmental and inexpensive food. At my school, St. Pius X, I participated in their science fair, and after that I decided to go on to the Northwest District Science Fair at the University of Toledo. (I mentioned "decided" because since our school is so small anyone who wanted to go on could.) While there, my project won the Governors Award for Excellence in Agricultural and Food Science Research plus \$25.00 and a Superior which enabled me to go on to the State Science Day in Columbus which is this Saturday (the 17th of April). No matter how this turns out, I owe a lot to you for taking the time to help me out. I am sure that you are a very busy man no doubt!

I hope you had a nice Easter season, and your weather actually starts to look like spring (unlike ours). Thanks again, Laura Gibson.

Ed.: Laura's report was wide-ranging and excellent. She drew on many sources of expertise: an entomologist in Georgia; a protein specialist at General Mills in Minneapolis (who conducted a protein analysis of her mealworms and crickets in comparison to beef); the New York author of a recipe book; Ronald Taylor (author of *Butterflies in My Stomach*); a professor in medicinal chemistry at the University of Toledo; the Toledo Zoo; the Cincinnati Zoo. If even 10-20% of the next generation develop the kind of interest and appreciation that Laura has in the beneficial side of insects, it will be a better world for both insects and people.

From a graduate student at the University of Arizona (July 1993)

Under date of May 17, Robin K. Roche, wrote in part: I've written to you before. I am a graduate student in entomology at the University of Arizona and I have been interested in ethnoentomology and entomophagy for some time now. Early last fall I wrote to ask if you knew of places where I could purchase more exotic insects (other than the standard mealworms and crickets that can be ordered from places like Rainbow Mealworms). You very kindly referred me to Dr. Fish of the New York Entomological Society and he was a great help and we enjoyed sharing our enthusiasm for cooking insects. He also ended up referring me to Dr. Tom Turpin (then president of ESA) and I was invited to help run the edible insect display at the Insect Expo in Baltimore last December. So, for all of that, I'd like to thank you for your letter.

At that time I was preparing a special Thanksgiving slide show and mini feast for our local organization, Sonoran Arthropod Studies. It was a great success! I love to cook so I tried adapting some of my favorite recipes from *The Silver Palate* and other cookbooks. I served Houpes de Grillon (cheese puffs with crickets), Caterpillar Crunch (spicy nut mix with fried wax moth caterpillars), and Chocolate Zoey's (chocolate covered *Zophobus morio* i.e., giant mealworms) to name a few. The Caterpillar Crunch and the Zoey's were the obvious favorites of the crowd. Since last fall I have several requests for the Caterpillar Crunch recipe. I probably will have a similar mini feast again this fall. Currently, I am teaching several spring workshops for local teachers and I have included entomophagy as a topic. I supply them with procedures and some hands-on experience as well as some ideas for experiments in the classroom. Not all the teachers are as eager to try this in their classrooms, but I know that I have converted a few! I make a point of making my recipes appealing and flavorful and most people are amazed that "insects don't really taste that bad!"

I'm sure that you get many letters like this every day, but I just wanted to let you know that you had a voice spreading the word about edible insects here in Tucson.

This is the author, in 2001, saying that Robin's Caterpillar Crunch recipe which was included along with her letter in that 1993 Newsletter, can, in this book, be found reprinted in Chapter 17, Miscellany.

University student in England designing "packaging" for edible insects (July 1993)

Under date of April 7, David Colderley writes in part: I am a student in my fourth year on a Degree course in Graphic Design at the University of Central Lancashire at Preston in the United Kingdom. As part of my course I have chosen as one of my projects a brief to design a range of packaging for edible insects, and also an advertising campaign to make people more aware of the possibility of being able to eat insects. I have found a few articles on the subject, including the one featured in the Benetton clothes magazine 'Colors' but I am finding it difficult getting hold of any research material. Therefore I am writing to see if you have any information available, or that I would be able to get hold of (books, leaflets)

Volume VI, Number 3 (November 1993)

From Therese Fish, Dale, Texas, dated September 16: Love your *Newsletter* – we’re all hooked . . . My husband’s boss’s son used our copies to research his project for his school’s science fair, and won second place with his chunky earthworm cookies (the worms were left in large pieces so everyone would know they were really in there). I believe he was beat out by a nuclear reactor, or something like that.

Further proof, if needed, that we aren’t error-free (March 1994)

From Joseph Evans, Grand Coulee, Washington, after reading about our change in policy in the last *Newsletter* and checking his mailing label:

My CM designation notes a non contribution to your great newsletter. Cognizant of my initial defraying of suggested \$5.00 when requesting your newsletter I underwent head, thoracic and abdomenable constrictions. However, herewith a contribution of \$10.00 to help perpetuate your great program.

Ed.: Any other readers who may have experienced those same symptoms, should write the editor for a prescription.

Newsletter gets very nice compliment from reader (July 1994)

Roger Grande, Jamaica Plain, Massachusetts, wrote in part:

Thanks for continuing to send me your terrific publication. . . . Whereas I do not have a background in science, my interest in your publication lies primarily in its subtle anti-colonialist theme. That colonialism is so complete as to destroy fundamental elements of indigenous peoples’ cultures, including diet, is, unfortunately, all too often omitted from political writings. . . . I find in your newsletter a splendid (and unconventional) respect for cultural diversity, without, of course, any sectarian axes to grind.

From the student section (July 1994)

(Ed.: The editor always hunkers down a little further in his chair and reads on with both anticipation and apprehension when the opening sentence of a letter says, “I am a student . . .” The students we hear from are usually well along on planning their project, and have a good idea of the specific resources needed, and they think big!)

Soman Chainani, Key Biscayne, Florida, wrote in part: I am a 14-year old student at Gulliver Preparatory School in Miami, Florida. Your work on the consumption of bugs has triggered my interest as I head toward the selection of a science

project to enter in the National Science and Engineering Fair. I plan to test alternative food sources found in the natural environment that may prove as a secondary choice to unhealthy modern meals. If taken one step further, the success of this project may be used to further research on world hunger, where the land may be used as a source to receive the tested alternate foods.

Already planned to be tested are seaweed, algae, soybean, tempeh, Chinese vegetables, Japanese meats, etc. Your research on bugs inspired me for my final and most important sample. What we see and loathe everyday may be our savior. I plan to test these alternate food sources through a colorimeter (for energy content) and in conjunction with a food laboratory (for nutritional content).

What I ask of you is some aid in completing my project. Is there any way . . . ?

From Andrea Croli, Aachen, Germany, in part: I am studying graphic design (visual communication) at the Academy of Aachen For my diploma I chose the theme "Edible Insects." In developing an advertising campaign, an information folder, some packaging examples and a concept idea to introduce insect products to the German market, I would like to evoke peoples' interest and curiosity for this kind of food. To be really convincing, I will organize an insect dinner as part of my presentation For this event I am looking for

(Ed.: Who knows? We, and edible insects, may be at the dawn of a new age as the next generation gets ready to take over.)

It was an all-around great day for edible insects at Oregon Ridge Nature Center (November 1994 Newsletter)

We received some interesting follow-up on the Oregon Ridge event [in Maryland] That it was a truly quality day at Oregon Ridge was further indicated in a letter from someone who attended the event:

Dear Dr. DeFoliart:

My wife and I enjoyed a splendid lecture and field trip and demonstration on Food Insects at the Oregon Ridge Nature Center leading me to ask for whatever number of past, present and future copies of your newsletter that can be provided and mailed. . . . This 2 hour exercise was conducted by a 19 yr-old counselor at the park named Adrienne van den Beemt with a degree of knowledge, charm, enthusiasm and audience captivation, free of self consciousness, that was barely believable to me, who has been on the giving and receiving end of scientific teaching since 1935. Keep an eye on this gal.

Sincerely, (signed)
William E. Grose
Assoc. Prof. Surgery, Emeritus
Johns Hopkins Med School

And finally, a letter dated August 16 from the organizer herself:

Dear Dr. DeFoliart,

Hello! My name is Adrienne van den Beemt, and I am a second year student at the University of Michigan as well as a naturalist at the Oregon Ridge Nature center in Cockeysville, Maryland.

The weekend of August 6 and 7, 1994, I held a program called “Eatin’ Bugs at Oregon Ridge”. I had been a little nervous about conducting this program because I had never heard nor seen such a program before. It went splendidly – with the invaluable help of your *Food Insects Newsletter*. I credit your publication with 90 percent of the information and recipes that I shared. Our nature center had issues back to 1988, and I must have gone through at least twenty newsletters during my research. I really do think that there are no better references around! They were absolutely wonderful – fascinating – and I have recommended *The Food Insects Newsletter* to everyone who lets me!

Around 30 people each day sampled Caterpillar Crunch, Worm Fritters, and Chocolate-Covered Crickets. People loved the cuisine – plates were licked clean, and I had several requests for recipes. The *Baltimore Sun* ran a story on August 7, 1994, which I have enclosed. The next day I found out that the story had been picked up by the Associated Press. Since then, I have been bombarded with calls from radio stations from Virginia, California, Pennsylvania, Michigan, Montana, and even from Austria and South Africa!

The program was an absolute success! I’d like to thank you wholeheartedly for your help and commend you on such a unique and resourceful newsletter. . . .

Sincerely, (signed)
Adrienne van den Beemt

The ultimate endorsement of edible insects – Colorado school kids eat the “worms” and leave the fritters (March 1995 Newsletter)

Signe Hartmann was one of the kids next-door who grew up with the Editor’s three youngsters here in Madison, Wisconsin. Ms. Hartmann is now in Denver, Colorado, from where she wrote, Nov. 19, in part:

. . . I’m working as a science resource teacher in three different elementary schools here – and my job is partially funded through a nutrition grant. So when I found out that one class was studying insects I immediately thought of you.

The information you gave my Mom was so helpful. The finale of our insect study was cooking and eating the corn/worm fritters and chocolate-covered crickets. I was amazed that the kids were picking the mealworms right out of the fritters to eat them individually. Needless to say it was a big success – and I’m sure we’ll be doing more insect-eating in other classrooms. Thanks again for all of

your information. It was also great to teach the students about different countries who use insects on a very regular basis.

Early alert for upcoming BBC productions (July 1995 Newsletter)

The BBC Natural History Unit has given attention to food insects topics for several years now. The following is excerpted from a letter from Ruppert Barrington (Producer), dated April 4th:

I thought I would just let you know that, inspired by your *Newsletter*, we have covered two lots of “Insects as food” for our BBC series on Insects. These were a short piece on the Mopane Worm in Botswana (unfortunately I could not get out there – we commissioned a South African crew to do this for us) and various insects being collected, sold and cooked in Thailand (Bamboo worms, crickets of two kinds, hornet grubs and giant water bugs).

The series (called Alien Empire) is being transmitted here in November this year. It is co-funded by WNET in USA and will, I imagine be transmitted in USA around the same time. The sequences are in the sixth (final) programme.

I am hoping, on the strength of this, that I may be able to get an entire programme commissioned on Insect eating. I keep fingers crossed for this. The gratifying thing is that most people react with fascination rather than disgust when they see this footage. We are very much pushing the angle that this is no different to eating Crustaceans, so western attitudes to eating insects are groundless.

(Ed. In a later letter, Mr. Barrington changed the time of probable showing in the U.S.: “The series is due to be shown by WNET early next year (probably February).”

To heck with modesty! No editor can resist printing letters like these (July 1995)

From David Strange, M.D., Petaluma, California, in part:

Thank you for founding and editing *The Food Insects Newsletter* for all these years. It is one of my favorite publications, about the only thing I get in the mail that I read cover to cover the same day I receive it. Your approach underscores at least two principles for The Good Life: Stay open to new experiences; and Lighten up.

From Joe Buehler, St. Peters, Missouri:

Enclosed is my check for This is to “re-up” my subscription, and to pay for one for my brother, who keeps trying to steal my copy! Thanks.

From the student section – students think for themselves

Megan Murray, age 12, Woodland, California, writes:

I am writing to you because I just got the *Almanac of the Gross, Disgusting and Totally Repulsive*, and I read the creeping cuisine and I would like the latest copy of your newsletter. I'm 12 years old and my mother says that even thinking about eating bugs is sick, but I want to try them myself. In 4th grade I read a book called *How to Eat Fried Worms* and wanted to try it, but I gave up because I couldn't find a worm!!!

We've seen above a lot of good mail arrived for the Newsletter. If we don't count letters of rejection in response to our applications for funding, there were only a few sour notes that arrived in the mail over the years. Of those that did, the following was, by far, far and away, the most irritating and unsettling to the editor. It was dated February 3, 1992:

Professor DeFoliart,

Many thanks for your tireless research into the crunchy subject of eating grotesque, squirmy bugs. I really do appreciate receiving your newsletter, it gives me hours of enjoyment and provides ample fodder for my column.

You have gotten many raves from my readers for your esoteric findings as well as providing me with some really gross stuff to exploit.

Any newsletter or newspaper should have your problem of exploding circulation, however I do hope you can weather it and still find a way to fund the continuation of this unique enterprise. Perhaps we can start a Save The Bugs (so we can eat them!) fund to further your research and continue the newsletter. If it comes to that, I'll work the phones myself.

Keep up the good work and I'll keep spreading the word out here in Houston that the cockroaches we have are not only pesky, they're also tasty!

Sincerely,
Matt Ray

Next is the column itself, on page 4A of *The Deer Park Broadcaster*, January 29, 1992; "News, Schmooze & Reviews" by Matt Ray. The article was titled, "Could future menus include Worm Tartar, Bug McMuffin?":

As luck of the literary world would have it, the new issue of *The Food Insects Newsletter* (from the University of Wisconsin-Madison, Department of Entomology) is out with even more interesting ways to consume revolting creatures most people don't even want to look at. But remember: *they are a delicacy in some countries.*

The thing newsletter editor Professor Gene DeFoliart doesn't seem to realize is that bugs just don't happen to be a delicacy in the United States (at least not that I know of).

Actually, insects couldn't be that popular here or there would be a Cricket McMuffin or Big Maggot Mac or something. In lieu of those things though, the newsletter makes other suggestions for your dining pleasure.

DeFoliart says we can learn from the Indians who have many traditional insect favorites which make good eating. They include weevils, long-horned beetles, giant water bugs (bet those are juicy!), aphids, cicadas, hornets (ouch!), termites, moths, dragonflies and katydids.

The newsletter also claims that Chinese people in Malaysia use some insects, and their by-products, as medicinal aids. The most patently repulsive example of this is the eating of the excrement of walkingstick insects to cure asthma, stomach upsets and muscular pain. It is also noted that the excrement can be brewed into tea and drunk to cleanse the body.

Just when we thought the American medical system was having some problems, all it took was a little walkingstick poop to give us a little instant appreciation.

Editor DeFoliart laments, "It is unfortunate that so few insects used in traditional Chinese medicine are available in the United States. One herbalist indicated to me that insects are difficult to import because the customs officials do not like to deal with them."

We might also consider writing those customs officials a thank-you note.

In a fortunate international development, Professor DeFoliart has bridged the growing gap between America and Japan by hooking up with a couple of bug-eatin' Japanese doctors.

According to letters from the doctors, also printed in the newsletter, the Japanese Ministry of Agriculture, Forestry and Fishery is planning a research project analyzing various insect functions, apparently including how they taste.

On a trip to the United States the Japanese doctors met with Professor DeFoliart who showed them his collection of food insects (a nice ice-breaker), which includes a lollipop with a *mealworm center*. I'm sorry, that's gross.

However, the Japanese doctors found the lollipop and other items quite impressive. As a matter of fact, the doctors also brought Professor DeFoliart a few gifts as a token of their esteem: cooked Japanese grasshoppers and a can of wasps.

According to the letter, all three men proceeded to "enjoy" the grasshoppers there on the spot. Apparently, the professor saved the wasps for later.

Remember the Letter-to-the-Editor earlier in this chapter from Joseph Evans of Grand Coulee, Washington? After seeing in the Newsletter that he had not been credited with paying for his subscription, which he knew he definitely had done, he said he underwent head, thoracic and abdominable constrictions. That's exactly what happened to me when I read Ray's letter and column. I started writing responses to publish with his column when I got around to publishing it in the Newsletter, and I definitely planned to make him look bad, bad, bad – as in stupid and ridiculous. By February 8th, I had gone through eight versions of my response, three of which were fairly short, blistering and to the point; five were longer, including the one below:

Mr. Ray:

Thanks for sending the clipping of your column in the Deer Park Broadcaster.

Why are you working in Deer Park – wherever that is? With your style, accuracy and all-around journalistic talent, you would be a godsend for the National Enquirer or the Sun or some other supermarket tabloid of similarly high journalistic standing. In only one column you were able to slur food traditions of American Indians, the Japanese, and, by inference, all other cultures that don't jibe with your idea of what's best about America.

From your fixation on cockroaches, it is obvious that you think an insect is an insect. I naturally presume then that you think a mammal is a mammal. You could provide much entertainment for our readers if you would let us know your favorite way of preparing skunk. Also, do you collect roadkills?

If you are looking for stuff that is really gross, as grist for your mill, you should check in on the S. & L. bailout, the thinning ozone layer, health care and health insurance availability in the United States, the leveling of the rainforests and irretrievable loss of biodiversity, so many things that are much more gross than anything you will ever find in The Food Insects Newsletter.

Please give my condolences to your readers in Deer Park. You implied that you have some.

Sincerely,
(signed)

One of the other long versions came down harder on cockroaches, but was otherwise similar to the preceding:

First, a piece of advice, re the last sentence of your letter. Quit eating those cockroaches. Even if they are tasty. They're very unsanitary, you know. They are not good for you.

My shortest version was short and snappy and probably my favorite:

Mr. Ray:

Thanks for offering to work the phones. But you should quit eating those cockroaches! They are very unsanitary, and are not good for you.

Sincerely,
(signed)

As I wrote and revised my various versions, one of which I would select to send to Ray and publish in the Newsletter for all to see, I was showing them to Catherine Howley, Linda DeFoliart and Lou in order to get their reactions. It was very frustrating that none of them seemed to get all that excited about the prospect that I was going to verbally degut Matt Ray in public. I'm not sure which one said it first, but whoever it was, it quickly was apparent that it was the opinion held by all three and none of them was too impressed with my intention of doing a body slam on Matt Ray. Anyway, one of them said, "The thing I've always liked about the Newsletter is that it was always above this

sort of thing.” So, thus ended my hope of verbally body slamming Matt Ray in public. None of the versions was ever sent. In the end, all I got to do was delete his name from the mailing list. That did not provide anywhere near the amount of pleasure I had been planning.

[Maybe include a listing of lead articles featuring the expert quality of the authors]

Chapter 11. Walking the Plank: The On Again Off Again ESA International Symposium

When several people were being contacted during the summer of 1987 regarding the desirability of starting a newsletter, they were also asked what they thought about the desirability of organizing a symposium in the not-too-distant future. They thought it was a good idea (see Chapter 10). So, the effort was launched with a letter January 12, 1989 to 18 potential participants. Reading, even 12 years later, about the tight time frames we were up against would make my hair turn white, if it wasn't already. As described in the letter, I had decided to try to tie our symposium to the 100th Anniversary Meeting of the Entomological Society of America that would be held in December of that year:

To:

Dr. Julieta de Conconi, Mexico
Dr. J. J. Dreyer, South Africa
Dr. Darna Dufour, USA (Colombia)
Dr. A.R. El Boushy, The Netherlands
Dr. Mark Finke, USA
Dr. Richard Gorham, USA
Dr. Robert Kok, Canada
Mr. Gerardo Larde, El Salvador
Dr. Francois Malaisse, Belgium (Zaire)
Dr. V.B. Meyer-Rochow, New Zealand (Papua New Guinea)
Dr. Jun Mitsuhashi, Japan
Dr. John Phelps, Zimbabwe
Dr. Darrell Posey, Brazil
Dr. B. Prasad, India
Dr. Kenneth Ruddle, Japan (Colombia)
Dr. Karl Schurr, USA
Mr. Pongtorn Sunpuag, Thailand
Dr. Ronald Taylor, USA

From: Gene DeFoliart

Re: Possible symposium on insects as food in conjunction with the 100th Anniversary Meeting of the Entomological Society of America.

The Entomological Society of America will be observing its 100th Anniversary at its December 10-14th, 1989, meeting in San Antonio, Texas. This would provide an excellent opportunity for acquainting a wide audience of entomologists with the fact that insects are of widespread and traditional use as food among indigenous populations in the developing world. Thus, I am writing to suggest that we consider organizing a symposium in conjunction with the ESA meeting. An appropriate title might be: "Insects as a Food Resource, Now and in the Future."

I hope you will excuse the group format of addressing this letter, but it is the quickest way of acquainting everyone with the location of those to whom the letter is being sent, and, in parentheses, where their studies were conducted. I have attached a tentative symposium format and schedule of speakers, but emphasize that nothing is confirmed. It's merely intended as a starting point. I would like to get your ideas on whether or not we should go ahead with planning, and, if so, who might be interested in participating. As many of you are not ESA members and don't regularly attend ESA meetings, travel costs will undoubtedly be a big factor. Hopefully, we can find sponsors who would help defray travel expenses, especially for those coming from overseas. Let me know if you have ideas regarding possible sponsor organizations. In the meantime, however, because of the short time frames involved, I will need to make some contracts before hearing back from most of you.

The first deadline for symposium proposals – in preliminary form – is April 1. Proposals will be accepted or rejected on the basis of the preliminary proposals. The final deadline, with no loose ends hanging, is June 1. In addition to section symposia, formal conferences and informal conferences, ESA approves up to five program symposia at its annual meetings. As our subject is much broader than any one or two ESA Sections, I have contacted Dr. James Shaddy, the National Program Chairman for the meeting, regarding our chances for one of the program symposia slots.

One of the bad things about the centennial year is that four of the five program symposia slots have been given to the Centennial Committee, leaving only one for everybody else. Nevertheless, I think our chances are good – for a couple of reasons. I was not at the 1988 ESA meeting this past December, but a limited amount of feedback from Section D officers and from two members of the Governing Board revealed nothing less than enthusiasm for the possibility that a food insects symposium might be offered. Also, I have had an enthusiastic response from reviewers and editors for a manuscript that will be published as a feature article in the Spring issue of the Bulletin of the ESA. The cover illustration for the Spring issue will pertain to insects as food, and the article should help give the subject some profile in the Society before the meeting – and possibly in time to influence the symposium selection committee.

The worst that can happen, if we don't get the available slot this year (or if we don't find sponsors), is that we would be off to an early start on planning for the 1990 ESA meeting. The 1990 meeting will be in New Orleans, which also isn't a bad place to go for a meeting in December.

Some of you may know of others who could be valuable contributors. It would be nice, for instance, to have a presentation or two that focus on the ecologically advantageous aspects of insects, such as their food conversion efficiency in relation to other animal sources, their potential for increasing food production without bringing down more forest, etc. I believe, however, that the first goal of the symposium should be to establish for the audience the extensive use and demand for insects that exists in many places. Thus, the decision on whether or not to proceed should probably depend primarily on how much

participation we can get from those who have worked in Asia, Africa, or Latin America.

Four hours are allotted per symposium, so probably up to 30 minutes could be allotted to speakers who have worked on developing countries, and 15 or 20 minutes for others. If we have participants that can be accommodated in four hours, the symposium could be continued although it would have to be done so under the designation of Informal Conference for the second session. Three hours are allotted for Informal Conferences, so we could have up to seven hours totally.

I shall look forward to hearing from you as soon as possible and to getting your ideas and suggestions. If there is a possibility that you can participate in the symposium, let me know: 1) A tentative title for your presentation; 2) How much time is needed – up to a probable maximum of 30 minutes; 3) Type (s) of projection equipment needed, and; 4) Whether you would need to have all or part of your expenses covered in order to attend. Also, let me have your telephone and/or TELEX numbers. My telephone is (608 262-5958; TELEX 265452 UOFWISCMDS

In closing, I do hope that we will find it possible to go ahead with this. It would provide an opportunity to get acquainted and to exchange ideas. Also, by raising good questions about the need for better harvest and production methods, we could challenge entomologists to get involved in relevant research.

Sincerely,

Gene R. DeFoliart

Professor

Additional letters, dated January 17th or 18th, were sent to Malaisse, Phelps and Ronald Taylor, the one to Taylor suggesting that insect snacks/hors d'ouerves might accompany the cocktail hour. Those readers who are steeped in this subject know that Ronald Taylor is the author of two well-known books on entomophagy. I said to him, "I do not know whether this is a tenable idea or not, but if you think it is, and would be willing to take charge of the event, I believe it could be one of the highlights of the Centennial Meeting." Taylor responded February 7th:

Dear Dr. DeFoliart:

I apologize for my delay in responding to your letter of January 17, 1989. I've been working furiously to meet a deadline for a book manuscript, and it took precedence over everything else. (I work as a writer now. I am just beginning a college biology textbook for Mosby).

I cannot tell you how personally satisfying it is to me to see how far the study of entomophagy has progressed on the past 10 years. When my books were published, there was virtually no interest in the subject at any level, anywhere in the world. I am delighted to receive your newsletter. I had contemplated doing it myself many times, but somehow I never got around to it.

I have to decline your invitation to participate in the symposium. The timing is wrong for me this year. I haven't spoken to my co-author, Barbara Carter (now Barbara Shannon), about your invitation. Perhaps she would be willing and able to take on the task. She has boundless energy. Should you want

to contact her, you can reach her at 10515 Bryson Ave., Southgate, CA 90280 (213) 566-5592.

The logistics of a cocktail party as you suggested would be horrendous. Considering the nature of the group, I would want to serve insects in as recognizable form as possible, rather than blended into a flour and served in a bread or otherwise camouflaged. The insects that are available in large quantities—crickets, mealworms, and bees—really aren't that tasty when served intact. The ideal insect, from my point of view, would be the wax moth larva. It is really quite tasty when fried. But the logistics of obtaining and processing the numbers required for such an event would probably be prohibitive.

Should you inform the press about the cocktail party, news of the event will spread coast to coast, probably around the globe. Heaven help the individual who is interviewed by the press. A rat race like he/she has never known will ensue. I wouldn't go through that again for all the tea in China.

I very much appreciate your thinking of me. You have my best wishes for a successful symposium. I will be anxious to hear of the outcome. And please keep me on your newsletter mailing list. I have not been involved in the field for some time now, but I am very interested, and do want to know what is going on.

Sincerely,
Ronald L. Taylor

Since I had invited 14 people to the United States, it seemed like a good time to start figuring out how to get them here, and for the five who were already here, how to get them to San Antonio. So, I did what I usually do at times like this, I wrote to all those foundations who, in more than 10 years of my urgings, had never given me a dime. Two-page letters describing the planned event and its importance went out on January 26, 1989 to the Kellogg Foundation, the Rockefeller Foundation, and the World Resources Institute, and on February 8 to the Ford Foundation and a new one, the Heifer Project International in Little Rock, Arkansas. The letters were as follows:

The possibility is being explored of holding an international symposium on insects as food in conjunction with the 100th Anniversary Meeting of the Entomological Society of America (ESA) in San Antonio, Texas, next December. A copy of the letter to potential participants and a copy of the tentative program (which is very preliminary) are enclosed. The title of the symposium would be, tentatively, "Insects as a Food Resource, Now and in the Future." As the majority of the potential participants are not members of the ESA and most are from overseas, this letter is to ask whether the Rockefeller Foundation might have an interest in contributing toward the estimated \$12,000 to \$15,000 needed to help defray travel expenses of some of the participants.

If insects are to make a significantly greater contribution to human nutrition in the future, it is the entomologists who have the biological expertise necessary for devising the methods and strategies needed for increasing supplies. The proposed symposium, as part of the centennial meeting of the ESA, thus offers a unique opportunity for informing and involving entomologists. It would also provide the

first opportunity for some of the few who are already involved in relevant research to meet each other and to exchange information and ideas.

The proposed symposium would also be an opportunity for building on existing momentum. Recent efforts to bring about more awareness of the importance of insects as traditional foods among rural populations in the developing world have met with some success. A news release last June which was picked up by the Associated Press resulted in nearly 100 followup contacts from news and educational outlets, including such sources as the BBC, Public Radio, CBS and Nickolodean television networks (both relative to children's educational programming), Weekly Reader, Chronicle of Higher Education, East-West Magazine, and Christian Science Monitor, among others. These and other contacts resulted in a considerable amount of positive public feedback. Also, the past year has seen activity aimed at networking scientists, laypersons and organizations who are interested in exploring the potential of these traditional insect foods for greater exploitation as part of a sustainable agriculture. As part of the networking effort, The Food Insects Newsletter was initiated in 1988 as a communication link, and it too has been well received with a rapidly expanding mailing list (copies of the first two issues are enclosed).

Twelve of the currently listed 19 potential symposium participants are located overseas and the availability of funding for at least partial reimbursement of travel expenses will undoubtedly be the factor that determines whether planning for this symposium can proceed. Because of time constraints imposed by an April 1 ESA deadline and lengthy turn-around times in the international mails, we have only a relatively short time in which to try to find funding support for the symposium.

ESA will provide free registration, which will save more than \$100 per participant, and I would guess that four or five of the potential participants can make it on their own funding, personal or from other sources. For most of the others, however, it will probably be necessary to reimburse lodging and meals while in San Antonio in order for them to attend. I believe that the presence of Dr. Julieta de Conconi (Mexico), Dr. Francois Malaisse (Zaire), and Mr. Pongtorn Sungpuag or one of his group (two PhD nutritionists) (Thailand) is particularly critical to the success of the symposium, and full reimbursement of their expenses would be warranted if necessary in order to get them here.

One additional benefit of the proposed symposium gathering at San Antonio is that it would provide an opportunity to look ahead to a possible followup at the 1992 International Congress of Entomology which will be held in China. While the first objective in San Antonio will necessarily be to show that insects are extensively used, especially among rural populations, and that they are important in complementing the largely vegetarian diets of those cultures, it is hoped that by 1992 the emphasis can shift more toward the ecological and environmental implications of food insect use.

Please let me know if I can furnish additional information that might be desired in considering this request. The galley proof of an article that will appear on the Spring (March) issue of the Bulletin of the Entomological Society of America is enclosed as a general reference to recent studies.

Sincerely,
Gene R. DeFoliart

Enclosures

Acceptances from symposium participants began arriving quickly, the first, dated January 20, from Darna Dufour, University of Colorado, the second from Mark Finke, dated January 23, and most had been received by mid-February. I wasn't surprised that I heard quickly from Mark. Major professors remain important figures for a long time in the lives of their graduate students. I still remember a conversation I was having years ago with Dave Pimentel in his backyard. Lou and I had stopped in Ithaca, New York, to see Dave and Marcia (old friends from our Cornell days), and Dave was describing to me one of his theories that we hadn't talked about before. I said, "Well, who agrees with you on this?" He hesitated for a moment, then resumed with, "Well, all of my students." And one of my major professors at Cornell, Herb Schwardt was the deciding factor in my leaving the University of Wyoming to come to Wisconsin. Lou and I liked living in Wyoming, and I set some pretty high demands when I was offered the position in Madison. After a few weeks of hearing nothing from Wisconsin, I got a letter from Dr. Schwardt. It said, "I hear you can go to the University of Wisconsin. What are you still doing in Wyoming?" Within a day, I called Wisconsin, said disregard my demands, and if the job is still open, I would like to come to Wisconsin. Also, I can remember that I was at least 40 years old before I even thought about calling any of my former major professors by their first name. So I rest my case about the importance of major professors.

About the time acceptances finished pouring in from prospective participants, the rejections began rolling in from the foundations. In addition to the foundations listed above, I had, at the suggestion of Pongtorn Sungpuag and Prapasri Puwastien of Mahidol University in Thailand later written, asking for symposium support, to the Canadian International Development Research Center in Ottawa. Our rejection letter from them was dated March 22, but, interestingly, with it we picked up another Newsletter reader and added to our future mailing costs. In writing us, Dr. R.H. Young, Senior Program Officer for Nutrition, said: "Regrettably, we are not in a position to offer financial support for a symposium on this topic, which does not fall within our current program focus. I did, however, find your Newsletter most interesting and would appreciate being included on your mailing list for future issues."

I do not recall, this long afterward, how Warren Rush, of Science and Technology, USAID (U.S. Agency for International Development) and I came together. My first surviving letter of record is dated March 15, 1989; it was pretty much a status report, as if Mr. Rush didn't have a lot of information up to that point:

Dear Warren:

As I mentioned on the telephone, we have been attempting to find funding which could be used to help defray travel expenses of persons participating in a

planned international symposium on insects as food. Our immediate problem is that we must submit a preliminary proposal by April 1, only two weeks away.

The symposium is planned in conjunction with the 100th Anniversary Meeting of the Entomological Society of America which will be held in San Antonio, Texas next December 11-14th. The title is "Insects as a Food Resource – Now and in the Future." I have enclosed a copy of the program, which is about 90 percent confirmed insofar as participants and titles of presentations are concerned.

The proposed symposium, as part of the centennial meeting of the ESA, offers a unique opportunity for informing and involving entomologists, the group that has the biological expertise necessary for developing more efficient and cost-effective methods of mass-production and harvest. It would also bring together as program participants an interdisciplinary mix of entomologists, nutritionists and ethnobiologists, and provide the first opportunity for some of us who are already involved in relevant research to meet each other and exchange information and ideas. An additional benefit of an international gathering of this group in San Antonio would be the opportunity to look ahead to a possible followup at the International Congress of Entomology which will be held in 1992 in China. While the first objective in San Antonio will necessarily be to show that insects are extensively used, especially among rural populations in the developing world, and that they are nutritionally important in complementing the largely vegetarian diets of many of those cultures, it is hoped that by 1992 the emphasis can shift more toward the agro-ecological implications of greater food insect use.

There is a high level of enthusiasm for this symposium, both among the participants and in the ESA. Of the 19 individuals originally contacted, 14 have accepted while three, J.J. Dreyer of South Africa (now retired), R.J. Phelps of Zimbabwe and R.L. Taylor of California are unable to attend. Two remain unheard from, R. Kok of Canada who is on sabbatic leave and K. Ruddle of Japan who travels two to three months at a time in Asia and Africa. I'm assuming acceptance by both until I hear otherwise.

Of the U.S. contingent, DeFoliart, Gorham and Finke will need no reimbursement of expenses; Dufour and Schurr need partial reimbursement if possible. Of the nine from abroad, all will need full or nearly full reimbursement of travel expenses in order to attend.

If \$12,000 to \$15,000 can be committed toward reimbursement of expenses for those who will need it, planning for this symposium can continue. Earlier contacts regarding support have yielded negative responses (though interest in the subject) from the Rockefeller Foundation, Ford Foundation, World Resources Institute and Heifer Project International. Replies from the Kellogg Foundation and the Canadian International Development Research Center are still pending. Time is now a critical factor inasmuch as we must present a preliminary proposal to the ESA Program Committee by April 1.

I believe this symposium, focusing on how to enhance the availability of these traditional foods of non-European cultures, has implications of potentially great significance for agroecology and nutrition in the developing world. I might mention that Professor Karl Schurr, one of the symposium participants, has suggested that thought be given to publishing the symposium papers. Prof. Schurr

has had experience in editing and publishing scientific papers by way of camera ready manuscripts and the most recent techniques of photo duplication. The cost of this type of publication is minimal. The cost of possible publication of the proceedings is not part of this proposal, however. Our only concern right now is to survive the April 1 deadline.

As it stands, we are sort of dressed up for the Ball, but with no way to get there. If AID might have an interest in funding or partially funding this conference, please let me know as soon as possible. My telephone number is (608) 262-5958.

Sincerely,
Gene R. DeFoliart
Professor

About here, we should probably break into another area of ongoing activity – my dealings with the ESA (Entomological Society of America). My program contact person here was Dr. James H. Shaddy, Northeast Missouri State University:

Dear Dr. Shaddy:

We are still interested in holding a symposium at San Antonio, titled “Insects as a Food Resource – Now and in the Future.” Our situation is, however, that we have the program participants pretty well set, but have not yet nailed down funding with which to partially defray travel expenses. I do not know whether we have to have funding assured by the April 1 preliminary deadline or have until June 1 for that, so I thought I had better bring you up to date on where we are.

I believe that in our earlier conversation, you mentioned that if we are successful in competing for one of the program symposium slots, the symposium could be continued in a second session as long as it is called a formal or informal conference. I have done the preliminary organizing on that basis and a copy is enclosed.

Fourteen of the 16 listed participants are confirmed, depending for all but three, and for all of the overseas contingent, on at least partial defrayment of travel expenses. We will of course shorten the second (conference) session slightly to fit within the three-hour limit if this actually comes off.

Our efforts to raise \$12,000-\$15,000 toward travel expenses have so far not been successful but we finally have some good news from AID. There is a very positive interest there and optimism that funding will be forthcoming although possibly it will have to be pried from several different programs within the Agency. Also, I have not yet had final responses from the Kellogg Foundation, the International Development Research Center of Canada, and FAO. The latter two contacts were made very late.

In summary we are dressed for the “Ball” but not yet assured that we have a way to get there. With the strong interest we have now found at AID, however, I think that funding can be confirmed before June 1, but is highly doubtful before

April 1. In the meantime I will let you know of any change in this situation as soon as it occurs.

Sincerely,
(signed)

Dr. Shaddy responded, dated April 12:

Dear Gene:

As per our recent telephone conversation I want to thank you for your willingness to convert your proposed symposium to an informal conference. I hope you will be able to obtain the financial support you are seeking.

Any of the proposed speakers that are not members of ESA will be sent hotel and registration information by the ESA office. I will provide them with the names. Also, if the speaker is not a member of ESA and spends less than 50% of his/her time with entomological matters or lives outside the U.S., I can give them complimentary registration. You will have to provide me with that information. Complementary registration does include a program, but it **does not** include the ESA mixer. The mixer will cost the individual \$20.00

I will look forward to receiving your final program before **June 1, 1989**.

Thank you for your interest. If you have any questions, please contact me.

Sincerely, (signed)

It was time to update conference participants. The following went out on April 17:

To:

Dr. Julieta Ramos-Elorduy
Dr. Francois Malaisse
Dr. Prapasri Puwastien
Dr. Darrell Posey
Dr. B. Prasad
Dr. V.B. Meyer-Rochow
Dr. Darna Dufour
Dr. Jan Mitsuhashi
Dr. Richard Gorham
Dr. Mark Finke
Dr. A.R. El Boushy
Dr. Gerardo Larde
Dr. Karl Schurr

From: Gene DeFoliart

Re: Proposed ESA symposium on insects as food

Dear Colleagues:

This is just a brief note to update you on the status, still uncertain, of our proposed symposium.

Early efforts with a variety of foundations and other organizations were unsuccessful in obtaining funding to defray travel expenses of participants. A belated contact with the U.S. Agency for International Development, via Warren Rush, did find interest, however, so we aren't quite dead yet. AID will apparently have to try to siphon the necessary funds from several departments, so it could be another month before we know whether they will be able to come through or not.

One other development has worked to our advantage, I think. There were 14 proposals for ESA program symposia, only four of which could be accepted. We were not one of the four, but Dr. James Shaddy, ESA National Program Chairman, has offered us two Informal Conference slots, one 4-hour session during a morning or afternoon and one 3-hour evening session, a total of seven hours. The Informal Conference designation carries a little lower "profile" than a Program Symposium, and, personally, I'm a little more comfortable with that at this stage of the game. The other advantage in this is that our deadline for obtaining assurance of funding is extended from April 1 to June 1.

Karl Schurr has suggested that we might publish the papers as a conference proceedings. He is experienced in publishing papers using camera ready manuscripts and photo duplication techniques, and done this way, the cost would be minimal. Details on this will be supplied later if the program is actually held.

I will keep you informed as soon as I know more. In the meantime, those of you who will require at least partial reimbursement should send me an estimate of what your round-trip airfare will be to San Antonio. Hopefully, it will be possible to reimburse airfare, and, partially, expenses for meals and lodging while in San Antonio. In addition, ESA will provide complimentary registration (waiver of fee) for all speakers from outside the U.S., and for speakers who are not a member of ESA and spend less the 50 percent of their time on entomological matters. Information on hotels, etc., will be sent later if the conference is funded.

The program as it now stands is attached. If any change is desired in the title of your presentation as listed, please let me know right away.

Sincerely,
Gene R. DeFoliart

On May 10, I sent Warren Rush an update on problems and uncertainties:

Dear Warren:

The proposed budget for the conference, totaling \$15,000, is attached. There are several uncertainties and loose ends, one of the major ones resulting from the fact that my addition and subtraction weren't very good yesterday. In retotaling the 11 airfares late yesterday afternoon, I found that the total was \$2600 more than the total I had given you on the telephone earlier, which all but wiped

out the approximately \$3000 margin I thought we had for bringing in Drs. Ledger and/or Okedi from Africa.

Just how much this budget can be stretched, and where, remains to be seen. The per diem request of \$250 per person is intended to cover about half of their expenses for meals and lodging, to and from airport, etc., while in San Antonio. I am hoping, however, that if airfares are assured, several of the participants will be able to obtain institutional support and/or use personal funds to cover other expenses.

For two reasons, I had the airfares quoted (May3) by local travel agency to be based on a Saturday, December 9, arrival. First, Saturday arrival resulted in a substantial reduction in about half of the fares. Secondly, the ESA meeting runs from Sunday noon, December 10 to Thursday noon, December 14. I do not know yet when the first of our two conference sessions will be scheduled, but it could be as early as Sunday afternoon. If not, I will probably schedule an informal meeting of the group anyway, for Sunday afternoon, in order to begin same planning on "where do we go from here?"

Various uncertainties. Dr. Posey, now in Belem, Brazil, expects by December to be spending a year in West Germany, so his probable point of departure is not yet known. The round-trip airfare for Tokyo to San Antonio quoted to me by the travel agency was \$1517 as shown in the budget, but a letter received yesterday from Dr. Mitsuhashi quotes the fare as \$3100. how much of the we'll run into, I don't know. I should hear from most of the participants within the next week as to fares quoted from their end. In Mitsuhashi's case, I think that if \$3100 is the lowest fare obtainable, we have no alternative but to drop him from the program.

The local travel agency of course cautioned that quoted prices are not guaranteed until the ticket is purchased and that prices are more likely to be higher than quoted rather than lower. Also, there is a general increase in prices for trips scheduled after December 8th, through the holiday period.

All but three of the U.S. participants will qualify for waiver of the ESA registration fee (worth about \$100 apiece), so that represents about \$1200 in costs that we are avoiding.

Relative to costs of publishing the conference proceedings, Dr. Schurr now estimates that it would be somewhere around \$15,000 for 200 pages and 1,000 copies. This is far higher than I had anticipated from his earlier comments, so is not considered in the proposed budget. He is gone for the next week, but we will look into possibilities and get firmer information after he returns.

As indicated above, I have not yet had a response from most of the participants to my letter of April 17 regarding airfares. Any that I have not heard from by next Monday (May 15), I will try to contact by TELEX or phone. If either Ledger or Okedi, or both, are available, we will then need to decide whether to drop someone in order to fit one or both into the program.

Sincerely,
Gene R. DeFoliart
Professor

P.S. According to Dr. Knausenberger, there might be a language problem with anyone he might suggest on locusts from northern Africa.

PROPOSED BUDGET
CONFERENCE: INSECSTS AS FOOD – NOW AND IN THE FUTURE

San Antonio, Texas
December 10-14, 1989

Personnel	0
Transportation (round-trip airfares to San Antonio)	\$12,250
Dr. J. Ramos-Elorduy, from Mexico City	\$215
Dr. F. Malaisse, from Brussels, Belgium	1236
Dr. P. Puwastien, from Bangkok, Thailand	1499
Dr. D.A. Posey, from Frankfurt, West Germany	1200
Dr. B. Prasad, from New Delhi, India	2810
Dr. V.B. Meyer-Rochow, from Auckland, N.Z.	1532
Dr. D. Dufour, from Boulder, Colo.	290
Dr. J. Mitsuhashi, from Tokyo, Japan	1517
Dr. A.R. El Boushy, from Amsterdam, The Netherlands	869
Mr. G. Larde, from San Salvador, El Salvador	463
Dr. K. Schurr, from Toledo, Ohio	278
Drs. G. DeFoliart, Madison, Wisc. ; M. Finke, Allentown, Pa.; J. Gorham, Washington, DC	0
Drs. J. Ledger, S. Africa; J. Okedi, Uganda, status uncertain	341
Per diem (\$50/day, arriving San Antonio, Saturday December 9, departing Thursday December 14, or \$250 for each of the 11 speakers requesting airfare)	\$2,750
Total	\$15,000

On May 23, I sent word to Dr. Shaddy that USAID would fund our conference:

I have finally received word (today) from USAID that they will fund our proposed informal conference in conjunction with the December ESA meeting.

The proposed two-session program is enclosed. As you will note, the status of two of the speakers is still uncertain. Unfortunately, I am leaving Madison early tomorrow morning and will not return until June 4. So I will be unable to completely finalize the program until I get back. I hope that this slight leeway can be granted and I will attempt to clear this up within a week after I

return (I have found that tying up all the loose ends involved with an international group of this size is more than I bargained for!).

Other information:

Equipment to be used is the following:

First Session: 35 mm. Slide projector;
Overhead transparency projector

Second Session: 35 mm. Slide projector;
Plastic foils projector

Attendance: As this is probably the first meeting ever on this subject, I really don't have the slightest idea how many to expect. Since we have no recognized "disciplinary clientele," attendance could be small; on the other hand curiosity might draw quite a number. I will guess that we should probably provide a room for at least 100.

Regarding waiver of ESA registration, I believe that all but DeFoliart, Gorham, and Schurr qualify for the waiver.

I would also like to request a room for a meeting of our conference group. If our first conference session is not scheduled for Sunday afternoon, I would like to reserve the room for our special meeting on Sunday afternoon at about 2:00 or 3:00 p.m. if possible.

I will get in touch again as soon as I return.

With best regards.

Sincerely,
[signed]

On June 7, I sent long-awaited good news to conference participants:

Finally, good news about the San Antonio conference! The U.S. Agency for International Development will provide enough funding to cover reimbursement for airfares plus partial reimbursement for per diem expenses (meals, lodging, etc.) in San Antonio. I have not yet received information on hotel rates, but expenses, including five nights in San Antonio, will probably run about \$450 to \$500. Hopefully, in order to stretch our USAID funds as far as possible, some of you will be able to obtain supplemental funding from your home institution or elsewhere to cover all or most of these San Antonio expenses. In those cases where this is not possible, USAID funds will be used to reimburse up to \$250 for the per diem expenses.

The ESA meetings will run from Sunday afternoon, December 10, through Thursday morning, December 14. It is possible, therefore, that the first of our two sessions could be scheduled as early as Sunday afternoon. Thus, in getting price quotes on airfares, I have had them based on Saturday December 9 arrival in San Antonio and Thursday December 14 departure. If it turns out that our first session

is not scheduled for Sunday afternoon, I think it would be a good idea to schedule a special meeting of our group for that time slot anyway.

I need to hear from each of you AS SOON AS POSSIBLE your city of flight departure, and the price quoted to you locally for roundtrip airfare (economy class) to San Antonio, arriving on December 9 and departing on December 14. In some cases, it will prove cheaper to purchase the tickets here, for pickup by you at your point of origin at flight time. If you are planning to tie other travel to this trip, I will still need to have the price quoted to you (for the above arrival and departure dates) because reimbursement will be based on the lowest available direct flight airfare.

Again, I will mention that ESA will waive the registration fee except for the three of us who are ESA members. This amounts to savings of about \$100 each. Within about a month or so, you will receive information on hotels, etc., from Dr. James Shaddy, ESA national program chairman.

Karl Schurr and I will be looking into the possibilities for publishing the papers as a "proceedings of the conference." This will probably depend on whether additional funding can be found. More details on this will be sent later.

Let me emphasize that any supplemental funding that can be individually obtained will be very helpful. With the vagaries of airfare pricing, we are operating on very tight budget and airfares tend to increase toward the end of the year.

After the long wait I think we can all feel good that, thanks to USAID, the hoped-for conference is now reality. Please send the requested airfare information as soon as possible. If you choose, our TELEX is # 265452 UOFWISC MDS; our TELEFAX is # 608 262 0123. A copy of the final program as submitted to the ESA National Program Committee is attached. Please note that each speaker is allotted up to 25 minutes and this time limit will be strictly enforced (ESA program policy). If you require less than 25 minutes, I'm sure there will be plenty of questions.

Cc: Mr. Warren Rush, USAID

Upon receiving the above news, joy erupted around the world, in the parts anyway where conference participants lived and worked. Everybody was in a congratulatory mood, and we started happily getting down to specific little late details like in the letter from Dr. Prapasri Puwastien of Thailand's Mahidol University. I quote one paragraph from her letter:

Thank you very much for the reimbursement of \$1478 which will be provided plus free registration. I have asked for the supplemental expenses from the university but it was too late. Any request for the budget from the university must be submitted one year ahead. Would it be possible for you to arrange an additional support for me to cover the minimum entire expenses.

Dr. Karl Schurr was still busy on finding funding for publishing the proceedings of the conference. He had or was trying a number of organizations. I wrote to him on July 12:

Dear Karl:

Please excuse this somewhat tardy response to your letter of June 14.

Regarding publishing the proceedings of the conference, yes, we should start exploring some funding sources, including Saudi Arabia if you think they might be interested. Unfortunately we aren't loaded with obvious Moslems. We have Prasad from northeast India – he might be muslim or Hindoo, or even Buddhist for all I know.

I am looking into the possibilities relative to the ESA's Miscellaneous Publications. They have done symposia proceedings and other types of longer pieces – more than 100 pages and more than 300 pages in one case that I know of. Their page charges may prove to be prohibitive, however.

As to official documents, USAID has prepared two letters, so I understand, although I haven't received either one to date. I do have a letter from Dr. Shaddy, ESA National Program Chair that confirms a place on the program. That's enclosed although it doesn't look too impressive. I will send the AID letter after I get it.

Congratulations on the smart kids. You have a right to be proud.

Sincerely,
(signed)

I mentioned religion because Schurr had mentioned back in January that he once had secured support for a scientific meeting by appealing to the Royal Family of Saudi Arabia and this might be a source if we have Moslems on the program or would be describing Moslem populations where insect-food is used.

The front page of the July 1989 Food Insects Newsletter, Volume II, Number 2, emblazoned the headline: **International Conference Scheduled on Insects as Food and Animal Feed** and inside detailed the program on page 5. The final program was as follows:

INFORMAL CONFERENCE
INSECTS AS A FOOD RESOURCE, NOW AND IN THE FUTURE

Probable afternoon session

- 1:30 Introduction and overview. **G. R. DeFoliart**, Dept. Entomol., Univ. Wisconsin, Madison, WI 53706, USA
- 1:40 Insects as food in Mexico. **J. Ramos-Elorduy**, Dept. of Biol., Nat. Auton. Univ. of Mexico, Apartado Postal 70-153, 04510 Mexico, D. F.
- 2:05 Insects, especially caterpillars and termites, as food in Zaire. **F. Malaisse**, Fac. Sci. Agron., B5800 Gembloux, Belgium
- 2:30 Insects as food in Thailand. **P. Puwastien**, Inst. Nutrition, Mahidol Univ./Salaya Campus, Nakorn Chaisri, Nakorn Pathom, 73170, Thailand
- 2:55 Insects as food in Brazil. **D. Posey**, Nucl. De Etnobiol. Mus. Paraense Emilio Goeldi, CP 399, 66040 Belem, Para, Brazil
- 3:20 Break

- 3:30 Future sources of non-conventional animal proteins in India. **B. Prasad**, Life Sciences Dept., University of Manipur, Imphal 795003, India
- 3:55 Use of insects as food by Tukanoan Indians in Colombia. **D. Dufour**, Dept. of Anthropology, Univ. of Colorado, Campus Box 233, Boulder, CO, 80309, USA
- 4:20 Insects as food in Papua New Guinea and the Australian Region. **V. B. Meyer-Rochow**, Dept. of Biol. Sci., Waikato Univ., Private Bag, Hamilton, New Zealand
- 4:45 Traditional food insects in Japan. **J. Mitsuhashi**, Fac. of Agric., Tokyo Univ. Agric. & Technol., Saiwaicho, Fuchu, Tokyo 183, Japan
- 5:10 Questions and panel
- 5:30 End

Evening session

- 7:00 FDA policies and regulations as they affect imported and domestic insect food products. **J. R. Gorham**, Food and Drug Admin. HFF-237, 200 C. St. SW, Washington, DC 20204, USA
- 7:25 Evaluation of the protein quality of various insect species when fed to rats. **M. D. Finke**, ALPO Pet Foods, P.O. Box 2187, Allentown, PA 18001, USA
- 7:50 Insects as manure converters to animal feed. **A. R. El Boushy**, Dept. Animal Nutrition, Agric. Univ., Marijkeweg 40, Postbus 338, 670 PG Wageningen, The Netherlands
- 8:15 Break
- 8:25 Fly and beetle recycling of coffee pulp for animal feed production. **G. Larde**, Inst. Salvadoreno de Investagaciones del Café, Final Primera Ave. Norte, Nueva San Salvador, CP 04108, El Salvador
- 8:50 Harvesting terminal lagoon biomass as animal feed. **K. Schurr**, Dept. of Biol. Sci, Bowling Green St. Univ., Bowling Green, Ohio 43403, USA
- 9:15 Insects, especially the lake fly, as food/animal feed in Uganda. **J. Okedi**, Makerere University, Kampala, Uganda
- 9:40 Questions and panel
- 10:00 End

It seemed that there might be a slight shadow intruding upon the happy times when, on September 6th, I faxed the following to Dr. V.B. Meyer-Rochow of New Zealand's University of Waikato:

Dear Benno:

Your letter of August 21 regarding airfare did not arrive until last Friday (September 1) so it was too late for me to respond before August 31 (actually it arrived in a Post Office damaged mail container which may have delayed it).

At any rate, I would not purchase any tickets yet. The conference is still apparently "go", but I have yet to get the necessary details from AID on when the money will be available. Also, frankly, I have been a little on edge because new administrative people have come in at AID in the past month as the result of retirements and transfers. Two of our staunch backers have retired and one is now

based in Cairo. So, the best I can say at the moment is that I still think we will have the conference, but do not put any of your own money on it yet.

I will get an update to you as soon as possible. Regards.

Sincerely,
(signed)

With Warren Rush's departure, someone named Ben Waite became my contact person at AID. In the year 2001, when I am writing this, I can find no mail in my files from Ben Waite. I also can find no mail that is for sure to Ben Waite. I did write a letter to Ben Waite, but I think that probably it was never mailed, because two words penciled in on the upper right-hand corner raise a question. They ask, "not sent?" Whether sent or not, I reprint the letter here. The thoughts contained were, without doubt, communicated to Waite or someone at AID in Washington, if not in writing, by telephone:

Dear Dr. Waite:

As a follow up to our telephone conversation a couple of days ago, I think it might be helpful to explain in a letter why it is now becoming urgent that I receive some kind of written confirmation that AID will fund the conference on Insects as a Food Resource scheduled for December 10-14, 1989, as part of the 100th Annual Meeting of the Entomological Society of America in San Antonio, Texas.

I was told as early as last June that such a letter of intent was being typed and was given the "green light," on the basis of wide support within AID, to submit the final draft of the proposed conference to the ESA National Program Committee (to meet their July 1 deadline). The conference received favorable action by the ESA Program Committee and has been included in the printed Program that will be sent to several thousand ESA members about mid-October or soon thereafter. As the conference (actually a symposium in all but official designation) is scheduled for Sunday (December 10) afternoon and evening, some ESA members will undoubtedly be altering their plane and hotel reservations in order to be there early enough for it. Also, at least a few people who are not ESA members are hoping to go to San Antonio strictly to hear the conference speakers. If there is any significant chance at this late date that AID might not fund the conference, I need to know quickly in order to have the conference stamped "cancelled" before the printed Programs are put in the mail. Also, it would be necessary to notify as soon as possible about 500 recipients of The Food Insects Newsletter.

The other urgency results from the fact that I need soon to free the 16 conference participants to make their travel arrangements, and to tell them when and how reimbursement of expenses will occur. The requested budget of \$15,000 was enough (but only barely), at airfares quoted during the summer, to reimburse for airfare and partially for per diem expenses in San Antonio (three participants require no reimbursement from AID funds, and we will effect a considerable savings by purchasing the tickets for the New Zealand and Tokyo participants

here for pickup there). The closer it gets to December, however, airfares can be expected to increase, as well as the difficulty in getting seats on San Antonio flights.

You mentioned on the telephone that AID funds might not be available until December or even January. I think this would be a minor problem for most of the participants, but could pose more of a problem for several, i.e., one or more of those coming from Thailand, India, El Salvador, and Mexico, and possibly, Uganda. That's a problem that can be handled one way or another, however, as long as we're assured the AID funding will be coming.

Regarding Dr Okedi, as I mentioned on the phone, it is my understanding that AID will bring him to Washington and, from conference funds, I need only to get him from Washington to San Antonio. How about his expenses in San Antonio, which will run about \$450-\$475, probably. I have told other participants that a maximum of \$250 will be available to partially defray expenses in San Antonio. Also, could you send me an address for Dr. Okedi; I have had no direct contact with him and he should be provided with information on the conference format, audio-visual equipment available for his presentation, hotel reservation, etc. as soon as possible.

As you can see from the above, I would be in a lot of trouble if a lot of people trek to San Antonio to hear a program that isn't there. I am, understandably I think, growing a bit nervous at having no official confirming paper in hand and with so many recent administrative changes at AID. A complicating factor is that there is no FAX or TELEX connection for a number of the panelists and turn-around time in the conventional mail is more than a month. I certainly will be appreciative of any information that you can provide from that end.

Sincerely,
Gene R. DeFoliart
Professor

It couldn't have been long after that when it must have seemed like it was definitely time for panic and desperation. I appealed to the Graduate School (letter to Eric Rude dated September 13). I tried to explain as forcefully as I could in the first sentence how dire things were, "As I mentioned on the telephone yesterday, I am suddenly in a nightmarish situation regarding an international conference which I organized, and which, until things suddenly began unraveling last week, was to be funded by the U.S.A.I.D." I then covered, in my standard length two-page letter, all or most of the points with which readers of this chapter are now familiar. Then, near the end was a sentence I thought was of pretty high quality: "While it would be personally embarrassing, as organizer, to have the conference program stamped "canceled," that is minor compared to the dampened enthusiasm and expectancy that would occur among the scattered (but not so few)

researchers around the world who are interested in the potential of this subject and are finally beginning to establish communication and a sense of disciplinary identity.”

The Graduate School wasted no time, replying September 15 (letter from Carol Miller):

Dear Professor DeFoliart:

I am sorry to report that the Research Committee did not provide funds for your conference. While the committee is sympathetic to your problem, this is not appropriate for Graduate School funding.

Sincerely,
(signed)

On September 21, 1989, the following letter went to each conference participant:

Dear:

This is a difficult letter to write. I am sorry to have to tell you that it has been necessary to cancel the scheduled conference in San Antonio.

I am sure that by now you were beginning to wonder why you hadn't heard from me recently regarding final arrangements. In late August, I began pressing USAID for a firm date when travel money could be released to conference participants. At that time, I learned that there had been some significant administrative changes at AID during the summer. Two staunch supporters of the conference retired in August, and another left on a long-term overseas assignment.

During the second week in September, I was informed that AID would not be able to follow through on its commitment. I think it all boiled down to the fact that the conference simply didn't have as high priority with the new group of administrators. A hurried last-ditch attempt the past week to get support from the University of Wisconsin Graduate School was unsuccessful.

Thus, with time now running too short for further efforts, there is no alternative except to abandon the idea while there is still time for the ESA to delete it from the printed program. I very much regret the inconvenience that this unduly protracted process has undoubtedly caused for you and for all of the planned participants. I hope that you hadn't yet put a lot of work into preparing your presentation.

Finally, let me say that I very much appreciate the fact you were willing to be a participant in the conference. Although this is a disappointing setback at this late stage, it isn't the end of the world as far as the future of studies on insects as food and feed are concerned. I believe that sooner or later there will be an opportunity for the kind of meeting we had hoped for in San Antonio.

Sincerely,
(signed)

The letters came streaming in from “would-have-been” conference participants. It was touching how they dwelt more on how much they appreciated the effort expended in trying to pull it off than in their own disappointment at losing the trip. Two people, Dr. El Boushy and Dr. Schurr both offered to help try to get the proceedings published even if we couldn’t have the meeting, while Julieta Ramos-Elorduy (because of divorce, no longer de Conconi) suggested establishing a joint endeavor sponsored by the UW and her university, the National Autonomous University of Mexico. Actually, I tried one more time (I must be stupid or something) to rescue the San Antonio show by writing (and sending it Federal Express), September 26th, to the John D. and Catherine T. MacArthur Foundation. I didn’t hear anything from them so wrote again, December 8th, asking if the packet ever arrived. If they responded the second time, it’s filed where I haven’t found it. As a start toward closing down, I notified the ESA to stamp “canceled” across our pages before sending out the programs for the national meeting.

Closing down efforts included a few more letters such as one to Dr. K.G.V. Smith, Editor-in-Chief, Entomologist’s Monthly Magazine, in London (October 10):

Dear Dr. Smith:

I am writing to let you know that, unfortunately, USAID did not follow through on its commitment to fund the conference on insects as food that was scheduled to be held in San Antonio, Texas, and the conference has been canceled. There will be more details later, but right now, I am trying to get this word to editors, such as you, who might have called attention to the conference in other publications.

I apologize for any inconvenience that this may have caused you or any of your readers.

Sincerely,
(signed)

For similar reasons, a short note was sent (October 16) to North American recipients of The Food Insects Newsletter:

The conference on “Insects as a Food Resource – Now and in the Future,” scheduled for December 10, 1989, in San Antonio, Texas, has been canceled. USAID was unable to follow through on its commitment to fund the conference. We regret any inconvenience caused for anyone who might have made plans based on the announcement in the July issue of the Newsletter.

The final word on the demise of the conference went out in the November 1989 Food Insects Newsletter, Volume II, No. 3. The headlines were not so emblazoned this time, but on the front page there was a small boxed heading that said “San Antonio Conference Scuttled” and in smaller type, “See Editor’s Corner, Page 2.” In the Editor’s Corner was the subtitle, “The Ill-fated San Antonio Conference”:

Modern professional life is too frequently too similar to a series of episodes from “The Perils of Pauline.” Take, for example, the San Antonio conference on “Insects as a Food Resource,” which was scheduled for December 10 and was announced in the July issue of the Newsletter. Everything appeared to be set, with the U.S. Agency for International Development planning to provide funding in the amount of \$15,000, which would largely cover the travel expenses of conference participants.

Things began unraveling in early September when the editor, who was also organizer of the conference, was informed by USAID that it would be unable to follow through on the commitment. This abruptly ended a stretch of several successive weeks in which the editor had been thoroughly enjoying life. Unfortunately for the conference, two strong supporters at AID retired in August and another left Washington on a long-term overseas assignment. The conference apparently simply got lost in the bureaucratic shuffle between two fiscal-year budgets and a new group of administrators for whom it had much lower priority.

According to the ESA national office, the anticipated conference had elicited “numerous inquiries and a lot of interest.” The editor is currently in diapause insofar as organizing conferences is concerned, but the program scheduled for San Antonio, or an expanded version of it, could quickly be resurrected for another time and place if a sponsor should suddenly appear on the horizon.

GRD

Chapter 12. Major Speaking and Writing Engagements

Before starting, I want to caution the reader that this chapter is very complimentary to me. Without some pre-warning, you might find yourself thinking as you read, “What an ego! Has this fellow no sense of modesty at all?” because that’s what I found myself thinking as I got farther and farther into this chapter. But this is a very complex situation. What the reader must remember is that I have been only the messenger. These nice things that were said were directed to me only because I was the messenger; the good feelings expressed were the result of having insects presented as something other than dangerous pests. I believe that when presented as something other than dangerous pests, insects become a fascinating subject for almost any audience. So without further apology, let us proceed.

Invitations to higher profile informational and educational endeavors didn’t start happening with any regularity until the late 1980s. But we received our first invitation to write a purely educational piece June 2, 1975, less than two months after the UW campus symposium. It came from A.C. Haman, Editor of the *Iowa Science Teachers Journal*. Mr. Haman, located in the Department of Biology at the University of Northern Iowa, Cedar Falls, wrote:

Dear Dr. DeFoliart:

As editor of the Iowa Science Teachers Journal, I am soliciting an article from you on “Insects as Human Food.”

ISTJ is designed to improve instruction and stimulate interest in science in the public schools of Iowa. The journal is sponsored by the Iowa Academy of Science.

An article of 500-1000 words would be much appreciated on this subject.

Thank you for your consideration and I hope you will participate in our journal.

Sincerely, [signed]

I responded July 8th, thanking Dr. Haman, and saying: “I will be glad to write such an article for you if it is not necessary to commit myself for it before September or October. I might be able to get to it before then but am rather ‘swamped’ right now and would not like to make a commitment to do it before then.” Dr. Haman responded July 10th, saying, in part: “An article submitted in October or November will be fine, and will not be published until April in ’76.” I got a reminder from Dr. Haman, dated April 13, 1976: “I know you are very busy but we would still like to have you submit an article on ‘Insects as Human Food’ for the Iowa Science Teachers Journal.” On May 26, 1976, I wrote to Dr. Haman saying I was sorry for the delay, but had been away from the campus for four months. On June 25, I sent the manuscript. It was titled, “Is There a Greater Role for Insects as Food?” For some reason, it was not published until 1979. Why, I do not know. I haven’t uncovered any correspondence dated later than the letter of June 25, 1976.

Doing an Unsolicited Review Article for the Bulletin of the ESA

More than ten years had passed since publication in the *Bulletin of the Entomological Society of America* of the paper that I had presented on the Madison campus at the Symposium on Unconventional Sources of Protein. I felt that it was time for a sort of review-type article, and the place to put it, if possible, was again the *Bulletin of the ESA*. Even though, by now (1988), we had published research papers on insects as a food resource, including in ESA's *Journal of Economic Entomology*, I still had my share of insecurities. Not long after submitting the manuscript, however, a letter arrived from Paul Opler, Editor of the *Bulletin*, dated June 11, 1988, saying:

I am writing to inform you that the single peer reviewer of your manuscript recommended its acceptance with no change It is most unusual not to have to send a manuscript back to the author for even minor revision. . . .

The reviewer had signed his name, although such signing on the author's copy is very unusual. The reviewer was Karl Schurr of the Department of Biology, Bowling Green State University in Ohio. His recommendation was checked "Strongly positive" with specific comments as follows:

This is an excellently written paper on a topic that is overdue. All appropriate citations are covered, the topic is more important than a layman would think. When 25% to 35% of major world grain crops are destroyed by insects (and we can't do much about it throughout most of the world), it is appropriate to look to insect protein for the diet of people.

With human populations reaching doubling times as short as 25 years to 30 years in a majority of nations, we can't expect cows, chickens, pigs & fish to be sufficient for animal protein sources. It is excellent logic to harvest & consume insects in every instance possible.

Since this is the first paper with a broad perspective, and an open-minded acceptance of non-traditional protein sources, it will be much to the credit of ESA and the *Bulletin* to pioneer this topic.

The title of the paper was "The human use of insects as food and as animal feed." It was published in 1989. I very much liked the blurb I inserted, in italics, at the beginning of the article:

Edible insects are a food resource that continues to be tapped extensively by populations in the rural Third World, while continuing to be ignored by food and agricultural scientists. The unfounded Western aversion to insects as food should no longer stand in the way of attempts, through advocacy, research, and extension, to increase the contribution that insects can make to human nutrition.

I had submitted the manuscript originally to Ms. Kate Kelly, Managing Editor of ESA. Steve Pazdan had been the Production Editor. The publication process had gone quite smoothly except for a late rumble about the publication costs for several color photos that accompanied the paper. They were of edible insects in Mexico, and thanks to Dr. Julieta Ramos-Elorduy de Conconni of the National Autonomous University in Mexico City

who had given me permission to use them. We got a call from our Purchasing Department saying they had an invoice for \$1,657, and I frankly can find no record and cannot remember how that was paid and by whom. Relative to it, however, I wrote on December 5th, 1989, to Darryl Hansen, Executive Director of ESA:

Dear Mr. Hansen:

Your letter dated November 15, but not posted until December 1, relative to our failure to pay charges related to my article in the March Bulletin ESA, was received yesterday, December 4. I had expected billing for the article so long ago that by now I presumed that it had been paid.

I note that the invoice was sent to Accounts Payable, 750 University Avenue, Madison, which explains why we never received it. It should have been sent to the Department of Entomology.

As part of the total bill will be paid from College of Agriculture funds, I will not be able to initiate payment until December 14, when I return to Madison from the ESA meetings in San Antonio. I am leaving here momentarily to go to Arkansas relative to a terminal family illness there, then hopefully on to San Antonio.

Be assured that this matter will have my attention as soon as I return.

Sincerely, [signed]

I heard in response from Mr. Hansen, dated January 9, 1990:

Dear Dr. DeFoliart:

Thanks for your December note. I was certain there was some reason for the payment problem. The invoice has been rerouted and I understand it was taken care of before we returned from San Antonio.

I hope the family matter is behind you now. Illnesses are always unpleasant even more so when there is no apparent satisfactory solution. I hope this new year has a better ending for you.

Sincerely, [signed]

First International Congress of Ethnobiology (Belem, Brazil)

Going on rather simultaneously with finishing the above manuscript and working it through the review and publication mill during 1988 was an invitation to, and hurried preparation for, participating in the First International Congress of Ethnobiology which was scheduled to be held in Belem, Brazil July 19-24 of that year. The Congress Chairman was Dr. Darrell Addison Posey, a U.S. citizen, however located at that time at the Museu Paraense Emilio Goeldi in Belem. Dr. Posey's letter of invitation was dated March 12, 1988:

Dear Dr. DeFoliart:

You will soon be receiving a packet about the First International Congress of Ethnobiology. One of the symposia will feature “World Potential for Little-Known Native Plant and Animal Food Resources”. It is my hope that insects as food will be one of the major subjects discussed.

Another symposium will be called “Natural Insecticides, Fertilizers, and Pest Control Techniques in Native Agricultural Systems”.

Any chance you could attend this Congress, to be held here in Belem, 19-24 July, 1988? It would be great if you could present a paper of your work and even, if possible, chair the session on little-known foods.

Please let me hear from you.

Sincerely, [signed]

I replied to Dr. Posey that I would attend the Congress with a paper titled “Insects as Human Food: The Need for Studies on Taxonomic Identity, Seasonal Availability, and Quantitative Use.” The abstract I submitted for my paper was as follows:

ABSTRACT

Worldwide, insects of more than 500 species have been reported as food. The actual number used is undoubtedly much higher than the number so far reported. Numerous investigators have called for greater government awareness of the nutritional importance of edible insects among indigenous populations. Government recognition would help counter the negative influence of western acculturation by providing “status” for these traditional foods, and, hopefully, would lead to more support for needed research on the taxonomy of edible species, their nutritional quality and quantitative use, and on biology that is relevant to more efficient harvest and/or production.

I managed to get an announcement of the Congress on the front page of the first issue of *The Food Insects Newsletter*, adding to above information that “The focal symposium of the Congress is ‘Native Peoples and Their Struggles to Conserve Their Natural Resources.’ Organization of the new International Society of Ethnobiology is also scheduled to take place during the Congress.” We had a full one-page report on the Congress in the second issue of *The Food Insects Newsletter*, noting that approximately 600 ethnobiologists (including anthropologists, biologists, chemists and sociologists) from 35 countries had been in attendance, along with representatives of 16 indigenous peoples from five continents.

[Probably add to the above paragraph just a little of Posey’s background with indigenes]

The Graduate School had awarded me a travel grant for participation in the Congress (see Chapter 6), but I ran into travel reservation problems and had to cancel the trip. In my absence, my paper was read by Dr. Katharine Milton, Professor of Anthropology at the University of California-Berkeley from whom I got a delightful letter, dated August 19, describing her many travails both in conducting the session because of so many long-winded speakers and her difficulties in cutting the length of my paper, which was also too long, down to size:

Dear Dr. DeFoliart:

Enclosed are the slides you sent to Belem to be presented in the Ethnobiology Congress. I chaired the session in which your paper was to be presented. In fact, the paper in total was not given – rather I gave a summary of the paper. Several people who were interested in it then got a copy of your text, after I received permission from Dr. Posey for this to be done. I myself kept the text you sent to Brazil but will be happy to return it to you if you need it. I also brought your slides back to the U.S. with me to send back to you.

The paper was simply too long to be presented in the session and I hadn't the time needed to cut it down to a 15 minute presentation. I did, however, go through the paper and feel that the summary that I presented and my comments on the text gave a good clear picture of your comments and ideas.

Though I did my best, as did all the chairs of the sessions, some of our colleagues simply were too long-winded and refused to cut their presentation – this meant that sometimes the sessions ran until 8 p.m. at night. Also though in the U.S. I would brutally force any colleague to sit down and shut up after their allocated 15 or 20 minutes, in another culture and with individuals in the sessions from other cultures, neither I nor some other chairs were as rigorous as we normally would have been. Thus individuals such as yourself who were not in fact there and whose presentations, though excellent, would have run far over 15 minutes, got short shrift. **

In any case, I did my best and everyone who was in the room for our session certainly was told about your paper and got the chance as well to Xerox it in total. I enjoyed it very much, it is really an excellent presentation and would be especially effective as a lecture since to do it justice would require some 50 minutes – all those slides are full of reading and it takes time to read them etc.

I look forward to meeting you some day.

(** because those who were there generally talked well over their allocated time)

Sincerely yours,
[signed]

I think most of us, once in awhile, try to cram 40 or 50 minutes' worth into 20 minutes of allotted time. But I sympathize with Dr. Milton. Anyone who has chaired a session, and is responsible for keeping it on time, knows that there are speakers who practically have to be pulled away from the podium by the neck. Anyway, the Proceedings were published; the citation for my paper is:

DeFoliart, G.R. 1990. Insects as food in indigenous populations. *In* Ethnobiology: Implications and Applications (Eds., D.A. Posey et al) Vol. I, pp. 145-150. *Proc. 1st Internat. Cong. Ethnobiol.* (Belem, Brazil, 1988).

ARPE's Commemorative Volume, Insect Potpourri

The letters ARPE stand for American Registry of Professional Entomologists, established in 1969 as part of the ESA (Entomological Society of America). In early 1988, the

leadership of ARPE proposed publication of a book tentatively titled “Sense of Entomology” as a contribution to the then upcoming 1989 Centennial Celebration of the ESA. The project could not be completed in time for the ESA Centennial, so, at the behest of the national Governing Council, the Chesapeake Chapter of ARPE undertook completion of the project, establishing the Centennial Book Committee for that purpose. The volume was intended as a popularized version of entomology for students and the general public.

I was first approached about being a contributor by M.J. (Joe) Sloan, an old friend of mine dating back to undergraduate days at Oklahoma State University (Oklahoma A.& M. in those days). After Oklahoma, we both went to Cornell for PhDs. Joe, long an entomological honcho with Shell Chemical, lived in Washington, DC and was a member of the Centennial Book Committee. I don’t remember the date when I was asked to be an author, but I wrote to Joe on October 16, 1989, enclosing a manuscript titled, “Insects – An Overlooked Food Resource.” The full title of the book is “Insect Potpourri: Adventures in Entomology.” It was published in 1992 by the Sandhill Crane Press, Inc., Gainesville, Florida. The Editor is Jean Adams. There are 55 contributors, all from the U.S. and Canada.

Plenary Symposium, 1992 Annual Meeting of the North Central Branch, ESA, Kansas City

The NCB meeting was scheduled for March 15-18, 1992, in the Ritz-Carlton Hotel, Kansas City, Missouri. The Program Chair for this meeting was Robert D. Hall of the University of Missouri Department of Entomology. Dr. Hall was also the organizer and Moderator for a plenary symposium titled “Insects Across the Ages” with the theme, “Socioeconomic Impact of Insects on Humanity.” I haven’t found the original invitation to be a participant, but the letter from Dr. Hall thanking us for agreeing to participate was dated September 19, 1991. The four others on the symposium were Dr. E.P. Catts, Jr., Washington State University, Dr. G.M. Chippendale, University of Missouri, Dr. S.H. Gage, Michigan State University, and Dr. E.L. Hostetter, USDA, ARS, NPA, Grasshopper IPM Project, Kimberly, Idaho. All but Hostetter were from departments of entomology.

I was scheduled to lead off as the first speaker. The title of my presentation was, “Insects as food: History and a modern perspective.” It seemed to be very well received. Somehow, my scribbled opening remark survived the years, attached to the front page of text:

During the past nine months, I’ve noticed that as soon as you retire, everybody thinks that you don’t have anything to do. When Rob Hall called last August to ask if I would moderate this session, I said, “I’m retired, you know.” He said, “Yes, I know.”

Dr. Hall’s “thank you” letter for being on the symposium was kind and complimentary. It looked like it would be safe to talk about insects as food at scientific gatherings in the U.S. It also seemed that maybe the time was ripe for symposia like this one, less

emphasis on insects as pests and more attention to some of their other attributes. Hall's letter was dated March 19, 1992:

Dear Dr. DeFoliart:

I would like to take this opportunity to thank you for your outstanding presentation in the Plenary Symposium during the just-past meeting of the North Central Branch, Entomological Society of America.

I heard many comments following the Symposium; all of them positive and enthusiastic. I was gratified that Tom Turpin, our current ESA president – who has the perspective of having had to attend various branch meetings – was particularly impressed with our approach.

Your contribution was fundamental to the success of the Symposium, and I appreciate your willingness to spend your time and resources to make it a reality.

Sincerely, [signed]

One might expect that Rob Hall's comments, as Moderator of the Symposium might be somewhat biased toward the rosy side. But a comment by one of our participants, Paul Catts, when he invited me about a year later to participate in a symposium on the West Coast convinced me that Rob wasn't exaggerating the success of this Kansas City symposium. In fact, I, too, heard a lot of good feedback while at Kansas City and afterward. Turning around the emphasis on insects, for a change, seemed to hold fascination for an American audience.

An Invite to Kansas State University

At first glance this would hardly seem to rate a separate heading, but this invitation was special. I was not in my office to take the telephone call on October 22, 1991, from Jay Nicholson, a graduate student in the Department of Entomology at Kansas State, and President of the Entomology Club, so he left a message with a secretary. It said that they would like for me to speak to them (give a seminar) on insects as food in the spring. The significance of this was that the entomology students at K. State get to choose the subject and speaker for one seminar a year. To me, there could have been no higher validation of the legitimacy of insects as food than to have these students cast their once-per-year vote for a chance to hear about it. I decided to decline the invitation, however, because of the proximity of K. State to Kansas City and informed the students of the symposium which would be held at the upcoming ESA-NBC meeting.

The New York Bug Banquet

A very interesting letter arrived, carrying the date of August 2, 1991, from Durland Fish, Ph.D., Associate Professor, New York Medical College, Valhalla, New York, and President, New York Entomological Society. I knew Durland Fish back to his grad student or postdoc days (I don't now remember which) at Notre Dame University under the illustrious Professor George Craig, mosquito geneticist. George and I had developed a

mutual admiration society and every other year he and his students, postdocs, etc., (he had a small army) would traipse to Madison to my lab, and in the alternate every other years my students and I would traipse to South Bend to his lab. Whichever lab, the subject of discussion was always anything relevant to the mosquito *Aedes triseriatus* and the transmission dynamics of La Crosse encephalitis virus and other California group arboviruses. When the letter arrived I hadn't had any recent contact with Durland. But, to the letter:

Dear Gene,

I am writing to you officially as President of the New York Entomological Society to invite you to host the First Annual Bug Banquet to be held at the Waldorf Astoria Hotel on May 19, 1992. We are in the process of collecting insect recipes representative of as many insect orders as possible to include on the menu. After the menu items are selected, we will challenge the local culinary schools to a "bug bake-off" to decide who prepares the best dishes and invite them to participate in the banquet.

The banquet is being held in honor of the 100th anniversary of the Society and will be the highlight of our year-long schedule of Centennial Year events. You will be our guest of honor and speaker should you accept the invitation. All expenses will be paid for a two-day visit to New York City, in addition to a \$500 honorarium.

We anticipate an excellent turn-out for this event and good media coverage. Our intent is to demonstrate by example that insects are creatures not to be feared and that they can benefit man as a source of nutrition.

I would appreciate any other suggestions you might have concerning the banquet, particularly menu suggestions and sources of recipes. I would also appreciate any available back issues of your newsletter for additional ideas.

Please feel free to call me if you have any questions or concerns. I do hope you can accept the invitation.

Best regards, [signed]

My response to Durland was dated August 14, 1991:

Dear Durland:

It is a pleasure to accept your invitation to the First Annual Bug Banquet as part of the 100th Anniversary celebration of the New York Entomological Society. I consider it an honor indeed to be the "guest of honor" at such a function sponsored by the Society, not to mention any function held at the Waldorf Astoria. I will need to get a new suit and my run-over heels repaired.

Also, congratulations on achieving such high honor as President of the Society, and at so young an age! I hadn't heard about that, yet.

As for back issues of the Newsletter, enclosed is a mint set. We've saved back a few copies of each issue for requests from libraries, etc.

As to sources of recipes, the best starting point would be to get a copy of the booklet, "Entertaining with Insects: or the Original Guide to Insect Cookery,"

by Ronald L. Taylor and Barbara J. Carter. Unfortunately, it is out-of-print, but you can probably get it from one of the libraries. It contains about 80-90 insect recipes (it's reviewed in Vol. II, No. 1, of the Newsletter). Actually, it's well-enough known that you may already have seen it. If you should sooner or later deem it desirable to contact Taylor personally, his address is: Dr. Ronald L. Taylor, 5375 Crescent Drive, Yorba Linda, CA 92687 (Tel. [no. given]).

A couple of other people who might be worth contacting relative to menu suggestions and recipes are:

Ms. Leslie Saul
Director, Insect Zoo
The S.F. Zoological Society
San Francisco, CA [street address and telephone number given]

Robin Pruisner
Ames, Iowa [street address and telephone number given]

These individuals are both connected with insect food events involving the public (both are mentioned in the current Newsletter, Vol. IV, No. 2).

Regarding the after-dinner speech, how long should it be, and should I or should I not, include slides? Also, what other duties will I have, if any?

We are just now starting work on an exhibit called, "Insects as Food in Different Cultures." It's aimed primarily at about middle-schoolers and will include 4 or 5 exhibit cases, a couple of slide series on an automatic timer and live crickets. I'll know better when we get it a little further along whether it's something you might want to consider among the side attractions there.

I am delighted of course to see this high-profile event focusing on insects as food. With the prestigious backing of the New York Entomological Society, there seems little doubt that it will help to achieve your stated goal of demonstrating that "insects are creatures not to be feared and that they can benefit man as a source of nutrition."

With warmest regards.

Sincerely, [signed]

Once again, as in several other instances, the best way to cover this event would seem to be to reprint our coverage from *The Food Insects Newsletter*, Volume V, Number 2 (July, 1992):

The New York Bug Banquet – A Day to Remember

The Event: The 100th Anniversary Dinner of the New York Entomological Society

The Date: Wednesday, My 20th, 1992

The Place: The paneled Tudor splendor of the Explorers Club in Manhattan

The Caterer: New York Parties

The action began at 5:00 pm with interviews and a photo-op session for the press and other media, cocktails and hors d'oeuvres at 6:30 pm, dinner at 8:00 pm. The after-dinner speaker was your editor, with the title, "Insects are Food. Where has the Western World Been?" Actually the bar was in place along with the Peppery Delight Mealworm Dip (delicious!) long before 6:30 pm, so conviviality got an early start.

The organizing committee did a great job, Durland Fish and Richard Falco, both of the New York Medical College, and Louis Sorkin, American Museum of Natural History; the president, vice-president and treasurer, respectively, of the New York Entomological Society. During a brief ceremony after the dinner, President Fish presented Lou Sorkin with a plaque in appreciation for all of his hard work in implementing this historic event.

Everything – the hors d'oeuvres, the buffet dinner and the desserts - was great. One item not listed on the menu, live honey ants, also proved popular with guests. About 100 live ants were brought by Raymond A. Mendez. Watching the line form for the honey ants, I thought about the old Roman epicures and how they would have loved to have something like live honey ants at their food orgies, to go with the cerambycid larvae which they "fattened" for the table on flour and wine. Table centerpieces included live tarantulas and scorpions (some with impressive dimensions), various insects, plant and floral arrangements, and origami insects both among the flowers and as napkin rings.

Rooms other than the dining room were adorned with larger than-life wood and brass insect sculptures by Patrick Bremer and Adam Pasamanick, respectively, living stick and leaf insects (some of these also with impressive dimensions) brought by Jane McEvoy who is Head Keeper of the Arthropod Exhibit at the Columbus, Ohio, Zoo, and insect dioramas furnished by Henry Galiano and Andrey Sharkov of Maxilla & Mandible, Ltd., New York. With more than 100 people in attendance, who had paid either \$45 (society members) , or \$65 (non – members) for the privilege, the venerable old Explorers Club was both sedate and rocking. Drove of media people were there, making sure that none of this would go unrecorded.

According to the Associated Press story, "Diners found the crickets crunchy with a taste like that of mushrooms. The mealworms were chewy and tasted like fish. The ants tasted peachy. The wax worm fritters were nutty." After trying her honey ant (only one per guest, please), "It's good. It's really good," said Leah Frank, a society member. The AP story, as it appeared in *The Daily Sentinel* of Grand Junction, Colorado, was headed, "Waiter, there's a bug in my dinner and it's delicious!"

Ken Ringle's story in the *Washington Post* was titled, "Bless This Grub – Let's Eat!" Some descriptions of flavors: "The mealworms taste like the sort of honey-roasted peanuts they used to serve on Eastern Airlines just before it folded.... The fontina bruschetta with mealworm ganoush tastes mushroomy. The wild mushrooms in mealworm flour pastry project a burnt, nutty flavor. The waxworm sushi with tamari dipping sauce is acclaimed for its insouciant flavor." I looked up "insouciant" in the dictionary; it means "gay heedlessness" or "lighthearted unconcern." According to Ringle, people were asking what kind of wine goes with insects. Fish suggested "Honey wine would be good, but we didn't get any. Maybe chardonnay."

U. S. News & World Report (June 1), in a story by Dana Hawkins and Jo Ann Tooley also reported some taste assessments by guests. "A fruity aftertaste, like ripe pears," proclaimed one. "Tasty. Crunchy like potato chips," said another. Of the honey

ants, “It’s like eating a piece of candy,” said Nancy Bennett, a seventh–grade biology teacher from New Jersey. Commendably, none of the press accounts that I have seen overlooked the real significance of the occasion – to promote a better understanding of the role insects play in the diets of other cultures, in some of which they are of considerable nutritional and economic importance. I didn’t see the results of CNN’s coverage, but have heard that it was handled well.

To participate in all of this, my wife, Lou, and I arrived at LaGuardia Tuesday afternoon and took a cab to our hotel, the Radisson Empire which turned out to be nicely located on Broadway, and across the street from the Lincoln Center. Upon checking in, the woman behind the registration desk said, ‘I understand that CBS is paying for the first night.’ I said, “That is correct.” With registration completed, she said, “ There are some messages for you. One from CNN. . . One from *U. S. News & World Report*. . . one from Nickelodean Television. . . One from *The Philadelphia Inquirer*. . .” At this point, I couldn’t resist looking around to see how many people were enjoying finding themselves unexpectedly in the presence of a celebrity. Unfortunately, only two other people were waiting to register, and both seemed preoccupied with their own thoughts. In the elevator, I turned to Lou and, unable to come up with anything original, borrowed a line from a beer commercial: “Life doesn’t get any better than this. This is as good as it gets.” She gave me that look she sometimes does, so I decided to cool it.

We were to meet Durland Fish at 6:00 pm in the hotel dining room. He got hung up at the airport, however, waiting for a shipment of kurrajong (cerambycid beetle) grubs from Australia, and we didn’t sit down for dinner until 9:00 pm, our first food since breakfast. Durland and I were to be on the CBS *This Morning* show with hosts Harry Smith and Paul Zahn the next morning. Now I learned for the first time that Durland Fish, not CBS, had instigated the idea of eating insects on the show, and Durland, not the banquet caterer, would be the cook. Durland had cooked only two insects in his whole life, two giant waterbugs which were part if a shipment that had arrived two days earlier from Thailand via Berkeley. He pronounced them good, but I remembered reading somewhere that Thai water bugs are a rather complicated piece of culinary art. They have thick hulls for one thing. Up to now I had been quite sanguine about this whole affair. I didn’t sleep well that night.

The car from CBS arrived promptly at 6:00 am for the short run to the studio. It took about five minutes to meet the program hosts, see the set where the interview would take place and who would stand where. It took another five minutes in makeup. That left two hours to kill. With about 30 minutes to go, I first noticed a strange kind of nervousness which may be unique to people who are about to go for the first time live on national television. You aren’t worried about the millions of people who may be watching and listening, but you are acutely conscious of the two dozen people back home, friends and relatives, who are sitting there with their fingers crossed hoping you don’t bomb out so badly that you embarrass them in front of all their friends and neighbors.

Finally, we were on. I envied Durland fiddling with his skillet, giving him something to look at and something to do with his hands. He was cooking three giant water bugs and three of the Australian kurrajong grubs which looked like huge segmented french fries. Neither of us had ever eaten one. Durland offered Harry one of the water bugs. Paula was acting like she wasn’t there, trying her best to be invisible.

Who could blame her? She was portraying perfectly the average American. She was why we were there. Suddenly, there seemed to be some confusion at the other end of the line. Oh no! Harry was spitting out the giant water bug – in front of a national TV audience. I had only one thought - we hadn't been there five minutes, but had managed to set the field back 100 years.

Harry Smith deserved a medal for handling it as gracefully as he did. As soon as we were off the air, I picked up a water bug and gave it a slight nibble. It was much worse than medicinal, it was awful! The cook hadn't a clue as to what had gone wrong. We should have offered Harry a kurrajong grub. Durland and I tried them upstairs after the show. They were superb! The taste was like a lean, high quality sausage.

At the Explorers Club, the bar was set up on a large terrace adjoining the dining room. Tuxedo-clad waiters were serving round after round of hors d'oeuvres, all of them attractive and all of them delicious. It was a beautiful evening, cloudless sky and a light breeze. I was out there, at one end of the terrace, reminding myself that, as speaker of the evening, I was going to have to nurse this one drink through the entire proceedings. A sort of impromptu press conference gradually convened until at least 20 journalists were gathered around with 4 or 5 microphones thrust forward and 4 or 5 cameras grinding away in the background. It crossed my mind that I should be running for president. Wasn't this the fearsome New York press corps that had torn apart the likes of President George Bush, Governor Clinton and Jerry Brown in the recent primary? Here they were, eating out of my hand.

It was fun meeting several *Newsletter* readers. Out-of-staters included Sophie Coe of Vermont, Jane McEvoy of Ohio and Joe Skulan of Madison, Wisconsin (brother Tom Skulan of Averill Park, N.Y. was also there). Among New Yorkers, Judith Newman of the *New York Times* had started the press ball rolling with a long and well-done article in the morning edition, and Scott Hamilton of the Explorers Club was of course there. I had met Kathleen Finch of CBS *This Morning* earlier in the day but had forgotten to ask her if she ever actually read the *Newsletter* between occasions such as this.

During dinner, I tried another giant water bug. This one was good, but it was still difficult to handle the chitinous outer covering. I hope some of our Thai readers will give us their insights on how you are supposed to eat this insect. I also ate another kurrajong grub. They should be eaten while hot. This one had cooled off and was just okay.

In my opening remarks after dinner, I mentioned that, except for passing through the airport, I hadn't been in New York City since 1949, and Lou hadn't been there since attending the World Fair at a very young age in 1939. I wouldn't say there was an audible gasp from the audience, but New Yorkers clearly had difficulty comprehending how two people could live a combined 96 years without finding it necessary to come to New York. Actually, I was in error. Lou reminded me afterward that I was in New York in 1956, so the total span was only 89 years. We stayed on for three extra days just soaking up the feel of the city. New Yorkers are right, there is no other place quite like it. The last I saw of Durland Fish, Richard Falco and Lou Sorkin, they couldn't wait until Friday when they could go home and put their feet up and forget about the First Annual Bug Banquet. But I hear they may try it again next year.

Gene DeFoliart, Editor

(Thanks to the many readers who sent newspaper and magazine clippings from around the country.)

MENU

AT THE BAR

*Assorted Crudites with
Peppery Delight Mealworm Dip*

BUTLERED HORS d'OEUVRES

*Plain, Wax Worm and Mealworm
Avocado California
Rolls with Tamari Dipping Sauce
Wild Mushrooms in Mealworm Flour Pastry
Cricket and Vegetable Tempura
Mealworm Balls in Zesty Tomato Sauce
Mini Fontina in Bruschetta with
Mealworm Ganoush
Wax Worm Fritters with Plum Sauce
Roasted Australian Kurrajong Grubs
Sauteed Thai Water Bugs
Thai Water Bug and Mango Dip*

BUFFET DINNER

*Chicken Normandy with Calvados Sauce
Rice Pilaf
Roast Beef with Gravy
Roesti Potatoes
Mediterranean Pasta
Melange of Vegetable Ragu
Mesclun Salad with Balsamic Vinegar
Assorted Seasoned and Cricket Breads with Butter*

DESSERTS

*Lemon Squares
Chocolate Cricket Torte
Mini Cannoli
Peach Clafouti
Assorted Insect Sugar Cookies
Coffee and Tea Service*

My after-dinner talk, bolstered by some excellent slides from Mexico and elsewhere, seemed to go over really well. I don't remember any other public event in my experience when the entire mood seemed so jovial and warm. And I'll never forget the young woman who came up afterward, took my hand and said, "Thank you! Now, I know why we were here."

I sent a list of my travel expenses to Dr. Fish, June 3, 1992, along with congratulations on having such a successful event:

Dear Durland:

Listed below are expenses for my trip to New York, with receipts enclosed.

Round-trip airfare	\$230.00
Taxi to hotel 5/19/92	17.00
Lunch 5/20/92	5.64
Breakfast 5/21/92	6.00
Phone calls: Six calls returned to media, one call to New York Medical College	11.81
Taxi to airport 5/24/92	17.00
Airport parking in Madison, 3 days at \$3.00/day	9.00
Total	\$296.45

I want to congratulate you, Rich Falco and Lou Sorkin on your success creating such a fantastic event, and we certainly appreciate having been invited to participate. I think people will be talking about it for a long time. Lou and I stayed over in New York for three extra days and thoroughly enjoyed seeing some of the city.

I have written a lead article covering the event for the July issue of the Newsletter, which I hope captures the spirit of the occasion. Included is the full menu, some material from press accounts, and our exploits at CBS.

Thanks again. We thoroughly enjoyed the experience.

Sincerely, [signed]

I had a fax or two from Durland in July and received a check for, including honorarium, \$796.45. I'm not sure but what that might have been my first honorarium, coming after retirement and having reached the ripe old age of about 66 years. I don't think it was customary to give honorariums for talking about mosquitoes, but I can remember being an after-dinner speaker only once at a mosquito meeting. That was at the annual meeting of the Illinois Mosquito Control Association, probably in the early to mid-1980s. And do you know what I talked about? I had been asked by the program committee to talk, not about mosquitoes and disease, but about insects as food!

There is one other thing I remember vividly about that mosquito meeting in Illinois. After checking out to head for home, I was waiting on a multi-lane street for the traffic light to change when I noticed that almost every car around me had a bumper sticker saying "Escape to Wisconsin." It was a common bumper sticker up in Wisconsin in those days, but it took me a moment to remember that this was down in the middle of Illinois.

I heard from Durland, letter dated August 14, 1992:

Dear Gene,

I'm sorry that you had to wait so long for your check, but things move along rather slow here in the summer. Everything except, of course, for field work which keeps us from doing anything else. I haven't even given Lou my receipts yet [Lou Sorkin, not Lou DeFoliart].

Well, the event was successful far beyond my expectations. We managed to get out our message in a "tasteful" and professional manner. And, the message was heard all over the world. We have news clippings from as far away as Singapore, word of a TV news broadcast in Australia, and I learned a few days ago that the story was shown aboard a cruise ship touring the Prevlov Islands.

The collection of articles enclosed should be almost complete. I would appreciate any others that you know about. There should be a large one in the next Audubon – "The joy of cooking insects". We have a video of the CBS morning show and the CNN noon broadcast, if you would like to borrow them.

Thank you for being our guest and providing the professional authority that was needed to keep the event serious.. Your presentation was well received and everyone left with a solid message that they aren't the only people who eat insects. I still like those waterbugs.

On a related subject, I enjoyed an excellent lunch dish of fried scorpions in Beijing last month. They were on the menu in several restaurants near Tian'anmen square and much better than the dog we ate later in the trip.

I hope you and Lou are having a great summer.

Warmest regards, [signed]

My last letter to Durland relative to the New York Bug Banquet was dated August 27, 1992:

Dear Durland:

The check for \$796.45 was received. Thanks very much – no apologies needed about the delay. I would have been just as slow getting one to you if I'd been on the sending end – it's been one thing after another this summer.

Thanks also for the packet of clippings. I don't think I've seen any that weren't included in your collection. I've seen a video of the CBS show, but if you find the time you might send the one of the CNN noon coverage. I will return it promptly. I believe you and your committee deserve all kinds of congratulations for pulling the event off so successfully. As you know, the Buffalo Museum of Science is going to do something similar next year after seeing what great publicity you all generated. All of this will help the "cause," making insects more respectable and appreciated.

I hope you enjoyed the "tongue-in-cheek" coverage of our CBS exploits in the Newsletter. With very best regards.

Sincerely, [signed]

An Invited Commentary in the British Journal, “Crop Protection”

One day (24 October 1990) a letter came from Mary Fox, Executive Editor of the British journal, *Crop Protection*:

Dear Dr DeFoliart

Professor Pimentel of the Department of Entomology at Cornell University has suggested that you would be an eminently suitable person to provide a short comment article for the journal **CROP PROTECTION** on insects as human food: nutrition and economics.

CROP PROTECTION is a successful international journal which is published bimonthly. The coverage is now being extended to include short topical articles and I feel that you could contribute something of great interest to our readers.

We would like a short article of between 1000 and 2000 words. We would provide you with 50 offprints of your article free of charge in addition to a small fee of [Br. Lbs] 30.

I hope you will be able to contribute to **CROP PROTECTION** and I look forward to hearing from you.

Yours sincerely, [signed]

I wrote back November 6, accepting the invitation. It was not until August 5th, 1991 that I had the manuscript ready to send:

Dear Ms. Fox:

Enclosed is the manuscript on “Insects as Human Food: Nutrition and Economics,” which I said I would try to submit shortly after “the first of the year.” I apologize for the delay.

There is a problem. As it stands, the paper is about twice the length you requested. So few people have any backgrounding in the subject and it is so counter to widely prevailing attitudes that it’s difficult to establish the necessary credibility for it if one is too brief, too general or too undocumented. So, I set out to be concise, yet comprehensive enough for the paper to stand as the definitive up-to-date short synopsis of the subject, adequately referenced to serve as an entry to the widely scattered literature. If the article is simply too long, though, let me know and I will attempt some form of drastic surgery.

Small details remain to be completed on three of the references, but I will get those to you shortly.

I hope, if the paper is accepted more or less as is, I can have permission to reprint it in a future issue of The Food Insects Newsletter, of course with full acknowledgement to Crop Protection.

Let me know if major surgery will be necessary, or if the article is not what you had in mind.

Sincerely, [signed]

Editor Fox wrote back, 13th August acknowledging receipt of the manuscript and saying that it would be forwarded on to Editor Dr. J.R. Nechols (Kansas State University) for processing. The next thing I know, I'm getting a letter from Nechols (January 10, 1992) saying the following, which, as you can imagine, was more than a little unsettling:

Dear Dr. DeFoliart:

Enclosed I am returning the original and both copies of your manuscript, "Insects as human food: nutrition and economics". This paper was forwarded to me by Ms. Mary Fox, formerly Group Editor of Crop Protection. I corresponded with her about my concern that the subject matter was not appropriate for our journal (unless, that is, we propose human consumption of insects as a form of biological control!). She has now left her position, and so I am returning this to you solely on the basis of my opinion. I think this topic is fascinating, but would suggest you submit it to a journal of nutrition or food science where it might fit in better.

Sincerely, [signed]

I replied to Nechols January 15th:

Dear Dr. Nechols:

This acknowledges return of the manuscript, "Insects as human food: Nutrition and economics."

Needless to say I was more than a little nonplussed to get it back after writing it specifically for Crop Protection at the request of the Executive Editor. A copy of her original letter is enclosed. It was not easy to find the time to put the article together and I agreed to do so only because of the audience that Crop Protection represents. I do not have an alternative journal in mind.

You mentioned that the former editor has now left the position and that you were returning the manuscript solely on the basis of your own opinion. It seems to me that there is a matter of journal integrity, and I am wondering whether, as a new member of the associate editor group, you were aware of how the paper originated. If the executive editor, in issuing an invitation, does not have final authority on the appropriateness of subject matter, or, lacking that, concurrence of the associate editors, that certainly should be communicated to any prospective author. I believe you would agree that such an invitation represents a commitment, as long as the paper is technically sound, that should not be reversible after-the-fact by a new alignment of associate editors. I don't know who, other than Pimentel, or how many Ms Fox may have consulted before issuing the invitation, but Pimentel obviously thought the subject is appropriate for the pages of Crop Protection.

In your letter, stating your concern that the subject matter is not appropriate, you say (tongue-in-cheek, I think) "unless, that is, we propose human consumption of insects as a form of biological control!" That is, in fact, one

important aspect of the subject as is clearly set forth under the section of the article subheaded, “In relation to Environmental Management and Sustainable Agriculture.” More examples could have been cited, but not within the space limitations of this article.

Under the circumstances, I have enclosed the three copies that were returned to me, and I most respectfully ask the editors to reconsider this matter. The paper is concise, yet comprehensive enough to stand as the definitive up-to-date short synopsis of this subject, and based on the feedback I get from crop scientists as the editor of The Food Insects Newsletter, the article will be of interest to many readers of Crop Protection.

Sincerely,
(signed, with enclosures)

Dr. Nechols responded promptly, January 23, 1992: I was certainly appreciative of his willingness to change his decision after hearing the history of the manuscript and his generous fairness in waiving further reviews:

Dear Dr. DeFoliart:

Thank you for your letter of January 15 regarding your manuscript on insects as human food.

After reading your letter, and rereading your manuscript, I have decided to accept it. I am basing this decision on two factors: (1) that Third-World countries, which make up a large part of Crop Protection's readership, (and, possibly, developed nations as you suggest) are good candidates for consumption of insects, including crop pests; and (2) that, technically, human consumption of insects constitutes biological control (I was not being facetious in my last letter).

I do want to emphasize that it is the prerogative of the subject editor to determine what is appropriate for publication, subject to challenge by the author[s]. On the other hand, I am sorry for the “mixed signals” that resulted from (a) recommendation from an editorial board member; (b) involvement of the Group Editor; and, finally, (c) the end review by myself.

There is one detail that needs to be addressed; the peer review process. However, under the circumstances (invited paper, Short Comment category vs. Research Paper, and, lastly the length of time since the initial submission), I will contact the Group Editor and request a waiver of the peer reviews. This may involve sending the manuscript to one of the other Principal Editors. In any event, I will try to expedite the process. Although I have not yet read the paper for technical editing, it appears to be very well written.

Crop Protection does appreciate the time and effort invested in the manuscript. And, as I said earlier, it is a fascinating subject. If you have questions, please contact me (phone number given; address shown below). I shall be in touch with you shortly.

Sincerely, [signed]

I responded to Dr. Nechol's letter February 10th thanking him for deciding to accept the manuscript and for being willing to reconsider it. I also assured him that I believed the article would have wide interest among the readership of Crop Protection, particularly Third World readers. Exchanges of correspondence relative to this manuscript, dealing with editorial questions and suggestions, completion of several citations, etc. to meet journal style requirements, continued up to July 28, 1992.

A Public Lecture at The Buffalo Museum of Science

I first knew Wayne Gall when he was a graduate student in our Department of Entomology at the University of Wisconsin. I hadn't had any recent contact with Wayne prior to receiving a phone call from him sometime before June 2, 1992. Having heard about the New York City event, Wayne wanted to do something similar in Buffalo, hosted by the Museum of Science. Wayne was now Associate Curator, Division of Invertebrate Zoology at the Museum. I wrote to him under date of June 2, 1992:

Dear Wayne:

Following up on our phone conversation, I could come to Buffalo anytime in January or February and probably in March or April. Nothing is yet scheduled for that entire period. A tentative title for my presentation is "Insects—An Overlooked Food Resource." It would be essentially the one I gave in New York City as there will probably be little audience overlap. I took about 40 minutes in New York City, but it can be longer or shorter depending on the situation in Buffalo, whether you want a public lecture, after-dinner talk or whatever.

The invitation to New York City included all expenses and an honorarium of \$500. I wouldn't necessarily have to have an honorarium to come to Buffalo if finding the money is a problem, but if you can afford a small one it would be used to help support our educational effort, i.e. The Food Insects Newsletter and other printed materials, a traveling elementary school exhibit, etc.

Sincerely, [signed]

Aside from phone calls, I next heard back from Wayne, dated July 31, 1992:

Dear Dr. DeFoliart:

As a follow-up to our telephone conversation of earlier this week, we would be most pleased if you could present a 45-60 minute lecture at our Museum on Friday evening, 12 March 1993, entitled "Insects: An Overlooked Food Resource."

We are pleased to offer you a \$500 honorarium, and we will pay for your transportation, lodging and meals; please forward receipts to me as I will request reimbursement for our Business Office. You can use the honorarium any way you see fit, e.g., toward your wife's expenses if she accompanies you, The Food Insects Newsletter, etc.

We would very much appreciate if you could plan to arrive in Buffalo by Wednesday evening, 10 March 1993, so that you might be available for any

media interviews or other public relations activities that our PR/Marketing Department might have planned on Thursday and/or Friday. We would also hope that you and your wife could stay through Saturday night to attend the Insect Banquet which our Development Office is planning as a fundraiser.

It is my understanding that you will make your airline reservations. When I receive your itinerary and receipt for reimbursement for airfare, I will reserve a motel room for you here.

At your convenience, please send me a copy of your c.v. or other biographical information, and a photo of you (a head-and-shoulders shot or a more informal shot of you in your lab or engaged in some entomological or entomophagous activity if possible) for possible publication in our Museum's newsletter.

It was great talking to you and I look forward to seeing you again!

Sincerely, [signed]

Among other things that had been going on, I sent a cookbook, a copy of Taylor and Carter's "Entertaining with Insects," and heard back from Wayne that he had photocopied the entire book before sending it back. The "entire book" has 160 pages! Also, I wrote to him on the 27th of August with the CV enclosed and telling him I was working on the photo, that Lou and I would remain in Buffalo through Saturday night for the banquet and then we were going to Warsaw, N.Y. to spend three days with Lou's mother before heading back to Madison on the 17th. Wayne wrote, fairly lengthily, 18th October describing some downsizing in the planning and the fact that they were still trying to find an interested caterer in the western New York area. In various transmissions I sent him a glossy photo, let him know that Lou had decided not to come with me, and suggested that if their local boosters' or wives' groups should decide to try to do some hors d'oeuvres in connection with the lecture, they might like some input from Marsha Lisitza who was our official project chef and had a lot of experience with insect cookery. Changes from their end were that they had decided to have the lecture be the focus of activities, move it from Friday to Saturday night with "bug snacks" afterward at a very modest reception, and to sort of somewhat meld the whole thing with the "Backyard Monsters," a traveling collection of huge robotic bugs that would be on exhibit at the Museum from January 15 to April 19, 1993. The Buffalo group had become a little skitterish after learning that the New York Entomological Society had lost money on their 100th anniversary event. So they had decided to scale down their dinner plans.

For reasons beyond anyone's control there would be more changes and indecision after I arrived in Buffalo. Let's pick up the story as reported in *The Food Insects Newsletter*, Volume VI, Number 2 (July 1993) under the heading, "The Buffalo Museum's Big Event Took a Hit, But Ultimately Triumphed Over the 'Storm of the Century'":

The Buffalo (New York) Museum of Science had put a lot of planning into the evening of Saturday, March 13th. The chief organizer was Wayne Gall, Associate Curator of Invertebrate Zoology. The evening would begin at 7:30 pm with a public lecture, "Insects: An Overlooked Food Resource," followed by the "Bug

Appetit” reception. To cater the reception, the Museum had engaged Pearl’s Pastries of Jamestown, New York.

Pearl’s features chef Bill Warner who is famed throughout western New York for his specialty desserts and his creative puff pastry. Of the several puff pastry insects and arachnids created for the occasion, a praying mantis, standing about three feet high, was particularly impressive. The hors d’oeuvres and desserts included:

Mushrooms stuffed with mealworms and wild rice
Chicken, green onion, and cricket springroll
Julienned zucchini and waxworm fritter with dipping sauce
Mealworm praline on pastry cream in puff pastry
Cricket hazelnut torte with raspberry

Local television, radio and newspapers provided good advance publicity, including televised interviews with several of the major participants for Saturday night. Gerry Rising’s column, “Nature Watch,” in the *Buffalo News* was particularly insightful, citing examples of how our narrow attitudes about food in the U.S. often work to the detriment of other people. By the close of business on Friday, ticket sales had passed the 300 mark. That was great, but all was not joy. It was becoming increasingly apparent that Saturday’s event might be on a collision course with what was being heralded as the “storm of the century,” slowly but inexorably moving up through the Atlantic Coast states.

Your editor, there to deliver the lecture (and, as usual trusting in good luck), planned to sleep in a little on Saturday morning but was jolted awake at 7:00 am by the telephone ringing. It was Wayne Gall, who had a big decision to make. There were 300 ticket-holders for 7:30 that evening; Bill Warner, the chef, was poised in Jamestown ready to head toward Buffalo with all the vittles; I was scheduled on a flight out the next morning; and the storm, now a virtual certainty to engulf western New York, was expected to become very noticeable in Buffalo before nightfall.

To make a longer story short, everything was rescheduled for Tuesday, March 16th. Despite the confusion of a postponement, 225 people showed up. Following the lecture, they made short work of Bill Warner’s tasty and attractive assortment of hors d’oeuvres and desserts. Add Bill Warner to the short but growing list of U.S. chefs who have successfully and creatively braved the frontiers of insect cuisine. And congratulations to Wayne Gall and the Buffalo Museum of Science for a highly successful fete in the face of great adversity.

Addendum: During my storm-lengthened seven days in Buffalo, Wayne G. introduced me to the “Original Buffalo Chicken Wings” for which the city is so justly famed. Talk about good! They reminded me of baked cicada nymphs. I ate nothing but Chicken Wings the last three days.

Wayne sent a nice “thank you” letter March 18th which arrived shortly after I got home:

Dear Gene:

Thank you for your wonderful lecture, “Insects: An Overlooked Food Resource,” here Tuesday evening. Your talk was well received, and we were very happy with the turnout (approx. 225 persons) given the unfortunate need to re-schedule after Saturday’s blizzard.

Thank you also for being so gracious as to agree to stay over a few extra days to allow the event to still happen. I trust that you and the Mormon cricket arrived in Madison safely, and that hopefully your cough has improved further.

After reviewing our observations of the “Bug Appetit” reception, we have concluded that your lecture was so effective that you incited the human equivalent of a shark feeding frenzy! We are still amazed at the demand Tuesday evening for goodies made with insects.

As you can tell from the facial expressions in the enclosed photo from yesterday’s *Buffalo News*, the Gall children thoroughly enjoyed (NOT!) the entomological culinary delights. There is no justice – first, mother nature rearranges nine months of planning, then the media sets up your children [Wayne’s computer knows how to make a little smiley face which it put right here].

Thanks again for making this event so memorable.

Sincerely, [signed]

My reply, dated April 7, 1993, was probably the last piece of correspondence between us pertaining to the Buffalo event:

Dear Wayne:

Please excuse the delay in writing. No excuse except that it’s been busy and I had a relapse of that cold but it seems about over now.

I’m glad everything came out as planned (except for the delay) back there despite the bad luck of running into the “storm of the century.” I know it was a hard decision to postpone everything but it was obviously the right decision – the only one in fact – which became obvious within about three hours after you made it. I’m just pleased that it turned out so well in the end.

Yes, the Mormon cricket made it back safely and now sits in a place of prominence in my office. I certainly appreciate receiving it. Bill Warner is a true talent!

My airfare was \$203, but I’m waiving reimbursement. That may help a little bit to make up for the increased expenses and reduced income caused by the storm. I certainly want to express my thanks for being invited to participate and for the opportunity of meeting so many people involved with the Museum. With best regards.

Sincerely, [signed]

P.S. It was too late to make the March issue but there’ll be a short piece about the Buffalo happenings in the July Newsletter.

Special Symposium, 1993 Pacific Branch ESA in Portland, Oregon

Under date of January 5, 1993, I received a nice letter from Paul Catts of the Department of Entomology at Washington State University, Pullman, Washington:

Last year at the ESA North Central Branch Meeting you gave a stunning presentation on “Insects as Food for Folks.” I’m organizing a similar symposium for the Pacific Branch meeting to be held in Portland, OR. It will be titled “Insects and People.” Will you agree to be an invited guest speaker for this symposium – speaking on your insects as food topic? I’ve gotten a commitment of \$1500 to defray your travel and subsistence expenses. This should also leave a modest honorarium for your efforts. Please let me know your answer as soon as you can as I’ll have to release these funds back to the Program Chair if you cannot come. My phone is (509) 335-5504 and if I’m not here, leave a message.

P.S. The meeting will be held 27-30 June, 1993 in the Red Lion Inn, Portland. Our symposium is on the eve of 27 June.

I called and confirmed by letter my acceptance and got back more details from Paul. The title of the symposium would be “Insects and People,” it would be held on the opening Sunday night, and the speakers and their subjects were as listed (all speakers from Departments of Entomology at their respective institutions):

1. “Planet of the Bugs,” by Andy McClelland, University of California, Davis, Calif.
2. “Insects Did it First,” Greg Paulson, Washington State University, Pullman, Wash.
3. “Bugs in Rhyme and Song,” by Tom Turpin. Purdue University, West Lafayette, Ind.
4. “Insect Jewelry,” Roger Akre, Washington State University, Pullman, Wash.
5. “Insects as Food for Folks,” by Gene DeFoliart, University of Wisconsin, Madison, Wisc.
6. “A Fly Thru History,” by Paul Catts, Washington State University, Pullman, Wash.

Our eldest daughter, Sharon, and her family lived across the River (the Columbia) in Vancouver, Washington, so we combined everything with a nice family visit. Actually, we had the visit with Sharon scheduled before I got invited to the symposium – shows how lucky you can be sometimes.

An Invitation From the International Journal, Biodiversity and Conservation

My invitation relative to this came from Dr. John E. Cooper, Professor of Veterinary Medicine, Sokoine University of Agriculture, a Visiting Research Fellow from the University of Kent, in the United Kingdom. Sokoine University is at Morogoro, Tanzania. Dr. Cooper wrote on 19 September, 1993:

Dear Dr. DeFoliart,

Biodiversity and Conservation is a quarterly international journal devoted to the publication of articles on all aspects of biological diversity, its description and conservation, and its controlled rational use by man. The scope of the journal is wide and multidisciplinary and embraces all life forms.

I have been invited by the Editors in Chief, Drs. Alan T. Bull and Ian R. Swingland, to edit an issue on microlivestock. The aim of the volume will be to draw attention to the need to exploit “new” food sources if the world’s population is to be fed and environmental damage minimized. It is proposed that the papers should cover the following [9 subject areas listed]

I am writing to invite you to contribute a paper on Invertebrates. The exact title can be confirmed later. . . .

Yours sincerely, [signed]

I should warn the reader that the next several pages could cause dizziness, as they did in the writer, in trying to pinpoint the whereabouts of Dr. Cooper at any particular point in time. I wrote to Dr. Cooper (now in Rwanda), October 22nd thanking him for the invitation and saying:

. . . I tentatively accept although there are a couple of problems. The first is that I am equipped only to handle the insects. I have no expertise in mollusks, crustaceans or annelids. So, for me to participate, it would be necessary to split the subject into two papers, restricting my paper to insects, or to find a co-author.

The second problem is trying to meet the March 1st deadline. . . .

I heard back from Dr. Cooper (1st November 1993) that it would be fine if I restrict myself to insects and suggesting that we use the Class Insecta to illustrate the potential of invertebrates. He also offered to extend my deadline for the manuscript from March 1 to June 1, 1994. I wrote my acceptance November 22, and thanked him for the time extension although saying I would try to get the manuscript there sooner. When I next heard from Dr. Cooper, in January 1994, he and his wife had been evacuated from Rwanda and their address was in Kenya. Their visit to Rwanda had been traumatic, with loss of their library and other possessions and the necessity of rescuing his Rwandan counterpart from Zaire. As the reader is probably beginning to see, each of the endeavors in this chapter seemed to develop its own particular set of side circumstances. If not confronting the “storm of the century” in North America, it was trying to keep up with the whereabouts of an editor who was moving about with great agility in Africa.

This next sequence of four short letters will show how much fun we were having keeping track of each other. On May 9, 1994, I wrote to Steven J. Edwards, Editor of B.&C (Biodiversity and Conservation) at Chapman and Hall in London:

Dear Mr. Edwards:

I am scheduled to be a contributor to the B & C issue on microlivestock. The editor of that issue, Dr. John Cooper, gave me an extended deadline for submitting my manuscript when I was last in contact with him last October.

Cooper was in Rwanda at that time. The manuscript is ready to send to him, but I assume it would be pointless to send it to Rwanda. Would you be so kind as to let me know how to contact him? Thank you.

Sincerely, [signed]

On May 18th, I wrote to Dr. Cooper at an address in the United Kingdom, which I apparently had obtained from him, according to the letter below:

Dear Dr. Cooper:

It was great news to hear that you and your wife are safely out of Rwanda. Even with all of the trouble spots in the world, it seems almost unbelievable the tragic havoc that is going on there.

When your note arrived the other day, I had, as one might expect, mailed a letter earlier that same day to the editor of "Biodiversity and Conservation" asking how you might be contacted.

You mentioned sending a note from Rwanda. I presume the one you meant is the one dated November 1 giving me an extended deadline to June 1, 1994, which is the last communication I had received from you.

Enclosed is the manuscript (three copies). I had trouble with length, and the manuscript is closer to 10,000 words despite chopping out three insect families originally included. Let me know if there are any serious problems with the manuscript.

Sincerely, [signed]

Actually, when writing this chapter I found a note from Dr. Cooper bearing a date of April 6, 1994, which had been sent from Rwanda. But, returning to the afore-mentioned sequence of four letters, on May 20, I received a fax from Professor and Editor-in-Chief of B. & C. Alan T. Bull:

Dear Professor DeFoliart

Your letter addressed to Steve Edwards at Chapman and Hall regarding the issue of Biodiversity and Conservation on Microlivestock has been passed to me.

I am in contact with John Cooper (who is now in England) and I am copying this letter to him. I was delighted to learn that your manuscript is written and ready for mailing. May I suggest that you send copies to me and I will arrange for one to go to John.

With my thanks for your contribution to the Journal.

Kind regards,

Yours sincerely, [signed]

On May 23, I wrote to Editor-in-Chief Bull:

Dear Professor Bull:

I heard from Professor Cooper later on the same day I mailed the letter to you, and, then, as I was preparing to send the three manuscript copies to him, your Fax arrived. I went ahead and sent one copy to him; two copies are enclosed. Thanks for responding so swiftly to my letter.

Sincerely, [signed]

My next note from Dr. Cooper was dated May 30; the return address now was indeed the UK, at the University of Kent:

Many thanks for your letter of May 18th and copy of your manuscript. It looks good!

I wrote to you from Rwanda just before the fighting started. It's probably still there! No real importance.

Best wishes, {signed]

The letter he mentions having written in Rwanda (and as probably still there) is probably his letter dated April 4 which I mentioned above and which was apparently long delayed in arriving. Letters and faxes continued, the next one worth mentioning being from Dr. Cooper to me, dated October 17, 1994 from Nairobi, Kenya:

Dear Professor DeFoliart,

The manuscripts are being sent to UK today. Thank you for your letter/fax including additional references and answering my queries.

Two further points have arisen and I wonder if you could respond direct to Prof. Bull in UK over these as I am about to drive to Rwanda for two weeks –

- 1) We need journal titles in full. I have done my best to expand yours but don't know them all. Could you please provide (annotate a copy of references?)
- 2) Prof. Hardouin has put forward an impassioned plea for the use of the term "minilivestock" rather than "microlivestock." He argues that microlivestock are microscopic organisms, e.g. bacteria, not metazoan animals. Would you mind if the title of your paper was changed to "Edible Insects as Minilivestock"?

Best wishes, [signed]

I responded, dated November 3:

Dear Dr. Bull:

Dr. Cooper asked me to send this directly to you.

- 1) I have no objection to changing the title of my paper to "Edible Insects as Minilivestock."
- 2) Enclosed is a retyped list of References with journal titles spelled out in full. I had to guess on one of them, Ghosh 1924. I can't locate my copy.

Dr. Cooper asked if I could furnish any illustrations to go with the paper. I don't have any glossy prints, but hope to get time over the weekend to look through my slides to try to find three or four that might be suitable for the article.

Sincerely, [signed]

Professor Bull wrote on November 11th that all papers were in and ready to deliver to the publisher. On November 13th, I sent to him six color slides with legends for possible use in illustrating my article. Prof. Bull wrote to me on November 25th that it might be too late for inclusion of the illustrations. The proofs of my paper were sent December 21st by Catherine Russell of Chapman & Hall, the publishers in London. On January 13, 1995, I sent a one plus page letter to Russell pointing out misspellings, etc. and closing with the following two paragraphs:

For three of the five references you had marked, Ghosh (19924), Grimaldi and Bikia (1985), and Ministry of Public Health (1987), I do not yet have the desired information. I'm hampered by the fact that my wife has just undergone major surgery and I am unable to spend much time at the University. For example, the translator of my copy of the Ministry of Public Health manual failed to translate the word on the cover which is probably the city of publication, which will necessitate a trip over to the Dept. of Southeast Asian Studies in order to find someone who speaks Thai. If I get any further information on any of these three, I will Fax it immediately.

The manuscript is being mailed back to you today.

Sincerely, [signed]

I heard from Dr. Cooper, dated February 6, 1995, and quote the third of the four paragraphs in his letter:

We now have a house in Kigali, Rwanda, which we are developing as the new headquarters for the Centre Veterinaire des Volcans. Our base in Nairobi, Kenya, is being retained, under the supervision of my counterpart, Dr. Jean Bosco Nizeye, and we shall be returning there at regular intervals to collect equipment and supplies.

He mentioned that mail could be sent either to Nairobi or Kigali, "but it is probably best not yet to entrust irreplaceable items to the Rwandan postal services." He also mentioned that we are "developing closer academic links with colleagues in Kenya, Tanzania and Uganda." The final line in my final communication from Dr. Cooper, dated July 11, 1995, was: "Do keep in contact. We are in Britain at present."

As one can readily see, there is sometimes more to a scientific paper than readily meets the eye. For those who, having now read the travails behind it, must see the paper, the citation is:

DeFoliart, G.R. 1995. Edible insects as minilivestock. *Biodivers. Conserv.* 4: 306-321.

International Symposium on Biodiversity For a Sustainable Future, Beijing, China

I could find no date on my invitation to be a participant in the symposium, “Biodiversity for a Sustainable Future” to be held in Beijing, September 19-21, 1995. My letter of acceptance to Dr. M.G. Paoletti of Padova University in Italy was dated October 6, 1994. I had met Dr. Paoletti sometime before when he paid a two or three day visit to my lab. I don’t remember that he said anything at that time about planning to organize an international gathering of any kind, but that doesn’t mean that he didn’t. He was well-known in ecological circles (he and Dave Pimentel were co-editors of the book, “Biotic Diversity in Agroecosystems) and he proved to be very interested in talking about insects as human food. We had extensive conversations. My letter was as follows:

Dear Maurizio:

Thank you for inviting me to participate in the symposium, “Biodiversity for a Sustainable Future,” to be held in China next September. I am pleased to accept. My acceptance has to be somewhat conditional as I am facing some health uncertainties during the coming year. I see no reason why I wouldn’t be able to prepare the paper, however, but someone else might have to read it if I am unable to attend. I would suggest the following title for my presentation: “An overview of edible insects and their role in preserving biodiversity.”

I think you have a good slate of speakers on the insects. I have met Puwastien, Mitsuhashi and Posey personally and have had correspondence with Malaisse, Okedi and Meyer-Rochow. I am curious about the F. Conconi scheduled for the first day. Is this perhaps Julieta Ramos-Elorduy (former married name, Conconi) of the National Autonomous University in Mexico City?

With best regards, and hopes for a very successful conference.

Sincerely, [signed]

My next official communication was April 4, 1995 from Sandra Bukkens, the Organizing Secretariat, who, I didn’t learn until sometime later was Maurizio’s wife:

Dear Dr. DeFoliart:

We sincerely hope that you, the inspiring force of the food insect research, will be able to attend the conference in person. In any case, we will include your contribution in the program.

Would you be willing to serve on the scientific committee of the conference? This would involve reviewing several papers, that will be presented at the conference on the subject of microlivestock, for their scientific content prior to publishing the proceedings.

Looking forward to an affirmative response,

[signed]

Another letter, to which this one was attached, had a lot of detailed information for participants, such as length of presentations (20-25 minutes, followed by 10-15 minutes discussion) and reminders to send an estimate of expenses, to get abstracts in soon if not already sent, and that the full manuscript would be due by July 1995 (the symposium proceedings would be published). I remember wincing at Maurizio's earlier reference to expenses: "We hope to be able to pay the invited speakers' living expenses in Beijing and at least part of their travel costs. At present we are approaching various organizations in an attempt to obtain support to reimburse travel costs (economy class)." Where had I heard that before? My response to the above letter from Ms. Bukkens was sent April 13:

Dear Ms. Bukkens:

Attached is the Abstract for my paper to be presented at the International Symposium on Biodiversity being held in China in September. If the abstract is too long, it can be easily shortened by about 10 lines by deleting the parenthetical examples.

It is my intention to attend the conference and to present the paper, my health and the health of my wife permitting. In the event that I am unable to attend, I will send the paper, together with supporting slides. In response to your request, yes, I am willing to serve on the scientific committee of the conference.

Regarding a tour before or after the conference, yes, we would be interested in such a tour, assuming it is not too long. My wife and possibly a third person would accompany me on such a tour if scheduled.

With best wishes for a successful conference.

Sincerely, [signed]

The third person alluded to above was Catherine Howley. She had done such an enormous amount of volunteer work over the years on *The Food Insects Newsletter*, it seemed about time to reward her in some way.

I was notified by Ms Bukkens, May 15th that the invertebrate papers would be on the second day of the symposium, September 20, that the session would be titled "Micro-livestock: Sustainable use of biodiversity for human food," and that the editor of the journal *Ecology of Food and Nutrition* had expressed interest in publishing the papers in that session as a special issue of the journal. The session had thirteen speakers scheduled. The program:

Wednesday, 20 September

Microlivestock: Sustainable use of biodiversity for human food

Chair: Gene R. DeFoliart

09:00 Gene R. DeFoliart (University of Wisconsin, USA)

Overview of edible insects and their role in preserving biodiversity

09:20 Luo Zhiyi (Shanghai Institute of Entomology, China)

Insects as a food resource in Eastern subtropical China

- 09:40 William C. Beets (University of California at Davis, USA)
Protein of micro-livestock and non-conventional animal proteins versus plant proteins in Integrated small-holder farming systems
- 10:00 Jun Mitsuhashi (Tokyo University of Agriculture and Technology, Japan)
Insects as traditional food in Japan
- 10:20 *Discussion*
- 10:30 – 11:00 Coffee break
- Chair: John Okedi
- 11:00 John Okedi (National Agricultural Research Organization, Uganda)
The use of insects as human food in Uganda
- 11:20 Francois Malaisse (Faculte des Sciences Agronomiques de Gembloux, Belgium)
The place of insects in traditional food in Zaire: biodiversity and sustainable management
- 11:40 Jintana Yhoun-Aree and Prapasri Puwastien (Mahidol University, Thailand)
Edible insects in Thailand: An unconventional protein source
- 12:00 V. Benno Meyer-Rochow (Oulu University, Finland) and S. Changkija (G.B. Pant Institute of Himalayan Environment and Development, India)
Uses of insects as human food in Papua New Guinea, Australia and North-East India
- 12:20 Sun Zhenjun (Beijing Agricultural University, China)
Earthworm: A potential protein resource for human food and animal feed
- 12:40 *Discussion*
- 13:00 – 14:30 Lunch at BAU
- Chair: Julieta Ramos-Elorduy
- 14:30 B. Prasad (Manipur University, India)
Future sources of non-conventional animal proteins in India
- 14:50 Christopher W.L. Mercer (Oro Conservation Project, Papua New Guinea)
Sustainable production of insects for food and income by New Guinea villagers
- 15:10 Jacques Hardouin (Faculte des Sciences Agronomiques de Gembloux, Belgium)

Minilivestock as source of food, feed or revenue in the sustainable rural development

15:30 Julieta Ramos-Elorduy (Universidad Nacional Autonoma de Mexico)
Could insect biodiversity be a feasible new sustainable alternative?

15:50 *Discussion*

16:10 – 17:30 Refreshment in Poster Display Area. Dinner, place to be announced

18:30 Departure for Beijing Opera

Also in that May 15th letter Sandra said “there will not be additional expenses for hotel accommodation for your wife.” A nice touch, I thought. In a letter of June 28th, I remembered to mention that Ms. Howley will require separate room accommodation. On July 14, I notified Sandra that we would arrive September 18 and leave September 24, and that airfare will not exceed \$1900. On July 28th, I informed Ms. Bukkens that Catherine Howley, after all, would not be accompanying us. In the last paragraph, I also pointed out something that I wanted to be sure she knew:

Regarding my serving on the scientific committee, remember that although I have worked with several nutritionists, I am not professionally a nutritionist, so I would prefer not to be sent papers that are heavy on real nutrition. Besides, the time element. As you can probably tell, I’m already three feet over my head with too many commitments. Aren’t we all.

She responded August 7th saying she was a nutritionist herself and she would review papers for their nutritional aspects. Finally, I faced reality and, on August 30, sent the following fax to Ms. Bukkens, the first of three straight rapid-fire faxes on consecutive days:

Dear Ms. Bukkens:

Unfortunately, I have finally had to concede to myself that it would be unwise on my part to attempt to attend the conference in Beijing. I waited as long as possible, hoping that the health situation for both my wife and me would improve sufficiently before September. I feel, however, that neither of us currently has the stamina and energy reserves for such a long and physically demanding trip.

The text and slides for my presentation are ready. Where, and to whom, should I send them? There are 47 slides (35mm), but about 32 are simply short headings or reproductions of parts of the text, so that the audience can follow the speaker more easily by simply reading along. Elapsed time for the presentation, based on a couple of trial runs, is about 25 minutes, but whoever reads the paper will need to move right along in order to do it in that amount of time.

The manuscript is also finished and I hope to put it in the mail to your Rome address within a couple of days. It is Word Perfect 5.1 using MS DOS. The

title has been slightly changed, to “An overview of the role of edible insects in preserving biodiversity.” I believe this more accurately reflects the content of the article, than did the original title, “An overview of edible insects and their role in preserving biodiversity.”

I very much regret missing this event, and very much appreciate having been asked to participate. The organizing committee is to be congratulated on arranging such an outstanding program, and I am sure that the meeting will be an outstanding success.

Sincerely, [signed]

Ms. Bukkens faxed back the following the next day, August 31:

Dear Prof. DeFoliart:

Thank you for your fax of August 30th. We sincerely regret that you and your wife will not be able to participate in the symposium in person. You had however informed us right from the beginning that your health status might have been a problem and your decision does not come as a surprise.

We appreciate your efforts in preparing your presentation and paper. I will most probably be the person who will read your paper. I therefore suggest that you send all materials to me. I will be leaving Rome for Beijing on Monday, September 11. Italian mail service is not optimal; it may be just possible to get the material here by air-mail but it would definitely be better to send it by courier (DHL).

Maurizio Paoletti also would like to express his regrets that you will not be able to join us in Beijing. He greatly admires your work and the idea and realization of a micro-livestock session in the symposium are partly the result of the fruits of your activities in this field.

We will undoubtedly be in touch with you in the coming months regarding the proceedings of the symposium and in particular of the micro-livestock session.

With kind regards, [signed]

On the very next day, September 1, I sent another letter to Ms. Bukkens, mainly explaining certain things about my manuscript and the slides to be used when presenting my paper. Correspondence between Sandra and I continued to fly. Totally, more than 40 letters and faxes passed between us relative to the symposium and proceedings. One of mine to her (September 6, 1995) alerted to the upcoming trans-Africa food conference and exhibition (with food insects to be included) to be held in Nairobi, Kenya in December, enabling it to be announced during the gathering in Beijing. I had been alerted via fax from Dr. J.P.R. Ochieng-Odero, Program and Planning Officer at RANDFORUM in Nairobi who thought I would be going to Beijing.

On September 7, I wrote to most of the participants who would be in the Microlivestock session at Beijing, inviting them to send me their impressions of the symposium for use in our coverage of the event in *The Food Insects Newsletter*.

On October 2, 1995, Sandra sent her first post-symposium report on how things went:

Dear Dr. DeFoliart:

I am writing you with a little update on the International Symposium on Biodiversity in Agriculture. All in all, the symposium went well and we are happy with the attendance and interest shown in the symposium. Unfortunately, Dr. Okedi from Uganda and Dr. Prasad from India had to withdraw their participation at the very last moment for health reasons. Nevertheless, the microlivestock session was successful and there has been an enthusiastic exchange of information among the participants.

Under separate cover, I am returning your slides. Unfortunately, I must have left the text of your presentation in Beijing (I remember giving it to a Chinese colleague who wanted to have it copied). I sincerely hope that you do have it on disk or a spare copy. I had your manuscript copied in Beijing and distributed to those interested in your presentation, which were many! Many of the participants have expressed their regret that you could not be present at the symposium in person.

I am enclosing a copy of the working document that was handed out at registration. It contains the abstracts of all presentations and a list with the addresses of the participants.

I am now embarking on the task to get the symposium papers published as special issues of scientific journals. As I mentioned before, the microlivestock papers go to *Ecology of Food and Nutrition*. Taking on your earlier offer, I will be sending you two or three papers in the next few days to review. . . .

I will remain the 'contact person' for all issues related to the symposium and look forward to remaining in contact with you on the micro-livestock subject.

With kind regards, [signed]

She followed up on November 9 by sending three of the symposium papers to be reviewed. I finished the reviewing and returned the manuscripts December 4th. In response to a question she had asked about whether, as a reviewer, I wished to remain anonymous, I replied, "In general, I don't like anonymous reviewing and have added my name to each review."

On December 20, 1996, I heard from Peter L. Pellett, Editor of *Ecology of Food and Nutrition* that the symposium papers were ready for the publishers, but he found he needed from me an abstract and key words. On January 3, 1997, I sent the following abstract, plus some key words:

Review of the Role of Edible Insects in Preserving Biodiversity

ABSTRACT In this discussion the principle is adopted that factors tending to increase food and/or income for economically marginal rural families, while decreasing pressure for land-clearing, pesticides and intensive agriculture, will tend to favor the preservation of biodiversity and a sustainable future. The great

diversity of habitats of insect species that serve as traditional foods presents an almost endless diversity of situations in which recognition and enlightened management of the food insect resource can result not only in better human nutrition but simultaneously aid in maintaining diversity of habitats for other forms of life.

Approaches include: 1) Enhancing forest conservation and management by acting on the desire of local populations for protection of traditional insect foods (i.e., caterpillars in Zambia, Zaire); 2) Reducing poaching in parks and wildlife preserves by allowing sustainable use of the food insect resources by the local people (i.e., caterpillars in Malawi); 3) Reducing pesticide use by developing more efficient methods of harvesting pest species that are traditional foods (i.e., grasshoppers); 4) Increasing environmental and economic efficiency by developing dual product systems (i.e., silks and silk moth larvae/pupae, honey and honey bee brood); 5) Reducing organic pollution by recycling agricultural and forestry wastes into high-quality food or animal feedstuffs (i.e., fly larvae, palm weevils). Other relevant considerations are that some edible insect species enhance their local environment in various ways (i.e., leafcutter ants in S. America) or create additional diversity of species within the habitat (i.e., termites in Africa). Some (as shown in cricket studies) exhibit considerably higher food conversion efficiency than beef cattle when fed diets of similar quality. Finally, there is need for research on industrial scale mass-production of edible insects, for increased recognition of the nutritional and environmental importance of insects by national governments, and for increased involvement of Western media and academia in dispelling unfounded cultural biases in the Western World toward insects as food.

KEY WORDS biodiversity, edible insects, entomophagy, food ecology, food insects

A fax from Sandra, dated January 22, 1997, carried big news of a different kind: "I apologize for the long silence . . . I have been on maternity leave (Mario and I had a baby – Olga – mid September of last year) and motherhood is taking up most of my time." I marveled. I don't know how women do it! In addition to shepherding the Microlivestock papers to *Ecology of Food and Nutrition* for final publication, selected papers from the other two days of the Symposium had been published in April 1997 in *Agriculture, Ecosystems & Environment*. And what the reader does not know yet is that three papers were added in the final Microlivestock volume that have not been mentioned here, one of which was authored by Sandra Bukkens. The title was, "The Nutritional Value of Edible Insects." It was 32 pages long. As I said, I don't know how women do it. In what was apparently my last communication from Sandra Bukkens, November 4, 1997, she said: "Olga is doing fine as is Mario. Motherhood is enjoyable although tough to combine with work!"

The 1999 Volume of the Annual Review of Entomology

I received a letter dated January 31, 1997 (funny how these opportunities that you just can't turn down pop up like clockwork just when you are finally starting to free up time from your last over-commitment) from Dr. May Berenbaum, Editor of the *Annual Review of Entomology* (and Chair, Department of Entomology, University of Illinois-Urbana/Champaign). In the letter, she said: "The Editorial Committee of the *Annual Review of Entomology* met recently to plan the contents of Volume 44, to be published in January 1999. I am writing on behalf of the Committee to extend to you a cordial invitation to contribute an article on Human Use of Insects as Food for this volume of the Review." The remainder of the letter covered a lot of details for authors, including that reviews should be limited to not more than 20 printed pages, or about 35 pages of double-spaced typescript including bibliography and illustrations. I mention this now, right at the start because, as we know from past experience, too much length is a problem in almost every speech and chapter.

The Annual Review series, published by Annual Reviews Inc. in Palo Alto, California is about as high profile as you can get when it comes to review journals, at least for entomology. There is an Annual Review series for quite a number of fields of science, maybe two dozen or more. This would be my second trip in the *Annual Review of Entomology*, having published with two of my former students, Paul Grimstad (University of Notre Dame faculty) and Doug Watts (U.S. Army Medical Research Institute of Infectious Diseases), a 26-pager, titled "Advances in mosquito-borne arbovirus/vector research" in the 1987 volume. It is a prestige proposition as far as food insects is concerned. My letter of acceptance to Dr. Berenbaum was dated February 27, 1997:

Dear May:

I accept with pleasure the invitation to contribute an article on Human Use of Insects as Food for the 1999 volume of the Review. It will be a nice opportunity to help build that Bridge to the 21st Century, indeed to the next Millennium!

I presume that the exact title can be determined later. Also, I think, at least at present, that I will plan to do it alone although that could possibly change when I start thinking about precisely how to go about it.

I appreciate being asked to do this. It's another indication that the subject is gaining much wider acceptance within the scientific community.

Sincerely, {signed]

On February 26, 1998, I mailed the manuscript to Naomi Lubick, Production Editor of Annual Reviews, and, you'll see, almost the first thing mentioned is length, too much of it, way too much:

Dear Ms. Lubick:

Enclosed are two copies of my manuscript, "Insects as Food: Why the Western Attitude is Important," for the 1999 Annual Review of Entomology. Enclosed also is the floppy disk; the ms is in Word Perfect 5.

The article is over-length. The first draft was 33 pp. according to the formula on page 3 of the Instructions. I've spent more time trying to shorten it than in writing it in the first place, but wound up making almost as many additions as deletions during the process. The special edition of *Ecology of Food and Nutrition* (Paoletti & Bukkens 1997) with papers from the China Symposium on biodiversity became available much later than expected, necessitating the late adding of nearly a dozen references. Current length is about 30 pp., I think.

I have quoted rather liberally, especially historical figures such as David Livingstone and C.V. Riley, probably more than is generally preferred by the A.R.E., but I believe history comes alive more when we can hear from historical figures in their own words.

Unfortunately, it was only after going to the trouble of getting total pagination on books that I noticed it was optional, not mandatory. I failed to get total pages on one book, Shaxson (1985) and one thesis, Wilson (1990).

Actually, I would have much preferred the author/date citing format for this paper because it is important for the reader to recognize that most of the discussion is about what is happening now, not a hundred years ago.

I am sad to report that my wife died suddenly on February 4th, leaving me almost totally unable to refocus on the paper. Despite the problems, I hope the paper is okay. It's a subject in which there is rapidly expanding interest.

Sincerely, [signed]

Ms. Lubick acknowledged receipt of the manuscript (March 2nd), noting that it "is estimated to be 33 pages in length; as it goes through the editing process, we will make suggestions for shortening the length if necessary." Some time later, I received the comments on the manuscript by the editor and the one outside reviewer. I was pretty pleased with both sets of comments. First, those by the Editor:

Defoliart

This is a wonderful contribution, destined, I think, to become a citation classic within the field of cultural entomology. The coverage of the topic is thorough and will provide for *Annu. Rev. Ent.* readers access to a literature that would otherwise be difficult to locate. The central thesis, that Western attitudes and bias can have detrimental impacts on developing nations and economies, is well argued and well supported. If there is a problem with the manuscript, it is that it exceeds page limits for the journal. I've made some suggestions as to text that can be excised without compromising readability (actually, removing the vaguely racist sections of Riley's story on p. 43 improves the text, and some speculative or unattributed passages can be removed) and have also provided alternative wording in places to reduce length.

The outside reviewer's comments were also pretty satisfactory:

DeFoliart has written an article that is easy to read and will serve as a real resource for people who are either casually or seriously interested in this topic. It

presents historical and recent patterns of use and integrates those with current agricultural and cultural climates.

My only substantive comment is that it should be noted that the leaf cutter ants consumed are the large alates. This is not clear from the text.

Regarding its length: I have suggested about 3 manuscript pages of simple cuts. There are numerous possibilities for cutting some of the longer quotes, but I enjoyed many of these and found them difficult to trim.

This reviewer had the same trouble I did. I knew those quotes were long, but I just found them hard to cut anyway. So it was nice to find that the reviewer had the same trouble. I returned the edited manuscript to Ms. Lubick on May 18th. One never knows just what problems one may run into in the final stages of polishing off a manuscript. The second paragraph of my letter to Ms. Lubick provides a good example:

Regarding the current names of the two Congos. It took three phone calls to the campus to come up with what apparently are the correct names at this moment anyway. The former Zaire is now the Democratic Republic of Congo or sometimes referred to as Congo – Kinshasa. In the ms. (p. 6), I have called it Democratic Republic of Congo (Kinshasa) which should remove any doubt. The former Republic of Congo is now the Congo Republic, or sometimes called Congo – Brazzaville. In the ms. (p. 9) I call it Congo Republic (Brazzaville).

By the way, the final published article had 28 pages.

The Encyclopedia of Insects

The letter inviting participation in this endeavor was from Charles R. Crumly, Ph.D., Senior Acquiring Editor, Academic Press, dated June 21, 2000:

Dear Prof. DeFoliart:

I am pleased to announce that Academic Press is now developing an important reference book entitled the **Encyclopedia of Insects**. This large one-volume work will provide a comprehensive, scientifically sophisticated overview of insect science to an audience of college students in the sciences and college educated non-scientists with an interest in insects.

All of the myriad areas of interest to entomologists and to other scientists and students who are interested are to be covered by the encyclopedia, including Major Groups and Notable Forms; Anatomy and Physiology; Behavior and Life History; Ecology and Evolution; and others. This collected body of knowledge will be presented in an uncompromising manner that is still accessible to the general reader. The published encyclopedia will include nearly 300 entries and about 1,200 pages, and it will also feature numerous illustrations, including many in color.

I am especially gratified to be working with outstanding editorial leadership: Vincent Resh (University of California, Berkeley) and Ring Carde (University of California, Riverside). They have recommended that we invite you

to join us as a contributor to the encyclopedia. We would be honored if you would agree to submit an article for this work, entitled:

Food, Insects as

.....

I looked up the word “uncomprising” as I was pretty sure I hadn’t run into that one before. Also, it got redlined on my computer screen even before I finished typing it in (which doesn’t mean a whole lot because my computer doesn’t spell any better than I do, even if as good). It wasn’t in the dictionary, though, which is a big one. So to get to the point, I think the word was supposed to be “uncompromising.” The remainder of the above letter consisted merely of information for authors.

I had my manuscript ready by November 6, 2000 as indicated by the following letter to Gail Rice, Senior Editor, Reference Books, Academic Press:

Dear Ms. Rice:

Enclosed is the manuscript of “Food, Insects as” for inclusion in the Encyclopedia of Insects. It is 19 pages double-spaced, including the Bibliography. Additionally there is one figure. Also enclosed is the diskette and the Checklist.

Relative to the Checklist, I did not include a glossary. It seemed to me that there aren’t any terms that require defining, especially as this is part of a work like the Encyclopedia.

I found it difficult to get by with only one opening paragraph defining the topic. It turned into five paragraphs of introduction which I hope maybe isn’t a big problem.

I didn’t think it is probably necessary to go after “permissions” as my longest quotation is only four lines (twice).

I hope the manuscript is satisfactory. With my topic and only six pages, it was tough deciding what to include and what to leave out. But I guess most of the authors will have that problem.

Sincerely, [signed]

As indicated above, the original letter of invitation had told authors to limit it to six pages.

Miscellaneous Other Opportunities

It simply wasn’t possible, from the start, to say yes to every opportunity. I had to say “no,” with genuine regret, to a third invitation to an ESA Branch meeting plenary symposium. We had to say “no,” with regret, to another Encyclopedia. In 1992, we were invited to write an article for *Scientific American*. The first and last paragraphs of the letter, written by Jonathan Piel, are quoted:

Dear Dr. DeFoliart:

Would you care to write an article for Scientific American about the significance of entomophagy? My colleague John Rennie, who very much enjoyed your talk at the centennial banquet of the New York Entomological Society, suggested that you would be an engaging author. We think the subject would be of interest to our readers, and we hope you will consent to write it in our behalf.

.....

We would be pleased to have an article by you on this intriguing subject. I look forward to hearing from you.

Sincerely, [signed]

On August 27, 1992, I wrote to Mr. Piel thanking him for the invitation, saying that I would very much like to write such an article, but that I could not do it right then. I gave specifics as to why I couldn't do it right then. I closed, saying, "I very much appreciate being asked to write for *Scientific American* and hope that it will be possible to do so sooner or later." The reader should realize that *Scientific American* pays \$1,000 for an article. I heard back from Mr. Piel, dated September 2, 1992: "We would be happy to wait for a manuscript until further developments warrant a return to the subject." Unfortunately, we never got back to it.

Chapter 13. Trying to Formalize Outreach – With Some Not-So-Fond Memories of the Center for Biology Education

What was the Center for Biology Education? In 1990 it was a new campus entity created from funding by the Howard Hughes Medical Institute. In a letter March 5, 1990 to department chairs (the chair of Entomology at the time was Chuck Koval), Louise Liao, Scientist/Administrator said among other things: “The Center for Biology Education would like to encourage you and your colleagues to develop your own creative approaches to improving biology education. . . . Any member of the UW community, including faculty, staff, graduate students and undergraduate students, may apply for grants of up to \$15,000.” Sent with the letter were several booklets describing the new grant program, “designed to provide both the stimulation for innovative ideas and the funds to reduce them to practice.”

By letter of September 24, 1990, Dr. Liao acknowledged receipt of two, not one but two, proposals from me to the Center for Biology Education. In one, I asked for a budget of \$10,882, in the other only \$5,400, thus coming very close to staying under \$15,000 for both. With retirement just around the corner, my thinking for the future had been shifting away from research and more toward educational outreach, so the C.B.E seemed made to order for us. In fact, because of the timing, I wouldn't be surprised if it maybe had occurred to me when I first heard about the C.B.E., that it had been placed at the U.W. by a Higher Being just so we could continue our good work. On October 12, 1990, I heard again from Dr. Liao:

Dear Dr. DeFoliart:

Thank you for submitting your proposals, “The Cricket as a Small Animal System for Biology Courses” and “Educational Outreach Program on Insects as a Food Resource.” I am sorry to inform you that we will not be funding your requests. Nonetheless, we would like to encourage you to submit revised proposals that address the concerns of the two review panels. The reviewers' comments are enclosed. . . .

There were two more paragraphs, but, after reading the first paragraph, anything below could be, to me, nothing more than idle chit-chat. Actually, the losers were informed that we could get help in addressing the reviewers' concerns as we drafted our revised proposals. The reviewers' concerns about my big proposal, the one asking for all of \$10,882, and titled, “Educational Outreach Program on Insects as a Food Resource, were stated as follows:

The CBE is apparently being asked to fund the continued production, distribution and research related to the Food Insects Newsletter. It seems obvious that the Newsletter fills a role in the larger international agricultural/nutrition community. At this time we are not recommending funding of the proposal. We do, however, feel that there may be educational outreach and/or materials development related to insects as a food resource that the CBE would be willing to support. These could include specific teaching activities that could be used with elementary, middle, high school or university students. The primary mission of the CBE is to

provide seed money for new projects that have some potential to continue beyond CBE funding. Professor DeFoliart may want to discuss ideas about rewriting this proposal with members of the CBE Steering Committee, particularly, Raymond Kessell, Jim Stewart and Dan Young.

The review panel's concerns about our lesser proposal, the one for only \$5,400, titled "The Cricket as a Small Animal System for Biology Courses," were stated in greater detail, and those concerns will be stated and addressed specifically in my revision of the proposal. The first and last paragraphs of their critique, quoted below, indicated they thought the project had some potential:

Although we are not able to recommend funding the proposal as submitted, we are very interested in some of the ideas presented. We would like to offer the PI a month to resubmit the proposal, taking the following questions and concerns into consideration:

.....

As soon as these items have been addressed, we will be anxious to evaluate the entire packet and consider it for immediate funding. If the PI is not able to respond in the next month, we would still strongly encourage him to resubmit for the February deadline.

In the middle of all this, I had a letter from Dr. Liao, dated October 31, 1990. Dear Dr. DeFoliart:

On behalf of the Center for Biology Education, I would like to invite you to our Sharing Conference, to be held on Thursday, November 15, from 12:30 to 4:30 p.m., on the 14th floor of the WARF Building. An important objective of the Sharing Conference is to assess and improve our grant program. The agenda is enclosed.

The Sharing Conference will include final reports from several recipients of the Center for Biology Education grant program. Ample time is allotted for evaluations and discussions, as we are interested in cooperative interactions among individual projects. We encourage you to use the refreshment breaks to share your own initiatives with other participants. Please feel free to contact the Center for Biology Education staff or any of the grant recipients to follow up on ideas expressed during the Sharing Conference.

We are hosting a Fall Conference on Tuesday, November 13, from 12:30 to 3:00 p.m., also on the 14th floor of the WARF Building. The purpose of the Fall Conference is to highlight ongoing activities and receive input with regards to our future directions. The agenda is enclosed.

We encourage you to attend as many sessions of both conferences as your schedule permits. We appreciate your continued involvement with the Center for Biology Education.

That was signed, “Sincerely.” Well, actually, about the last thing I felt I needed at the moment was a “sharing conference.” I had shared about everything I could think of with their committees already. In fact, I thought I could probably critique the agenda of their Fall Conference at least as expertly as their panels had critiqued my proposals. To begin with, three refreshment periods in a three-hour program? And only 30 minutes each for four concurrent small-group discussions? [Maybe give more detail for this conference – even copy in entirety?]

On November 8, 1990, I wrote to Dr. Liao as follows. “Dear Dr. Liao”:

Thank you for your letter of October 12th notifying me that neither of our proposals to the CBE were funded, but inviting us to resubmit without waiting for the next regular submission deadline.

Enclosed are four sets of an Addendum to our proposal, “Educational Outreach Program on Insects as a Food Resource.” I did talk to Dr. Young as you suggested, about both proposals, and also tried to contact Dr. Stewart several times by phone regarding this one, but was unsuccessful. The gist of the Addendum is that, although biology teachers have not been a specific target of our outreach effort, we are finding that teachers at all levels are making specific use of the educational materials that the program generates.

We have been more undecided about whether to resubmit the Cricket Proposal, but recent “hands-on” experience at Van Hise School have rejuvenated our enthusiasm and I expect to submit an Addendum to that proposal within a week or two.

Signed “Sincerely.” What I had addressed to the Committee as my “revision” was just over three pages long not including the budget (slightly increased from the original to \$11, 624) and loads of sheets of documentation, 33 in all, most of them communications of one sort or another from people involved in one way or another, at one level or another in “education.” I don’t know if it shows in the Addendum, but I hadn’t been in such a mood since my battle with the Ag College Curriculum subcommittee. It was dated November 7, 1990:

To: CBE Committee on Outreach in Biology Education
From: Gene R. DeFoliart, Department of Entomology
Re: Addendum to the proposal, “Educational Outreach Program on Insects as a Food Resource”

I want to thank the Committee for considering our proposal. Although not recommended for funding as originally presented, the Committee’s critique suggested that there may be educational outreach and/or materials development related to the subject that the CBE would be willing to support, and “these could include specific teaching activities that could be used with elementary, middle, high school or university students.” Actually, I believe that the project is already involved in such specific activities, but it may have been somewhat masked in the original proposal by my focus on validating the concept and the broader public education effort. Rather than revising the text of the original

proposal, this Addendum may be a better way of clarification and I hope this is satisfactory to the Committee.

In responding to the Committee, I have attempted below to distinguish the specific educational and teaching activities of the project as I perceive them, and to document (via attached examples of correspondence) the specific teacher/student situations in which the project is having an impact:

Specific Activity #1: The most important educational function of the project has been and continues to be the development of a new concept that is both biologically interdisciplinary and intercultural (intercultural globally, but counterculture in the U.S.). This concept and the expanding Resource File on which we continue to work was described in detail in the original proposal. I think it unlikely that anyone would argue that, in biology education, the development of new concepts is less important than the development of new teaching techniques, or that the attempted introduction of a new concept is not a “specific teaching activity.”

Specific Activity #2: Three main mechanisms have been and continue to be used in introducing the concept, the mass media, articles in scholarly publications, and The Food Insects Newsletter. Examples of all three were appended to the original proposal. All three are helping us to identify/create the user market for these educational materials both within the public-at-large and within the academic community, and within the latter not only researchers but teachers from the elementary to the university levels. The articles and the Newsletter are also used as educational tools and we have ample evidence in the form of voluminous correspondence and requests that they are receiving a warm reception in the biological academic community, including at the highest intellectual levels, e.g., attached notes from Professors Marmorosch of Rutgers University and Blum of the University of Georgia (both of whom are members of the National Academy of Sciences). There is also evidence from numerous sources that these educational materials are successfully bridging the concept to the social sciences, e.g., attached note from Professor Jack Kloppenberg, UW Rural Sociology.

Specific Activity #3: Responding to requests from university professors for information and materials for use in their courses, e.g., attached letters to/from Professors McClelland of UC-Davis, Kaya of UC-Davis, and Burgett of Oregon State University. The Newsletter and other materials are also being used in courses at the Univ. of Utah, Idaho, Montana State, Ohio State, Miami Univ. (Ohio), Ripon College, UC-San Francisco and undoubtedly at others that we don't know about.

Specific Activity #4: Responding to requests from elementary, middle and high school teachers and students, e.g., attached correspondence to/from Janesville, Wis.; Marshall, Wis.; Lake Villa, Ill.; Meriden, Conn.; Gaylord, Kansas; Big Horn, Wyo.; Ishpeming, Mich.; Rochester, Mich.; Jackson Heights, N.Y.; and Unionville, Ontario. Joyce Miranda of Unionville is a middle schooler who called me twice last week after reading an article in Omni magazine, one of the many examples of the value of the media campaign in helping to create/identify the user market.

Specific Activity #5: Responding to requests from a variety of organizations that are involved with public education at all age levels, e.g., letters from the San Francisco Zoological Society, the Space Coast Science Center at Melbourne, Florida, the Cleveland Museum of natural History, and Sonoran Arthropod Studies at Tucson, Arizona.

Specific Activity #6: We are initiating a service to teachers in the next issue of the Newsletter that is intended to provide sources of specimens and other visual aids of use in teaching this subject, e.g., attached excerpt from the November 1990 Newsletter (now in preparation).

Specific Activity #7: Responding to libraries that request The Food Insects Newsletter, three at the UW being Steenbock, Institute of Environmental Studies and the State Historical Society, e.g., letter to Gilbertson.

Specific Activity #8: Working as a resource person with UW students enrolled in various courses who undertake projects in this subject area. There have been at least 8-10 who have done term papers or other class papers, e.g. note from Tara Thiede, also one L. & S. student who used this subject for his presentations as a member of the UW debating team (he won a lot of them, too), and two Senior women in Agricultural Engineering who undertook 4-month research projects for their Senior Thesis credit.

Specific Activity #9I developed and teach a one-credit course, "Human Use of Insects as Food/Animal Feed" (Ent. 324). The Resource File mentioned under Specific Activity #1 serves as the basis for this course, and the sequence of topics covered is as shown in the attached Book Outline. Time permitting I hope to have this in the form of a class manual before the next offering of the course during the fall semester, 1991. I then plan to convert it into a text and reference book.

Specific Activity #10: As part of an exhibit (that included live insects) set up by Chris Merritt at Van Hise School on the interesting and diverse biology and beneficial aspects of insects, we included a segment on insects as food. Merritt was functioning as a member of the Science Committee, a group of parents that includes professional scientists and educators who are interested in seeing students exposed to a higher quality of biology at the middle and elementary levels. This exhibit is now in its fourth week, and it has been so well-received that we are considering working up a more "thought-through" exhibit design that would include the "insects are edible" angle as one of the focus points. If so, this endeavor would be split between this project and a proposal (on crickets as a laboratory animal for school biology courses) that we are revising for the Instructional Materials Development Committee of the CBE.

In its critique, the Committee mentioned that, "It seems obvious that the Newsletter fills a role in the larger international agricultural/nutrition community." If that is true, I believe it is simply a testimonial to the validity of the concept and to the success of the efforts cited above in introducing it to the academic community both here and abroad. It appears, as mentioned in the original proposal, that the concept is beginning to acquire a momentum of its own which will permeate to all age levels of biology education, and with recognition of its potential implications not only for agriculture and

nutrition but for ecology, environment and economics. The volume of feedback relating to these latter areas is steadily increasing, e.g., the three attached letters received just within the past week from the Environmental Defense Fund, Crop Protection (a journal), and The North-South Connection.

Up to now, this outreach program has been conducted without any formal budgeting except for a small grant from the Curricular Revitalization Project for development of the course, Ent. 324. Most of that went for foreign language translations. In this proposal we are asking only for interim funding to keep the project going while we look for longer-term funding from outside sources. A slightly revised budget page is attached.

Again, we appreciate the time that the Committee has spent reviewing both the original proposal and this Addendum. I hope the Addendum makes it clearer that the materials generated by the project are being used by teachers and students in classroom settings, and there is every indication that such use will steadily increase and with spin-off innovations of its own.

[Documentation, Specific Activity #2]

From Professor Karl Maramorosch, Department of Entomology and Economic Zoology, Rutgers University, New Brunswick, N.J., May 3, 1989:

Dear Dr. DeFoliart: Congratulations on your excellent Newsletter! I like its contents and your sense of humor. Keep up the good work. Cordially, (signed),
enc. \$5.00

From Professor Murray Blum, Laboratory of Chemical Ecology, Department of Entomology, University of Georgia, Athens, Ga., March 7, 1990:

Dear Gene, A small contribution for the publication of your excellent Newsletter. All the best. Cordially, (signed)

To Professor Murray Blum:

Dear Murray: Thanks very much for the contribution of \$10 toward the costs of printing and distributing The Food Insects Newsletter. Contributions such as yours are becoming more welcomed than ever recently, since the Department of Entomology, which has up to now partially subsidized postage, is getting increasingly balky about the size of my postage bills. Frankly, my strong suspicion is that I may be losing influence since I announced that I would retire as the medical entomologist by the end of the year, and do my new thing (food insects) as an emeritus professor. I decided that 40 years of medical entomology was maybe enough and I needn't try to keep up on two fronts any longer.

Again, thanks for the check and very best regards. Sincerely, (signed)

From Professor Jack Kloppenberg, Rural Sociology Department, U.W.-Madison, July 20, 1989:

Gene – What a lovely newsletter. Very nicely done. Put me on the mailing list. Congratulations on all the publicity recently. All the best. (signed)

[Documentation, Specific Activity #3]

From G.A.H. McClelland, Senior Lecturer, Department of Entomology, University of California, Davis Calif., February 7, 1990:

Dear Gene: It was good meeting you at San Antonio. I want to thank you for sending the copies of the Food Insects Newsletter. This is a storehouse of information.

Although as you know, I am not actively researching on this matter, it gets a very special place in my Insects and Human Affairs course that I teach here to about 300 students per year. Already, three of my current students are reading the newsletters with amazement.

Thank you again. I am enclosing the form to be put on the mailing list. I hope my “spreading the word” is cause enough for me to be on the list. Sincerely, (signed), Enclosure

To Dr. Harry Kaya, Department of Entomology University of California, Davis, Calif., September 19, 1989 (from DeFoliart):

Dear Harry: Enclosed are the slides of several edible insects. Hope your class enjoys them!

Slide No.

1-3) Chapulines (grasshoppers) in the market at Oaxaco, Mexico.

4) Gusano blanco del maguey [skipper or megathymid butterfly larva (*Aegiale hesperiaris*)] in restaurant in Mexico City (this was in Bull. Article).

5) Dried mopanie worms (the saturniid caterpillar, *Gonimbrasia belina*) as purchased in

a village market in Zimbabwe (also in the Bull. Article).

6) Roasted *Atta* (leafcutter) ant abdomens as purchased in Bogota, Colombia.

7) Mormon crickets (*Anabrus simplex*) at bait (used extensively as food by

western

North America tribes).

Sincerely, (signed)

From Professor Michael Burgett, Oregon State University, Corvallis, Oregon, September 27, 1990:

Dear Dr. DeFoliart: My sincere thanks for sending along past issues of The Food Insects Newsletter. The materials contained in it will provide a wealth of information to enhance my presentations on entomophagy in the classes I teach. My newly found, and less than deserved fame, accorded me by the American media as a bug-eater, will soon fade (but taking slightly longer than the 15

minutes A. Warhol gives us. As an aside, I have been contacted by the game show TO TELL THE TRUTH and will be flying to Los Angeles in a few weeks for a taping session. It is my hope that I will be able to convey the serious nature of entomophagy, while at the same time satisfying the curiosity of the T.V. masses.

I also enclose a short semi-recipe of my favorite insect dish in hopes that you might consider it for a future issue of the newsletter. Again my thanks for your professional courtesy.

With personal regards, I remain;

Yours truly,
(signed)

[Documentation, Specific Activity #4]

To Mrs. Neumann, Harrison School, Janesville, Wisconsin, October 7, 1988:

Dear Mrs. Neumann: Professor Koval passed along the request from two of your students, Katie Emery and Natalie Schumacher, for information on the nutritional value of insects.

There is no single good source of such information, so I have xeroxed several pages of text and two tables from a long manuscript that is awaiting publication in the Bulletin of the Entomological Society of America.

One book that would be of some help if it is in your library is, "Butterflies In My Stomach, or Insects in Human Nutrition," by Ronald Taylor (Woodbridge Press Publishing Company, Santa Barbara, California 93111).

I hope that you will be able to glean some information that may be helpful from the enclosed pages. The use of insects as food is an important subject, and I'm glad your students are interested. My telephone is (608) 262-5958. Please don't hesitate to give me a call if you have questions that I might be able to answer.

Sincerely,
(signed)

P.S. As an afterthought, I have also enclosed a copy of the Food Insects Newsletter, the first issue of which was mailed out in July. It may contain information of interest.

To Mr. Tom Reisenauer, Marshal Public Schools, Marshall, Wisc, June 19, 1990:

Dear Mr. Reisenauer: The enclosed information on periodical cicadas was Xeroxed from Illinois Nat. Hist. Surv. Reports #297 (May 1990) which arrived in the mail late last week. It's probably too late to do you any good, but since I don't know how much information you were able to get from Phil Pellitteri, I thought I would send it along anyway. At least you'll be ready for them when they show up again in 17 years! Sincerely (signed)

To Missy Mcroy and Mrs. Zeske's Reading Class, Gavin North School, Lake Villa, Ill.,
June 6, 1990:

Dear Missy Mcroy and All: In response to your letter received May 29, I have enclosed an article published in the May 27th *Chicago Sun Times*. It contains some general information about the use of insects as food around the world (almost everyone uses them except we North Americans and Europeans), and some easy recipes for the 17-year cicadas that are buzzing all around Illinois right now.

Also enclosed is a typed manuscript, awaiting publication as part of the 100th Anniversary celebration of the Entomological Society of America, which may contain material of interest.

Finally, there is a recipe book containing about 80-90 recipes based on insects, mainly the mealworm (larva of a beetle), cricket, and honeybee larvae and pupae. The title is "Entertaining with Insects: Or, The Original Guide to Insect Cookery," by Ronald Taylor and Barbara Carter, published by Woodbridge Press Publishing Company, Santa Barbara, CA 93111 (1976). It is out-of-print now, but there might be a copy in the library near you.

There are so many insects, it's beyond the scope of a mere letter such as this to say which ones should not be eaten. Most can be safely eaten, but nevertheless, you should have guidance from someone who is locally knowledgeable about insects to be sure that you don't eat something that should be avoided. Certainly, the cicadas are okay to eat.

I hope the enclosed materials will be helpful and good luck on your project.

Sincerely,
(signed)

Newsletter Address Form returned by Jon Wallace, c/o Meriden Alternate School, Meriden, CT, no date. Areas of interest: High school and college science teacher – interested in exposing students to the idea of insects as food.

From Gil Henning, Gaylord, Kansas, January 26, 1989:

Dear Sir: I am an 8th grade student at Smith Center Jr. High School, Smith Center, KS. For my Science fair project, I would like to explore innovative food alternatives for third world countries. My father heard on a newscast that you have a recipe for fried honeybees and Greater Waxmoth larvae. Could you tell me how you fry them, so I could try it?

If you have any information on innovative foods of any kind, I would be interested in receiving it in the mail. I want to read all I can on the subject. Are there any books I can get from a library?

Thank you for your help.

(signed)

To Ms. Penny Mentock-Barkan, Big Horn, Wyoming, September 7, 1990:

Enclosed is the article I mentioned on the phone and a complete set of The Food Insects Newsletter, except for Vol. I, No. 1. There are recipes scattered throughout the various issues, although not very many, and a book of recipes based on insects is reviewed in Vol. II, No. 1. Unfortunately, the book is out-of-print.

I hope the materials may be of help to the “Interdisciplinary Teaching Unit,” and if I can be of further help, don’t hesitate to let me know.

Sincerely,
(signed)

To Ms. Sara Moyle, Ishpeming, Michigan, October 3, 1990:

Dear Ms. Moyle: In response to your request, enclosed are several issues of The Food Insects Newsletter. I have also enclosed a reprint of an article, “The human use of insects as food and as animal feed,” which may be of interest. I hope these will be of use with your middle schoolers. Let me know if I can provide any additional information that might be of help in this subject area. Sincerely,
(signed)

To Mr. Ed Byrnes, Rochester, Michigan, August 23, 1990:

Dear Mr. Byrnes: In response to your telephone request, enclosed are four recent issues of *The Food Insects Newsletter*. There is no charge. Inasmuch as I understand you are a teacher, I have also enclosed a reprint of an article, “The human use of insects as food and as animal feed.” I hope these will be of use. Sincerely, (signed)

To Mr. Garry Hare, Science Department, Joseph Pulitzer Intermediate School, Jackson Heights, N.Y., October 9, 1990:

Dear Mr. Hare: As per your request, enclosed is the current issue of The Food Insects Newsletter. Also, as you are a teacher, I have enclosed all of the Newsletter issues except Volume I (1988), the supplies of which are now quite limited. Also enclosed is a reprint of an article, “The human use of insects as food and as animal feed.” I hope this information will be of interest to you and your students. Sincerely, (signed)

P.S. Vol. I, No. 2 is also enclosed.

To Ms. Joyce Miranda, Unionville, Ontario, Canada, October 23, 1990:

Dear Joyce: I enjoyed talking with you this morning and hearing about your planned paper on insects as food. I have enclosed a complete set of the Food

Insects Newsletter and a copy of the article, “The human use of insects as food and as animal feed.”

I hope these will be useful in preparing your paper; and if I can be of further help, do not hesitate to call on me. Good Luck! Sincerely, (signed)

[Documentation. Specific Activity #5]

From [Ms.] Leslie Saul, Insect Zoo Director, The San Francisco Zoological Society, San Francisco, California, January 17, 1989:

Dear Dr. DeFoliart: Thank you very much for the copy of The Food Insects Newsletter. It is of great interest to us that such a newsletter be published. Once a year we promote insects as a protein source at our open house, “What’s Bugging You?” Day. The topic is always a popular one!

Best of luck with your publication. Sincerely, (signed)

From Kathleen Menzies, Education Coordinator, Space Coast Science Center, Melbourne, Florida, April 6, 1989:

Dear Professor DeFoliart: An article, in USA Weekend dated January 27-29, 1989, telling of your work with insects as an alternate food source has recently come to my attention. I am most interested in this topic.

Our science center is a hands-on facility and we love to introduce the public to new ways of thinking. Insects as a food source is the kind of concept I am looking for as part of a World Environment Day exhibit.

I would like to serve a food made of insects. Any information, recipes, photographs or resources that you might be able to forward to me would be greatly appreciated. We will acknowledge you in our display and promote your work.

Thank you for your assistance. Sincerely, (signed)

From Ellen V. Walters, Supervisor, Exhibits Division, The Cleveland Museum of Natural History, Cleveland, Ohio, November 16, 1988:

Dear Dr. Defoliart: Your interest in edible insects came to my attention in an article written by Dianne Molvig for the October 18, 1988 Christian Science Monitor. As an exhibit designer at the Cleveland Museum of Natural History, I found it most interesting and full of potential for an informative, as well as amusing, exhibit.

I would like to illustrate the exhibit with examples of preparation and gathering by different cultural groups as mentioned in the article.

Some of the insects mentioned would be available to me from the Museum Entomology Collection, but I was interested in knowing if you have written papers on this subject that would give me additional information on which I could develop my theme, or perhaps some book titles or publications I might search out

in the library. I am aware of one title "Entertaining with Insects" by Taylor and Carter.

Any consideration you might give this request would be appreciated.

Sincerely,
(signed)

From Steve Prchal, Founder, Director, Sonoran Arthropod Studies, Inc., Tucson, Arizona,
February 14, 1989:

Dear Dr. DeFoliart: Thank you for sending us the first two issues of The Food Insects Newsletter. We read it with great interest and are most interested in continuing to receive the publication for our library. Is it possible to reprint articles from your fine newsletter in Backyard Bugwatching? I have enclosed our most recent issue and a brochure about SASI so that you may know more about the organization. You or some of your colleagues may be interested in joining nearly 1000 others around the country who support SASI's mission and programs.

Founded in 1986, SASI brings together the general public and both amateur and professional entomologists who share common ideas and goals in environmental education and conservation. SASI's programs focus entirely on the arthropods (90% of life on earth) and their relationships with plants, other animals and humans. Through living exhibits and a variety of educational programs, SASI encourages its members and Tucsonans to take a close look at the fascinating world of the arthropods.

Our goal is to develop an Arthropod Discovery Center in Tucson Mountain Park. A site in this pristine Sonoran Desert setting has already been secured and plans for butterfly gardens, nature trails, exhibits and research facilities are underway. 1989 will bring exciting Members programs and other activities at the Center.

SASI's Insect Zoo, currently located at 2437 N. Stone Avenue, features a variety of living Sonoran Desert arthropods including leafcutter ant colonies, aquatic insects, honey bee colony and potentially dangerous insects and arachnids. Selections from SASI's arthropod toy, stamp and specimen collections are also exhibited. Admission is \$1.00 for ages 3 and older; admission is free for SASI Members. Exhibit hours are 11:00 am to 4:00 pm, Tuesday through Saturday.

Members of SASI, receive Backyard Bugwatching, our quarterly magazine featuring informative articles by SASI Members. The current issue includes articles about insect philately, termites and egg parasitism avoidance. Additional membership opportunities include special field trips, lectures, participation in volunteer projects and unlimited admission to exhibits.

Thank you for keeping Sonoran Arthropod Studies, Inc. on your mailing list. Please feel free to call me at (602) 884-7274 if you wish to discuss any aspect of SASI or how we might interact.

Sincerely,
(signed)

[Documentation, Specific Activity #6]

[For the November 1990 Newsletter]

A Tentative Venture into Buying, Selling, Exchanging

From correspondence and other feedback, it is evident that the Newsletter and related materials from the FIRDP (Food Insects Research and Development Project) are used by many readers as a source for introducing or strengthening presentations in their biology courses on the use and concept of insects as food. This is happening not only in university courses, but also at the elementary, middle, and high school levels.

The editor teaches a 1-credit course here at the University of Wisconsin on the human use of insects as food/animal feed, and the course is spiced up considerably by having available (thanks to the generosity of a number of people in Africa, Asia and Mexico) some good examples in the form of dried or alcohol-preserved specimens, color slides and prints. Although the variety of examples we've accumulated so far is very small compared to the great variety of species consumed, these visual aids elicit great interest from students.

It seems that the Newsletter might perform a valuable service by offering to serve as a means of contact for those wishing to buy, sell or exchange materials that would be useful as teaching aids. Needless to say, 99% of the pertinent species (and especially the appropriate life stages) are not yet stocked by the biological supply houses, so there is no commercial source. For those of you who might wish to advertise your needs or offers in the Newsletter, remember that space is at a premium. So please keep them brief. We'll see how this works. Who knows?; this might prove to be a lucrative source of supplementary income for some young entrepreneurs who happen to be in the right locations.

[Documentation. Specific Activity #7]

To Ms. Jean Gilbertson, Senior Academic Librarian, Steenbock Agricultural Library, UW Campus, February 16, 1990:

Dear Jean: Enclosed is a set of The Food Insects Newsletter, five issues to date. We will put Steenbock on the mailing list in care of whoever you say.

Again, thanks for spending an hour with my Entomology 324 class on how to conduct computerized literature searches on our subject matter. It is very helpful and very much appreciated.

Sincerely,
(Signed)

[Documentation. Specific Activity #8]

From Tara Thiede, UW student, undated:

Dr. DeFoliart, I'm interested in writing a paper for an Ag J class about the marketing strategies for insect products. I'm taking this angle on insects as a food resource because too many stories have been written about the insects as food in general.

I have a full schedule this afternoon but would like to contact you by phone to set up an interview (possibly Thurs. afternoon?).

Thank you for your time. (signed)

[Documentation. Specific Activity #9]

Title: The Human Use of Insects as a Food Resource

Chapters:

- 1) Introduction and Overview
- 2) The Higher Classification and General Bionomics of the Insect Groups Used as Food
- 3) Insects Formerly Used as Food by Indigenous Populations of North America North of Mexico
- 4) Food-Relevant Biology of Insects in North America
- 5) Insects Used as Food In Mexico
- 6) Central America and Caribbean Islands
- 7) South America
- 8) Food-Relevant Biology of Insects in Latin America
- 9) Insects Used as Food in Southern Africa
- 10) Central and East Africa
- 11) Coastal West Africa South of Latitude 15 N
- 12) North Africa and the Middle East
- 13) Food-Relevant Biology of Insects in Africa
- 14) Insects Used as Food in South-Central Asia
- 15) Southeast Asia, Indonesia and the Philippines
- 16) Eastern Asia
- 17) Food-Relevant Biology of Insects in Asia
- 18) Insects Used as Food in Australia and the Southwest Pacific
- 19) Food-Relevant Biology of Insects in Australia and the Southwest Pacific
- 20) Western Attitudes and Research on Insects as Food – Europe
- 21) Western Attitudes and Research – North America
- 22) Western Research on Insects as Animal Feed
- 23) Toxic and Allergenic Hazards Posed by Insects as Food
- 24) Broad Spectrum Technologies of Potential Use in Manipulating Edible Insect Populations
- 25) The Agro-Ecological and Economic Implications of Greater Use of Insects as Food

[Documentation. Specific Activity #10 and letters from Environmental Defense Fund, the journal Crop Protection and The North-South Connection]

Not duplicated here.

On November 13, 1990, I wrote to Louise Liao:

Dear Dr. Liao:

Enclosed are four sets of an Addendum to our proposal, "The Cricket as a Small Animal System for Biology Courses." This is submitted as an Addendum, rather than a revision of the original text, after discussion with Dr. Young. I hope we have responded satisfactorily to the Committee's concerns (Instructional Materials Development). We very much appreciate being asked to resubmit without waiting for the next regular deadline.

Sincerely,
(signed)

The budget for this one was also increased, even more substantially, to \$8,290.

To: CBE Committee on Instructional Materials Development

From: Gene R. DeFoliart

Re: Addendum to the proposal, "The Cricket as a Small Animal System for Biology Courses"

I want to thank the Committee for considering my original proposal and inviting me to resubmit without waiting for the next regular deadline. I believe that the questions raised can be better addressed in the form of an Addendum to, rather than a revision of, the original proposal, and hope that this is satisfactory to the Committee. Before responding to the specific questions, I believe it would help to provide some additional descriptive detail as to how the proposed system would work.

The school cricket system that we would like to develop is based on maintaining a sequence of small breeding colonies that would produce more than 1,000 cricket eggs per day throughout the school year. The fecundity of the cricket at 32-34°C is shown in Figs. 1 and 2 (Barbara J. Nakagaki, PhD Thesis, 1990) and Table 1 (Megha Parajulee, M.S. candidate, pers. comm., 1990). Approximately 1200 eggs were produced per cricket in Nakagaki's studies and nearly 1500 eggs per female in Parajulee's studies. The data in Table 1, based on a cohort of initially 50 freshly emerged females and 50 males, includes the mortality rate (low) that occurs among adult crickets during their fecund period.

As shown in Table 1, nearly 70,000 eggs were produced over a period of 44 days, with 64,460 of them produced during 27 days of high egg production (Days 6-32). Because nymphal development is asynchronous, new females appear in a cohort over a period of about 2 weeks (see original proposal), thus the

period of high egg production would be extended from about 4 weeks to about 6 weeks but with a lower daily production than shown in Table 1. Thus, starting a new breeding colony cohort at 6-week intervals would ensure a steady supply of cricket eggs which could be reared to any desired stage under specific conditions for experiments of all kinds, for dissection studies, for feeding other lab animals, feeding the school mascot (depending on species) and all of the insectivorous avian, mammalian, reptilian and amphibian pets in the neighborhood. Also the crickets are edible, nutritious (rat and chick studies have been conducted) and palatable and some could be given to home economics classes for exploring previously unimagined new horizons in food preparation. Dozens of recipes are available.

The only thing wrong with the above scenario is that the above data were all obtained on crickets reared at constant high temperatures (above 30°C) under large-scale mass-production conditions with controlled RH and well-defined diets (cheap but not commercially available). Our main task during the year covered by the proposal is to readjust equipment design to small scale proportions and procedures and to redefine life table parameters at ambient temperatures. That may well be all that will be accomplished the first year with the small time allotment that can be devoted to the project under the modest budget requested. Under ambient temperatures the whole process will be slowed down, and using commercially available feed (we'll probably start with Purina Rabbit Chow, with which we've had some experimental experience), fecundity will be lowered. The high-temperature numbers (except growth rate and a few less important parameters) can easily be regained, however, by slight adjustments upward in breeding colony size. Relative to equipment design changes, our objectives include identifying and pricing commercially available plastic or glass containers (in the general size range [floor area] or 30 x 40 cm); developing a new watering system that reduces labor, reduces cricket mortality caused by drowning, and keeps water fresher; and developing a double-layered perforated floor arrangement that improves cage sanitation and therefore aesthetics (see original proposal).

Responses to Specific Questions in the Critique

1) Would all developmental stages be present at once?

Yes. The cricket life cycle (at high temperature) includes 10 days in the egg stage, 4-6 weeks in the nymphal stage and 6-7 weeks of oviposition by adults (most of it being completed in a 4-week span as shown above). If egg trays (each containing 1000 or more eggs) are harvested from the 50 pairs breeding colony and replaced at 24-hr intervals, eggs within one day of the same age are obtained. The egg trays can be refrigerated (at about 4-5°C) (an early objective is to determine how long they can be held in cool storage without appreciable loss of viability), then (by planning ahead) they can be withdrawn and incubated to produce any reasonable quantity of any life stage at any given time. Surplus eggs can be discarded or given away. To maintain a continuous supply of fresh eggs, a

new breeding colony cohort should be started (from eggs incubated and ready to hatch) at about the time the current colony enters egg production). The new breeding colony will then be coming into production as the preceding colony begins to phase out. Even without specially hatching eggs to produce specific life stages that may be needed, because of asynchrony most life stages would be present and visible at any one time in one or the other of the two breeding colonies.

2) Are there many cricket-based exercises and projects for the classroom . . . ?

As mentioned in the introduction, Polt (1971) and Thompson (1977) have described a number of simple experiments and observations on crickets. Those by Polt include: 1) Visual perception (color and brightness) using variously colored blocks, 2) Olfactory perception, 3) Visual vs olfactory stimuli, 4) Aggressive behavior in male crickets, 5) Determination of social hierarchy among males, and 6) Territorial behavior among males. Those by Thompson include: 1) Morphology of sound production (stridulation or “chirping”) in males, 2) “Left-handed” vs “right-handed” stridulation, an inherited characteristic, 3) Relationship between chirping rate and temperature, 4) Molting and metamorphosis (crickets pass through 8 nymphal instars), and 5) Effect of temperature on cuticle coloring.

Other experiments and exercises, some simple, others more complex, can undoubtedly be designed although that is not one of our objectives during the period covered by this proposal. According to Dr. Dan Young (pers. comm.), fresh crickets are highly suitable animals for some exercises requiring dissection (“nice and glistening white” when opened) compared to the large Romalea grasshoppers and other long-preserved specimens that are commonly used. Also, grasshoppers are the standard for introducing students to insect external morphology. Crickets are smaller, but very similar morphologically (and under our proposed system always available at no extra cost to the biology budget).

3) Can the cricket be utilized as a source of food for other commonly cultured biology “lab animals”?

We haven’t studied this or surveyed the literature on it, but crickets appear to be readily acceptable to most vertebrates and invertebrates that include insects in their diet (specific predators excluded). We have a lengthening list of “customers” coming into our lab, mentioning that they have a snake, or a lizard, or a bird, or some praying mantises or tropical fish, etc., and saying that they heard that we have surplus crickets. I personally have known several cricket-eating cats. Crickets are also among the live foods sold in pet stores (at a relatively fancy price for a few crickets).

4) In response to the concern (justified) about a student hourly doing most of the work, Dr. Christine Merritt, a PhD entomologist, has been added to the budget on a 20% time basis. Also, the project will have the benefit (without cost) of

peripheral input from Mr. Megha Parajulee, an M.S. candidate who is working on cricket mass-production under high-temperature conditions.

Our first objective will be to solve the equipment design problems (see above and original proposal). This will be the focus for the first 3-4 months, using crickets supplied from the high-temperature project. The focus will then turn to redefining life table parameter values under small-scale rearing at ambient temperatures, and using cricket food that is commercially available but less than optimum for growth, fecundity and food conversion efficiency. Some side questions will also be answered, such as effect of prolonged storage on cricket egg viability.

5) We have reduced the requested “Supplies” budget somewhat but are unable to be much more specific in itemizing supplies than we were in the original proposal. In redesigning equipment, we will be purchasing and testing for suitability an assortment of plastic/glass containers for use as cage units; assorted aerators, porcelain tips, plastic tubing, etc., that might be incorporated into an improved watering system; heat lamps and heat tapes to determine which, or whether either, will increase cage temperatures enough above ambient to significantly increase growth rate and thus shorten life cycle; materials yet to be determined from which (with departmental shop help) we hope to fashion a double-layered cage floor for better sanitation. Also needed will be such items as commercially purchased cricket foods, petri dishes for use as oviposition and food trays, etc. These are all small items, but we aren’t sure what else we may need once we get started on the equipment-redesign part of the proposal.

6) “We would like to have a better idea of the specific technology/products to be developed, along with a suggested plan as to how such materials might be distributed and made available to teachers.”

It is hoped that this Addendum has clearly answered the first part of the above question. The “technology/product” that we want to develop is a cricket culture system that is easily maintainable in elementary, middle, high school and college biology labs and provides a cheap, abundant source of invertebrate material for observations and experimentation. The cricket packet that we purchased from Carolina Biological, in order to see what is available, was pathetic. The equipment was shoddy and completely inadequate and not more than half-a-dozen crickets were still alive. Even those quickly escaped from the flimsy paper cage provided. If this was a fair sample of what’s available to the majority of school biology teachers around the country, it’s no wonder that the teaching of whole-animal invertebrate biology is in a sorry state.

As to the second part of the question, it would seem logical as a first step to prepare a small booklet on “the culture of crickets and their uses in school biology classes.” This could include not only the details of culturing on the scale outlined above, and specific experiments and observations of varying levels of sophistication, but instructions for dissection accompanied by good illustrations of internal anatomy and external morphology. Addresses of real cricket suppliers

should also be included. A second step would be to describe the system and the availability of the booklet in an article published in an appropriate journal such as *The American Biology Teacher*. This can't be done, however, until the proposed culture system has been developed, quantified, and shown to work within the school science milieu.

One avenue of immediate and continuing interaction will be through Chris Merritt who is a member of the Science Committee at Van Hise School. This is a group of parents, with various educational and professional expertises, who are interested in seeing a better quality of science education in our schools (see enclosure).

A revised budget is attached. The "Supplies" category is somewhat reduced, but "Personnel" is rather substantially increased.

On November 28, I again wrote to Dr. Liao:

Dear Louise:

When I turned in the Addendum (revision) to our proposal, "Educational Outreach Program on Insects as a Food resource" on November 8th, we started flagging new correspondence that was identifiably from teachers, and any other specific educational requests received.

The latter includes input and then critiquing a Discovery Channel exercise for 8th graders (critique request enclosed). Also, we had another contact from CBS television which reminds me that we originally heard from them a year or more ago regarding a possible segment on their Sunday morning children's educational program.

Requests for information from teachers and students in the past two weeks include:

- 1) A student doing a "science research project" in Cumberland, Maryland.
- 2) A teacher in St. Johnsville, New York, who teaches "an outdoor education course to teachers in the summer."
- 3) "An elementary school teacher with the Los Angeles Unified School District."
- 4) A professor in the City College of New York Department of Anthropology who includes in her Introductory Anthropology course a discussion of "entomophagy in ancient cultures and how it may serve us today in alleviating food shortages and substituting for the inefficient and ecologically harmful cattle industry."
- 5) A professor in the Department of Biological Sciences, University of Calabar, Nigeria.
- 6) A teacher in Willseyville, New York, who teaches classes on "wild edible and medicinal plants."

It would be appreciated if you would pass this on to the Outreach in Biology Education Committee as additional documentation that our project has a

continuing (and probably increasing) role specifically with teachers and students in formal classroom endeavors. Thanks.

Sincerely,
(signed)

My last letter of record to Dr. Liao (at least in my files) was dated December 17, 1990 and summarizes as perceived by me the Committee's thinking concerning my proposal.

Dear Dr. Liao:

In my last conversation with Dr. Stewart he indicated that the CBE is viewing our two proposals as, in fact, one "package." I was glad to hear that, because that's the way we look at it, and I believe it will help in any further dialogue concerning objectives and budget.

I have just completed the basic document that we will be using in seeking longer-term outside support. A copy, complete with all attachments (except those previously submitted), is enclosed, and I have sent copies to Dr. Stewart and Dr. Young. The document includes all of the objectives in our two former proposals to the CBE plus a couple of additional ones for which no CBE funding is requested.

I have also enclosed a new (or revised) budget proposal to the CBE. It totals \$14,467 and it is intended as an interim budget for 6 months. The requested amount is about \$5,000 less than the total of the two budgets submitted previously.

Within the context of the new proposal document, it is my understanding that the CBE is interested in funding Objectives 6 and 7, but is not interested in funding Objectives 1-3 (Objectives 4 and 5 in the new document are not part of our proposal to the CBE). Objective 3 includes the Newsletter. Although it apparently was not clear in our original proposal, it has not been our intent to ask the CBE for Newsletter support. That is handled by volunteer staffing, contributions from recipients, and my own private funds.

In addition to funding for Objectives 6 and 7 (70.5% of the newly proposed budget to CBE), we are retaining, however, our request for some support of activity under Objectives 1-3 (29.5% of the budget). We hope the Committee will reconsider its position on this, as the interrelatedness of all of the objectives is much clearer, we believe, within the context of the total program as described in the new proposal document.

Objectives 1 and 2 are the "guts" of our program. Without this information-generating base, we would have nothing to say under Objectives 3-6. Most of the requested 20% of Chris Merritt's time for this part of the proposal will be spent on information retrieval under Objective/Procedure #2, biology, which will contribute directly and immediately to both my course (Objective 5) and exhibit development (Objective 6). Objective 3 is also part of the core of our program. The increasing intercommunication being established within the scientific community is what gives the concept its validity; without this validity, Objectives 4-6 would be meaningless.

Regarding the cricket culture part of the proposal (Objective 7), I should mention that, for the next six months the project will have the benefit, at no extra cost, of input by Megha Parajulee, a graduate student in my laboratory who is working on certain aspects of the mass-production of Acheta domesticus. His insights relative to the nurture of crickets will be invaluable.

Finally, there is some urgency in coming to a decision. Chris Merritt will have been without salary for three months as of the end of December. While the Committee might argue that that is our problem, I will say that Merritt represents our key staffing if Objectives 6 and 7 are undertaken.

Sincerely,

Enclosures

cc: Dr. James Stewart
Dr. Daniel Young

I have no record of receiving any further communication from the Committee, so maybe it was passed to me by phone. Or maybe it got lost in my files or somewhere. It is obvious that the committee and I were not completely together on just what should happen, and apparently the Committee was not willing to bend, judging from a letter I wrote that may or may not have been sent. It was penciled on yellow scratch paper, as if ready to be handed to a secretary and was not dated. Even if it was not sent, I think it is useful in that it expresses quite accurately what I thought of the way the CBE committees had handled our proposal(s):

Dear Louise:

We believe that the Educational Outreach Committee's flat rejection of any support whatsoever for Objectives 1, 2 and 3 of our proposal leaves us no alternative but to withdraw both of our proposals in their entirety. We were willing to bend two-thirds of the way insofar as our own priorities are concerned in order to accommodate the Committee, but we are not willing to abandon our basic project for what we consider the relatively insignificant objectives that the Committee is willing to support.

We appreciate the consideration given our proposal, but I think that our ideas and those of the Committee are about 120 degrees apart as to what a good educational outreach program can be.

Sincerely,
(signed)
Gene R. DeFoliart
Professor

P.S. Please tell the Bottle Biology people that, despite our rejection, we will continue to give them their weekly supply of crickets, thus saving them 17 cents per cricket based on the price at the State Street Pet Shop.

I heard no more from the CBE, although Chris Merritt heard from them a few more times. Chris put the first one, dated 17 December, 1990, on my desk with a postem she had stuck on it saying, "Can you believe this. I got it in the mail!! Chris." The letter said:

Dear Dr. Merritt,

On the behalf of the staff, steering committee, and others associated with the Center for Biology Education, I would like to express our regrets that you were unable to attend the Center's Fall and Sharing Conferences, November 13 and 15, 1990.

The conferences provided wonderful opportunities for grant recipients and those interested in biology education to gather and exchange ideas. The Center recognizes that the projects initiated by its grant recipients are the results of tremendous work and commitment. It was a pleasure to showcase these efforts.

The Center for Biology Education would like to encourage existing initiatives while continuing to incorporate the creative efforts and input of all members of the UW-Madison community into its projects. Four small-group discussion sessions held during the Fall Conference generated lively discourse concerning various issues in biology education. Indeed, some sessions would have lasted long into the evening had they not been constrained by time! The Center would like to focus the dialogue initiated at these sessions into action. Included with this letter is a summary of the points discussed. I invite you to review these points and contact the discussion leaders to find out how you can express your concerns and participate in Center programs and activities in your area of interest.

If you would like extra copies of "Points of discussion in biology education" or any Center documents, please don't hesitate to contact me. Address written inquiries to me at Room 660 WARF Building, in care of the Center. My phone number is 262-5480.

The letter was signed by Tracy Saffran, Communications Specialist. I couldn't help but laugh at the mention of the four concurrent discussion groups that "would have lasted long into the evening had they not been constrained by time!" I think I remarked above on how ridiculous it looked to schedule only 30 minutes each for those four concurrent discussion groups. Chris continued to hear from the CBE at least until January 10, 1992, maybe longer for all I know.

Chapter 14. Retirement, Expanding Outreach, The Traveling School Exhibit

I officially retired from the University of Wisconsin active faculty to emeritus status July 1, 1991, one week after my 66th birthday. I had been looking forward to this for one main reason. I could bid a fond farewell to medical entomology which had an abundance of competent operatives (including about 20 of my former students) and didn't need me, and use the freed-up time for more work on food insects, which, I thought, did need me. In addition to outreach activities that we were already pursuing, I planned to put together an exhibit on edible insects that could be taken around to the elementary/middle schools in the general Madison area. It didn't take long to begin realizing what a treat was in store when I started mixing it with these elementary aged kids.

At Orchard Ridge Elementary, the very first school at which the exhibit was set up, the teacher had the class (fifth graders, I believe) write letters to thank me for coming to Orchard Ridge with the exhibit and the slide show [get details from my Kansas City ESA speech and other pertinent documents]. One boy wrote, "You are a very funny man for your age." Another wrote, "You are the best scientist I have ever met. And I am not kidding." Nobody ever said that to me when I was a medical entomologist. This was going to be fun.

At another school, we had finished the slide show and the question/answer session was drawing to a close when I said: "OK, we have time for one more question." One of the boys raised his hand. "Do insects have sex?," he asked. This was the first time I had been asked a question like that, but with hardly a pause, I said, "Oh, yes. Insects are like other animals. There are males and females of each species, and they get together to produce the next generation." Then I said, "Okay, that's it for today. We're out of time. It's been nice being here today, and I hope you've all enjoyed it as much as I have." The class stood up to leave and I started gathering up my stuff. I was thinking I had handled that sex question pretty well. And it was probably pretty lucky that it came up when it did - late. I sensed that someone was still there, and I looked up. One of the little girls was standing there, a cute little black gal in pigtails. "Yes?," I said. Sort of twisting and turning, she said, demurely, "How do insects have sex?" This time, my hesitation was noticeably longer. I said, "That is a very interesting question, honey. But you know, there are a million kinds of insects, so it would take a long time for us to discuss how they have sex. And we're all out of time. But that's a very good question and I hope you will remember to ask it again the next time I come back. Bye, bye." You know how you feel when you know you've been babbling. That's how I felt.

At another school, as we got underway the class was being a bit unruly - talkative and generally noisy. With almost each new slide that flashed on the screen there would be Yuks and other expressions of greater or lesser disgust. The teacher wasn't giving any strong indication that she was in charge - the first time I had run into a power vacuum. Finally, I said, "OK, enough yuks." I continued, "It's ok to say 'yummy,' though, if you see something that looks really good, and something that you think you might like to try." Silence greeted the next several slides. It was becoming uncomfortably quiet when, with a huge white woodboring beetle grub showing on the screen, a big kid in the back of the room came forth (bless him) with a long drawn-out "yummmm." It took only a moment before he was joined in a chorus of yummmms, and we had yummmms the rest of the way. Day saved.

Those are just a few examples of what happens when you mix kids and insects. Actually, I should have had a premonition of how it would be from an experience Chris Merritt had had back in January, 1991, when she had put together an insect exhibit (not focusing on food) at the Van Hise Middle School. Live crickets were a part of her exhibit and she told the students that they could each take a cricket home if they brought a suitable container in which to keep the cricket. One little girl showed up with a regular little house made from a shoe box. It had a sloping roof, neatly cut doors and windows, a porch and was painted in bright colors. An elegant home for a cricket.

Beginning about May in 1991, I was spending a lot of time on the exhibit, poring over entomological price lists and ordering specimens of anything that I recognized (by matching against country inventories) as eaten anywhere. For insects with complete metamorphosis, it is usually the early stages, like larvae and/or pupae that are eaten. In most cases those stages were not available from price lists, and it was necessary to order the adult insects, noting on the labels in the exhibit drawers that it is the larvae or pupae that are eaten. One advantage in having to order adult insects, however, is that these are frequently, such as with butterflies and moths, the most showy. Altogether, I finally had six exhibit drawers. There were other things, too. I named the exhibit "Insects as Food in Different Cultures" and put together "A Guide to the Exhibit," which is here reprinted:

[Copy; maybe pictures will be added later]

The usual procedure at a given school was to, after contact from teachers, set up the exhibit on a Monday, so kids would have several days of access, then I would go out on Thursday or Friday, give a slide show lasting 30-40 minutes, and then do questions and answers for awhile. The following letter was mailed out to teachers in the Madison School District on November 14, 1991:

Dear Teacher of Grades 3-6:

Attached to this letter is a description of an exhibit called "Insects as Food In Different Cultures." It was designed primarily for students of upper elementary and lower middle school ages, but is probably suitable for a wider age range.

Beginning with the week of December 2nd, the exhibit will be available for one week to any school in the Madison District, on a largely "first come, first served" basis. There is no charge for the exhibit.

If you are interested in having the exhibit at your school, and wish to discuss dates and other arrangements, please call Professor Gene DeFoliart at (608) 262-5958 or 262-3227, or write to the above address.

Sincerely,

We heard from the following schools (listed alphabetically) and scheduled one per week (no more than one) through the spring semester of 1992: Elvehjem, Falk, Huegel, Lindbergh, Marquette, Mendota, Midvale, Orchard Ridge, Randall, and Schenk. We also set up at the McFarland Elementary School, in McFarland, which may not be part of the Madison District (I don't remember). Age groups attending the slide presentations were

mostly 3rd, 4th and 5th graders, groups were mostly between 25 and 45 students per group but ranged as high as 65 to 85, with as many as three groups at several schools.

While scheduling the schools above we apparently attracted wider attention, receiving an invitation to be a presenter at the Southern Wisconsin Science Forum to be held February 13, 1992 at the Sheraton Inn in Madison, and also to give a lecture-demonstration at the Dane Countywide Invention and Science Fair to be held February 29 at the Dane County Fairgrounds Forum Building in Madison. The Sheraton meeting involved addressing 25-30 teachers in a first group and an uncertain number in a second group. The title of our workshop was "A Traveling School Exhibit: Insects as Food in Different Cultures." The Dane County Fairgrounds affair mostly involved displays by students, grades kindergarten through eighth, with each classroom in a school eligible to send one invention and one science display. Its goal was to stimulate creativity and develop problem-solving skills in students. As I recall, it was quite a mob scene and a lot of fun. Our demonstration was titled "Insects as Food in Different Cultures." Chris Merritt was a big help, both in the logistics of getting set up and helping manage the crowd after we were started. Our subject apparently went over pretty well. We were invited back to both events the next year (although I regretfully had to decline because of the press of other demands).

In our exhibit cases, in addition to the short typed summaries of the biology and food use of insect groups, individual specimens were identified by scientific name. At the schools we visited, I was amazed from the start how those 3rd, 4th and 5th graders read the small print and didn't back off from those long scientific names. In classes where the teacher had asked the students to send us a letter, thanking us for coming, often, a student's letter would say, "My favorite insects were [and they would write in the scientific names of several]."

Here is an example - these first ones from the fifth grade at Orchard Ridge School:

Dear Dr. DeFoliart

I liked your presentation a lot. I also loved your exhibit. Some of my favorite bugs were the Pomponia imperatoria, the Tropidacris violeta, the Eurycantha horrida, the Goliathus orientalis, the Euchroma gigantea and the Sternocera equisignata. Thanks a lot for coming.

Your friend,
Eric M.

Other letters made liberal use of the scientific names, but the above will suffice as an example. Following is a sampling of other letters:

Dear Dr. DeFoliart

I really enjoyed your presentation. I thought the bees that didn't sting were the best! They should bring some of them here, along with the coca cola ants! The exhibit was Cool, I liked the Stenocera equisignata. It has a very bright color! I hope you have fun on your trip!

Sincerely,
Guistina P.

Dear Dr. DeFoliart,

I really enjoyed your presentation with the bug slides. I never knew that some bees didn't have stingers and that so many people around the world eat bugs. One of my favorite parts was the part when the Mexican people cut tall grasses and put them out on the lake for water insects to lay their eggs on them.

Sincerely,
Paul

Dear Dr. DeFoliart,

Thank you for coming and giving your presentation on insects. It was very enjoyable. I liked the slides of people selling the insects in outdoor markets. The insect exhibit was very interesting. I would like to try a honey ant sometime. I never knew that an ant could taste like honey. Today in Reach class we saw an article called Bug Grub. I hope it sounds like something you've heard before [It was a newspaper article with my picture in it – several of the students mentioned it].

Sincerely,
Naomi M.

The 4th graders from Huegel Elementary sent artwork instead of letters to show their appreciation. It was high quality art and I'm sure that if examined by a taxonomist, new genera and species of insects would be found. Students from Elvehjm Elementary combined art and short thank-you notes. From April: "Thanks for sharing your Bug exhibit with us. I really enjoyed it. Even though it was extremely gross." Rebekah M. was more positive: "Thank you for coming to our class. It was very fun to learn about the different kinds of bugs people in different countries eat."

Students from McFarland Elementary also combined art with shorter notes. From Elizabeth D.: "Thank you for showing us the slides of all those insects. My favorite part was the caterpillars – they look like noodles. I had fun."

Students from Marquette, like those from Orchard Ridge, wrote longer letters. I will start with three students who seemed still a little skeptical:

Dear Professor DeFoliart,

Thank you for bringing the insects. I learned a lot of things. I can't believe you can eat that. Where did you get that idea from. How far did you go to get the pictures?

By C.J.

Dear Professor DeFoliart,

Thank you for bringing the slides. I thought they were kind of interesting even though I would never want to eat an insect, but I know you ate one or more but I'm not criticizing that in any way. It was interesting.

Sincerely,
Sam H.

Dear Professor DeFoliart,

Thank you for coming to show us slides, they were very interesting. Some of them looked pretty gross like the rhinoceros beetles, they looked so mean and hard. But some of them looked pretty good. I would like to try maybe some of the insects that were all cooked and just looked like meat. I don't think I would ever want to eat that honey ant because they are alive and they might take a bite out of me instead of me taking a bite out of them. Thank you again for coming.

Sincerely,
Leah J.

Most of the other letters from Marquette were more positive. The first one suggests how fun it would be to surprise the teacher on her birthday. A few others follow:

Dear Professor Defoliart,

I thought that was very nice of you to come in and teach us so much on insects and bug-food. It looked like you put a lot of time into your display and slides. Did you know it was my teacher Ms. Wong's birthday? I think it would be pretty funny if someone made her a cake with bugs in it. I hope you come back again.

Yours truly,
Elena K.

Dear Professor Defoliart,

We had a great time. Some kids were a little grossed out but most of the kids liked it a lot. With your talking about it, it made the insects very interesting and some even tasty! I liked the honey pot ants. I've had them before when I went to Mexico and Guatemala.

Thank you,
Mike F.

Dear Professor Defoliart

I thought you did a good job on the speech. I hope you had a good time. I sure did. Did you eat all those bugs? I never eat bugs but you did didn't you? I'm glad you came and talked to us. I had fun

Melinda

Dear Professor Defoliart

Thank you for coming to our school. All those bugs looked interesting. But I would not care to eat some like the rhinoceros beetle. The honey pot ant does not sound bad. I thought your display was wonderful, same with your slides.

Sincerely,
Henry

Dear Professor Defoliart

My name is Tobin A. I thought your program was very interesting. I doubt that I will ever eat any insects but if I had to I would eat the honey pot ant.

Thank you for coming. I really enjoyed it. It was interesting to find out what kind of insects people eat. And what kind of insects are in different parts of the country.

Sincerely,
Tobin A.

Dear Professor Defoliart,

Thank you for coming to Marquette and showing us the slides and talking about your experiences. I think that I might want to try some like the honey pot ants. It was very interesting and educational. Thank you!

Jesse C.

Dear Professor Defoliart,

I liked your insects and I think you did good research and good slides and some of them were good and some of them were slimy. I would like to try some of them. I have a lot of questions for you to answer. Like how did you do your research! Was it fun doing it?

Sincerely,
Deante W.
I love your work!

Dear Professor Defoliart,

My name is Andrew J. I thought your show and the different insects on display were very interesting. The honey pot ants looked like they might be kind of tasty. Although they didn't look appetizing to me, it's interesting to know that people eat them in other cultures. Thank you for coming. I really enjoyed your show.

Your friend,
Andrew J.

P.S. If I didn't know they were insects I would probably like them.

At some schools, instead of involving students, teachers simply wrote a thank you note. For example:

2/23/92

Dear Gene,

Thank you so much for the informative and “delicious” presentation. The response from teachers and students was excellent – the slides and display cases were talked about for days.

Hope we can call on you again next year. Thanks again.

Sincerely,

Jill Cohen Kolb

& Randall School

On April 29, 1992, we hosted Professor Carl Personke’s Language Arts class composed of 22 UW Education majors, followed later in the morning by 22 second graders from McFarland Elementary school. The program consisted of essentially the same audio/visual materials we had been taking to the elementary schools. A few days later, I received from the university students a nice green-covered booklet of poems. It was titled “Butterflies, Bees and Other Bugs.” The entire cover and the borders of the pages were attractively decorated with a variety of insects of a quality you might expect from Language Arts students, but from few others. Many of the poems, nearly all, in fact, were in free verse. Each student also added in his/her own handwriting a note of thanks and a comment on what they thought about what they had seen and heard that morning.

When I first started working on this part of this chapter, I selected eight poems for inclusion. But I got to thinking this was one of the first feedbacks I had had from the arty end of the campus. So, I decided to include everything, not only the poems, but also the written comments. It would be interesting to see whether students from non-science fields reacted any differently to this subject than did the students I was more familiar with from various science disciplines. It also occurred to me when I was doing this that it would be fun to some day drop Personke a note and tell him that every student in his 1992 class was now a published poet. The poems and comments of the poets follow:

THE CRICKET

Crickets—

Nature’s orchestra

Creating beautiful music

Peaceful quiet Spring evening

Invisible.

Tracy A.

(Prof - Thanks so much for taking the time to show us the slides and talk to us about bugs in the diet. Somehow I can’t see myself eating bugs but it was really interesting to see cultures that do. Thanks Again.)

THE WASP

Wasps—
Buzzing insects
 Building a nest
 Annoy the worrisome bystander
 Pests

Tracey B.
(Gene – Thank you for showing your colorful and interesting slides and knowledge with us. I also appreciated your insight on the Mexican “no-see-ums.”)

A LADYBUG SANDWICH

A ladybug sandwich is easy to make,
A few simple steps is all it will take.
You start with two slices of your favorite bread,
In the middle goes the ladybug—watch out for its head!
Pile on the lettuce, onions, tomatoes, and such,
But don’t worry, you can never have too much.
Don’t forget the mayo for that extra taste,
And never let a single bit go to waste.
Ladybug sandwiches can be made any day,
Now hurry and eat it before it flies away!

Michelle F.
(Gene – Thanks for the slide presentation. It was very enjoyable & informative for all of us.)

THE TRUE KATYDID

Katydid –
Secret singer
 Feeding on leaves.
 Unique style of music.
 Green.

Scott M.
(Gene – Thanks for the presentation about bugs. I told my roommates about eating bugs for a healthy diet. They were grossed out. My journal pal really enjoyed the slides and so did I. Thanks again.)

ROACH

Oh little bug with nice long tentacles
At roach motels you pay no rentacles.

Robert M.

(Gene – I am always on the lookout for new recipes. Thanks!)

WALKING STICK

Lively tree

Walking upside-down

Feeling free from all

Camouflage

Michelle S.

(Thanks for the bug day!)

ENGLISH PEPPERED MOTH

Moth –

English Peppered

Hiding, surviving, dying

Moss, pollution, ashes, soot

Dirtying, changing, cleaning

White, black

Change

Mark D.

(Thanks for the presentation!)

ANTS

Strong, industrious

Caring, repairing, defending

Harvesters, workers, soldiers, slavemakers

Gathering, scurrying, hurrying

Intent, unsuspecting

Aardvark

Lillian R.

(Gene, I thought the discussion and slide presentation was interesting. My views on eating bugs have changed. I may try it. Thanks.)

THE BLACK WIDOW

The widow awaits

In darkness the beast hungers;

Tangled flies will die.

Kevin W.

(Don't eat a Black Widow because they taste really bad! Thank you for the interesting slide show.)

THE DRAGONFLY

Dragonfly buzzes
Dips, twirls, spins by the water
Suddenly is gone.

Kelley W.

(I'm still debating whether or not I could actually eat a bug or not. Maybe if no one told me what it was I could do it. Thank you again!)

DRAGONFLIES AND DAMSELFLIES

Odonata
Skillful practiced
Darting, hovering, dashing
Hunter, predator, prey, helper
Flying, flashing, fluttering
Beneficial, beautiful
Dragonfly

Julie M.

(Gene, Thanks so much for taking time out of your busy schedule to spend the morning with us. I really enjoyed learning about other cultures and how insects are used as food. Thank you -)

PRAYING MANTIS

Mantis
Praying creature
Eats its mate
Calm as can be
KILLER

Julie J.

(Gene – Thanks for your time! Your presentation was fascinating, not very appetizing though! Thanks again!)

BLACK

Black is a spider
eight legged beast
Black are the shadows, lurking

preying upon its feast
Black is the widow
poisonous and feared
Black is the death she brings
she is scorned, not revered
Black is the mystery
the spider, misunderstood
Black is the shroud it wears
to hide its works of good
Black is the world
if the spider were gone
No silken web of beauty
to catch the light of dawn.

Jane K.

(Gene, I really enjoyed the slide presentation – very interesting!! Thanks.

HAIKU TO CRICKETS

Sometimes quiet winter nights
Full of clear and frozen skies
Leave me missing crickets

Jan B.

(Thanks again for the food for thought!)

THE DOG FLEA

Flea
Annoying bug
Makes dogs itch
Itchy Itchy Itchy Itchy
Pest

Gina T.

BUSY BUMBLEBEE

Bumblebee
Hard worker
Gathers sweet nectar
Just to give life
Dies

Erica P.

(Gene – I told my Mom about our trip and when I mentioned that we learned about bugs for a healthy diet, she of course said “yuch.” I tried to tell her that they really don’t seem that bad. They taste like bacon, or they are like shrimp. I don’t know if she will ever eat bugs, but thanks for opening up my mind!)

BOOKWORM

Bookworm –
Insect pest
 Burrowing into books
 Knowledge turning to dust.
Vermin.

Eileen M.
(Dear Gene, Thanks for the interesting slide show – I’m still not particularly interested in eating bugs, but I understand the possibilities.)

CRICKETS

Cricket—
Familiar friend
Singing through darkness
Peaceful sounds of summer
Country

Denise R.
(Gene – You did a great job with the slide presentation! I’m spending next summer in Mexico and I can’t wait to try some bugs! (Well, maybe I can!)).

TARANTULA

Female
Laboratory tarantula
 waiting two years
 how did it feel
 starving?

Brynne M.
(Dear Gene, Thank you so much for the time you spent in helping prepare for our fieldtrip – it went really well! Thanks!)

THE WATER STRIDER

Boys down at the creek
watch dainty, darting shadows;
cast by Jesus bugs.

Boyd R.

(Gene, Thanks for the interesting slide show & talk. I really enjoyed it!)

THE PRAYING MANTIS

Mantis halts its prayer;
Arms snap forward to seize the
Gentle butterfly.

Bob W.

(Gene, Thanks for the fascinating presentation! I enjoyed it and so did the kids [he may mean the McFarland elementary bunch – I think he was their teacher].
Maybe someday I'll even get up the nerve to eat a bug! Thanks again.)

FIREFLIES

Bright flying insect
Appears in sight a moment. . .
Making darkness light

Andrea H.

(Thanks for the presentation! Surprisingly, the bugs don't seem as bad as I thought before.)

THE EARWIG

Small creature waiting
The bright sun sets in the sky
Earwigs on the move

Amy R.

(Thanks for the presentation. It was very interesting, but I'm still not sure if I'd be able to eat some of those (maybe if I didn't know what I was eating!))

Professor Personke closed out the collection with a poem of his own on the last page:

FLEA SANDWICH

A flea sandwich is easy to make;
I make them all the time.
You take a goldfish wafer
The size of a dime,
A flake of parsley,
A drop of sauce,
One celery seed,

Throw the flea across.
Some Elmer's glue
To hold him down,
Then throw it away
And eat in town.

Carl P.
(Thanx, Gene! I owe you one – a martini that is)

Well, naturally I couldn't let that go by without a response, even though mine might not be as professional. He knew more about poetry, but I knew more about bugs. Anyway, I would nominate this exchange, unhesitatingly, as the most unerudite exchange between two UW-Madison professors during the year 1992:

Carl,

It was a pleasure
Of ample measure
To show your kids some bugs to eat
Some of which are hard to beat
Much better for them than fatty beef
And much more protein than in a leaf
Almost any flavor
They would savor
Come again for more ado
And we'll be ready with some stew

Gene

The school exhibit was set up one more time in 1992, in May at Steenbock Memorial Library. There were a few additions, such as canned insects (wasps and grasshoppers sold in Japan and silkworm pupae in South Korea) and sun-dried caterpillars from Africa. I received the following letter from Barbara Hamel, Information Services Librarian, dated July 20:

On behalf of Steenbock Library, I would like to thank you for agreeing to provide our May/June "Insects as a Food Source" display.

Your insect collection received a great deal of attention while it was here in the library. Reactions ranged from intrigue, to amazement, to disgust (at the thought of eating the insects) as people viewed the display. The mounted insects, as well as the canned and "processed" insects, were interesting to see. Canned insects are not something people in the United States typically find on the shelves of their local grocery store, so I think your display was an eye-opening experience for many.

You have played an important part in making our series of displays a success. Thanks again.

Sincerely,

It turned out to be nice that the Steenbock was our last use of the display. In starting to take down the exhibit one of the glass shelves collapsed, hurling one of the beetle cases to the floor where it broke leaving many of the specimens (mostly medium-sized to giant scarabaeids) broken and in great disarray. Steve Krauth was going to try to repair the damage, but I never saw it again so don't know how successful he was. I noticed in the years 2000 and 2001 that some of the specimen cases were on display over a period of several months in the front lobby of Russell Labs. Steve Krauth was no doubt responsible for this. Now that I think of it, though, I never did see the big scarabaeids there.

In the first three or four years after 1991 and '92 when preparation and showing of the school exhibit took so much time, putting out *The Food Insects Newsletter* and responding to the correspondence it generated was the main time-consumer. Responding to invitations for several major speaking engagements and invitations to write several review articles also used up a lot of time. Another time user was working on something called "The human use of insects as a global food resource," which by year 2000 had become a gigantic beast of 30 chapters totaling over 900 pages. In responding to all the requests for information which for several long periods in the early to mid-nineties averaged several dozen requests per week, I began to think of myself as an extension person. And I began to think the College of Ag and/or the Extension Service should be helping to pay for secretarial help – for which the Department of Entomology was now charging my funds. In other words, subscribers to *The Food Insects Newsletter* were supporting University of Wisconsin extension work. That's the way I looked at it. It may have been extension work created by the Newsletter, but once it was extension education, it was a University responsibility. I spent a lot of time over a span of a couple of years pointing this out to the new Dean of Agriculture (see Chapter 16).

Chapter 15. Finding, and Losing, a “Sugar Daddy” – The Agrecol Corporation

I read an interesting article in the Money section of the Wisconsin State Journal of October 20, 1991. It was titled “Agrecol: One man’s lifetime dream” and subtitled “Madison firm to nurture agricultural/ecological products.” The article was by Mike Flaherty, Agriculture reporter, and it is reprinted below (minus the accompanying photographs):

Since he was a prisoner of war in the famous Stalag 17 during World War II, William T. “Bill” Graham has had a penchant for the dramatic.

Returning from the war, Graham built his idea for a typewriter brush into the W.T. Rogers Company – a prodigious Madison company.

And now, having recently sold that corporation, Graham is building another one. He’s creating – from scratch – one of the nation’s most unique agricultural research companies.

By the end of 1992, Graham’s new company, Agrecol, hopes to have completed work on a 48,000 square-foot research center in Madison that will include greenhouses, corporate offices, warehouses and a home for visiting scientists who will overlook a new man-made pond and wetland area.

The \$3 million to \$4 million research center, on 38 acres he owns east of Stoughton Road, will be “a showplace – a beautiful park,” Graham says.

“I’ve always been interested in plant varieties and in watching things grow,” he says. “Now I’ve sold the Rogers Company, so I’m able to do it – and I’m going to do it first class.”

But what makes the new facility unique is the way it will conduct its business.

The center will have a sizable staff. But much of the work will be done by scientists outside the company – scientists from Madison, around the country, and around the world who want to convert their ideas into products for the marketplace.

“What we’re going to do is allow scientists to be their own entrepreneurs,” Graham says. “They’ll provide the ideas, We’ll provide the research facilities, administration, the production and the marketing.

“Then we’ll split the profits,” he says.

In fact, he adds, each scientist working with Agrecol will work technically, within a Subchapter S corporation created specially for each scientist to receive and administer the profits from each newly developed product.

The new research park will even include a “guest home” where visiting scientists from distant places can live while their research is being conducted, Graham says.

Right now, Graham is the sole owner of Agrecol (the name is derived from agriculture and ecology) and its sole investor. But eventually, he says there will be several owners.

“I don’t know of anything quite like it,” said Ken Smith, a spokesman for the UW-Madison Biotechnology Center who recently compiled a directory of

biotech firms operating in Wisconsin. “There are companies that will do custom research for other companies, but as far as I know, this is new.”

It’s like a business incubator for agricultural research ideas.

Already, Agrecol has a number of projects on the table, says Patrick LeMahieu, an Agrecol company manager.

It is developing a new type of turf grass that requires fewer herbicides and fertilizers and less irrigation water; two new snack foods; an enzyme that removes potentially dangerous nitrates from drinking water; and a new plant to be grown in Wisconsin that can substitute for wood in the paper-making industry.

Agrecol’s research center is being built in a dry farming area that was once a wetland area. Graham and LeMahieu say that if they can get government permission, they’d like to rebuild part of the research park into a real, water-bearing wetland.

The area can then be used for research on wetland restoration research, wildlife habitat restoration, ground-water protection and, perhaps, research on the production of products that grow only in wetland areas.

“That’s all speculative, though,” LeMahieu says. “We haven’t got the permits yet to build the wetlands. And we want scientists to come to us with ideas. I’m not sure how we’ll make money on it – though that is the idea.”

“I don’t know if this is a smart time (to start a new company). And I wonder, in my lifetime, whether I’ll ever see a profit on it,” Graham says gruffly.

“But it’s something I’ve always wanted to do – and I’m going to do it.”

When I read this, my first thought was that, finally, God had created this company and placed it in Madison just to make sure I would get all the backing I would ever need to bring all my ideas to fruition. I sat down and wrote one of my letters, of course (October 29, 1991):

Dear Mr. Graham:

I read with great interest the article in the October 20th Wisconsin State Journal about the new company you are building, Agrecol.

From the newspaper account, it sounds like your company might be exactly the type of enterprise that could take the next crucial steps in a new agricultural/ecological frontier that I have helped to spearhead—insects as a food resource. Nothing could be more counter-current to U.S. food traditions than this concept, yet evidence is now accumulating that the tide can be turned—with enormous potential for the development of a whole new class of food products that are environmentally sound. And not only that, but a change in American attitudes could open vast new opportunities for helping to meet the challenges of global malnutrition and hunger.

I have no specific development proposals to make at this time, but have enclosed materials that indicate the current use of insects as food around the world (they are among the traditional foods of most non-European cultures), and suggest the potential magnitude of research, production, marketing and international trade that could develop:

- 1) The Food Insects Newsletter. The mailing list for this desktop operation has grown from 100 with the first issue in July 1988 to nearly 1400 presently. A complete set is enclosed although most back issues are now out-of-print and furnished as photocopy. Various articles make clear the environmental implications of a wider acceptance of insects as respectable food.
- 2) Reprint of an article, "The human use of insects as food and as animal feed" published in 1989 in the Bulletin of the Entomological Society of America.
- 3) A manuscript, "Insects as food: nutrition and economics" submitted recently at the invitation of Crop Protection, an international agricultural journal published in London.

There are other recent happenings, involving me personally, that indicate a corner is being turned, at least in the academic world, a prerequisite for changing public attitudes in general:

- 1) A government/industry group of six Japanese scientists visited my lab in August. I would call it primarily a "feasibility probe," to check out attitudes here in the United States and particularly to find out if the USDA is taking any active interest in the subject.
- 2) I have been invited as the guest-of-honor and after-dinner speaker at the focal event of the 100th Anniversary celebration of the New York Entomological Society. The event will be the First Annual Bug Banquet, to be held in May 1992 at the Waldorf Astoria Hotel. Local culinary schools will engage in a "bug bake-off" to determine who prepares the best dishes and participates in the banquet. This is expected to be a high-profile media event.
- 3) I've been invited to give the lead-off presentation in a plenary symposium, "Socioeconomic Impact of Insects on Humanity" at the Annual Meeting of the North Central States Branch, Entomological Society of America next March in Kansas City. My title: "Insects as Food: History and a Modern Perspective."
- 4) I've been invited by the Entomology Graduate Students' Club at Kansas State University to give a seminar there next Spring. The significance of this is that the students get to choose only one speaker per year, but from anywhere in the United States and on any subject.

I cite these examples to suggest that the "climate" may soon be changing rapidly, with creation of a market demand for which no products will be available (my correspondence reflects this also, with frequent questions as to where edible insects and recipes can be obtained). My own efforts have recently been devoted entirely toward public education, but your new company appears to have the resources and goals that would be ideally suited for exploring the commercial possibilities.

Please let me know if Agrecol is interested in any further information or conversations on this.

Sincerely,
(signed)

P.S. Enclosed is a description of the educational program that I mentioned, called “Educational Outreach Program on Insects as a Food Resource.” It was submitted as a proposal for funding to several foundations early in 1991 and was not funded, but we are continuing with it anyway. Also enclosed is a short CV.

The surviving record of my dialogue with Bill Graham and Pat LeMahieu is very one-way. That is because I mostly wrote letters, they mostly used the telephone. I was invited over to Bill Graham’s house for lunch – I think it was just a day or two, or three before Christmas. Bill was a gracious host. In addition to Bill, Pat and me, two or three other Agrecol-connected fellows were there, although they left for back to work soon after lunch was over. Bill and Pat were very interested in what I had had to say in my letter and what I had to add to it during and after lunch. From both Bill and Pat, I was told several times, “You can write your own ticket.” I think I probably felt like it feels to a high school All-American being recruited by a top-flight college coach. They wanted me. In quickly following up after the luncheon meeting I addressed (December 27, 1991) a letter to Pat, who was Director of Operations (and later President) of the company:

Dear Pat:

I enjoyed meeting you and the discussions we had on Tuesday. I must say that I was up about two hours earlier than anyone else around here on Christmas Day, starting to outline on paper some initial thoughts on how to proceed. My thinking on insects as food has focused entirely on public education lately, but Agrecol’s interest requires thinking about a different set of specifics. The timetable for possible product development has been speeded up considerably.

I’ve put some of those initial thoughts down on the attached sheets – mostly attempting to decide which insects are likely to offer the most promise for the least developmental effort. The social insect groups – bees, ants, wasps – may offer the best bet in this country. I would like to have talked with a colleague, Dr. Robert Jeanne, a social insects specialist, before preparing anything, but he will be out of the State for another week. Some of my general ideas may be dismissed right away by the various specialists, but we hope that some of the ideas are valid. We won’t know until we get some of the outside insights, and can start making some informed decisions.

Let me know if you have any comments or questions relative to the enclosed. Unless I hear differently from you, I will begin contacting some of the people who can provide the kinds of specific biological information needed. If we get some good news there, we will need to ring in some of the food processing people. Hopefully, we will identify some systems that say “Go!”

Sincerely,
(signed)

Enclosure
cc. Bill Graham

The enclosure was a 4- plus page summary of suggestions of systems for possible development, which I apparently whipped out over a three day span that included Christmas. It was titled “Some Preliminary Thoughts, Suggestions, Questions Concerning Formation of S Corporations Aimed at Developing Edible Insects as Marketable Products (For Consideration by Agrecol Corporation”):

The first S corporation might be based on developing products from edible social insects – bees, ants and wasps. All of these insect groups are considered edible (delicacies in fact) almost everywhere else in the world, and, in Japan canned wasps have long been marketed as a gourmet delicacy (current price in Tokyo about US \$8.00 per 3-ounce can). So-called “Baby Bees” were formerly imported to the U.S. and Canada, as were chocolate-covered ants. A few comments about each group:

Honey bee brood (pupae). A big advantage with the honey bee is that it starts off with probably the best public image of any insect in the United States (it will probably be second only to the Monarch butterfly when Congress votes soon on a national insect, and second only because it originated in Europe while the Monarch is a “native American”).

The honey bee pollinates plants, “works hard” in the American tradition, already produces a highly regarded food – honey, as well as other commercial products such as beeswax, “bee pollen,” etc. It would be difficult or impossible to design an insect that would be more environmentally harmonious than the honey bee.

With thousands of beekeepers, amateur and commercial, around the country, a producer network and marketing outlets are already in place. All we have to do is, first make sure (there is supporting evidence), and then convince apiculturists that they can make more money by producing bee brood and honey than they can with honey alone. Honey in fact is a highly subsidized agricultural product and a side benefit of this is that it might be a way of getting honey producers off the government-subsidized list. Brood management and harvesting techniques have received only a little research and so far remain labor-intensive, but at high prices as a gourmet food, this insect looks economically feasible.

If we decide to look into this, resource people that I would contact include Dr. Justin Schmidt and Dr. Eric Erickson, USDA Bee Laboratory, Tucson, Ariz., Dr. Michael Burgett, extension apiculturist at Oregon State University, Dr. J.K. Ryan, founder of Biological Consultants, Inc. in Edmonton, Alberta and formerly in the Food Science Department at the University of Alberta (unless disallowed by S corporation regulations), and several commercial honey producers, all of whom subscribe to The Food Insects Newsletter. In fact, all of the above are Newsletter readers, already interested in the food prospects of bee brood and experts in bee biology and management.

Without going into details, nutritionally, bee brood is great, high in Vitamins A and D, low in fat and cholesterol.

Wasp, primarily yellowjacket, brood (larvae/pupae), and possibly adult wasp abdomens as a separate product. Yellowjackets have become one of the biggest

nuisance insect problems in the U. S. in the past decade or two, in residential and urban recreational areas. This insect might offer an opportunity to combine pest control with supplying a gourmet food product. If harvesting the wasps for this purpose can be shown to reduce local populations and thus the pest problem, it would represent a new kind of biological control – with humans acting as direct predators. This should make a good selling point in advertising the food product. There should be a certain degree of consumer satisfaction in disposing of a nuisance problem by simply eating it, especially if it tastes good!

Yellowjackets nest underground and the nests are easily detected by the traffic going into and out of the nest entrance. The need for supplier networks could represent a continuing opportunity for Boy Scout and other youth groups to raise money while simultaneously rendering a community service, local reduction in the nuisance problem, and without the involvement of pesticides. If adult wasp abdomens (which I understand are very good when eaten raw) prove to be a processible product, it should be a simple matter to design (for sale) a plastic entrapment chamber that would be set over the nest entrance at night to catch them as they exit the nest in the mornings.

Another advertising point for wasps, including yellowjackets, is that they were favorite delicacies of our Indian forebears throughout much of North America.

Regarding possibilities for economically feasible mass-production of wasps under controlled conditions, I will have to check with experts, one such being Dr. Roger Akre, Washington State University Department of Entomology, a specialist on yellowjacket biology. Another is Dr. Robert Jeanne, across the hall from me in Russell Labs, one of the top two or three insect behavior scientists in the world, and a specialist on wasps.

Ants. Numerous species of ants are consumed around the world and species in at least two genera were widely used by North American Indians, i.e., *Pogonomyrmex* (harvester ants) and *Camponotus* (carpenter ants). We'll have to talk to ant specialists to determine what possibilities exist for harvesting or mass-rearing for food products

Insect imports. There should be some good opportunities here if Agrecol is interested in looking into them. Canned "African locusts," for example, should have appeal to the environmentally aware, as these insects have devastated Africa for centuries and been the target of millions of tons of pesticides dumped on the continent. An excellent contact would be Dr. John Ledger, formerly head of the Department of Medical Entomology at the South African Institute of Medical Research and now director of the Endangered Wildlife Trust based at Johannesburg. Ledger has been a leading spokesman for eliminating or reducing the insecticide campaign and has done some research on methods of harvesting locusts as a high-protein animal feed. About a year ago, I put him in touch with a "bug vac" (suction machine) designer in Massachusetts, but I don't know whether anything significant has come from it. Migratory locust biology, particularly their habit of clustering densely on vegetation at night, suggests that,

with a little effort, efficient harvest strategies could be developed that simultaneously provide human food or animal feed and locust control – without pesticides. The winged forms of the large African termites are another potential product, with excellent flavor. A former graduate student of mine, Dr. John Phelps, in Zimbabwe, tells me that Europeans living there eat the termites, although not in the quantities that the indigenous people do.

Mexico could be another fertile field for imports. More than 200 species of insects are consumed and several kinds are on the menus of the best restaurants in Mexico City and other urban centers, and some were formerly exported. A good contact would be Dr. Julieta Ramos-Elorduy who has long advocated the “industrialization” of edible insects in Mexico and for 20 years has conducted an extensive research program at the National University in Mexico City. She spent six weeks in my lab in 1986 under the auspices of USAID. Mexican restaurants, I presume, could become one of the market outlets.

Once involved, there would seem to be endless import possibilities, with economic benefits accruing (hopefully) not only to Agrecol but to some of the most marginal rural economies in the developing world. A couple of insects are already being imported from Asia and sold in Asian food shops in this country, canned silkworm pupae from South Korea and giant water bugs from Thailand. The buyers of course are primarily people in the Korean and Thai communities, respectively, around the country.

Insects already commercially produced in the United States. We can delve into the possibility of products from mealworms (a beetle larva), *Acheta* crickets and the greater wax moth larva. These insects are sold in pet stores as food for birds, snakes, fish, etc, as fish bait, and in the southeastern states for fish culture. There is a recipe book, based on these insects and delightfully done, called “Entertaining with Insects, or The Original Guide to Insect Cookery,” by Ronald Taylor and Barbara Carter. Published in 1976, it is out-of-print. I talked to Taylor a few months ago, suggesting that with the rising interest in insects as food, reprinting the book might be in order. There is an environmental connection in the case of the cricket which, at high temperatures (30 degrees C, thus requiring some energy input), is 15-20 times better than beef in food conversion efficiency.

A couple of miscellany. “Montana grasshoppers” might have the same kind of environmental appeal as “African locusts.” Dr. Florence Dunkel of Montana State University, Bozeman, would be the appropriate contact regarding commercial feasibility. If Agrecol is interested in Product development in developing countries, one such possibility is a highly competent and motivated research group at the Universite Marien Ngouabi, Brazzaville, Congo, which is interested (among other objectives) in developing a high-protein flour from certain insects that are consumed in that country. A year ago, I had the opportunity to critique an excellent proposal that this group had prepared for submission to USAID. Whether it was funded I don’t know.

The Educational Outreach Program on Insects as a Food Resource. Some mention was made during our conversation on the 24th that this existing public education program, including The Food Insects Newsletter, might be included as part of a S corporation. I believe, for the time being, however, I would prefer to keep it separate from S corporation enterprises. The Newsletter has achieved a high degree of credibility and my own effectiveness as a spokesman is probably better served if it remains a non-profit endeavor rooted in academia, with support coming from reader contributions. That might have to change, however, if Newsletter growth continues at a rate that outstrips our ability to handle it on the present basis.

I believe that Agrecol could reap some good PR in this field, however, if it could see its way clear to underwrite some of the expenses of the educational program. As this program has grown over the past three to four years, the Department of Entomology (bless them) has continued to subsidize day-to-day costs for postage and clerical assistance to the extent that they were able within their operating budget constraints. The Department is finally cutting off my water, however, as of December 31st (New Years Eve of all times), creating an immediate and critical need for about \$2500 to handle these day-to-day costs through another year. That figure is based on 8 hours/week at \$5.00 per hour for clerical (a student hourly is assigned to typing my correspondence) (a total of \$1920/year) and \$50/month postage (total of \$600/year). If present growth continues, the above numbers won't cover either clerical or postage, but it would provide a running start.

In the above, I've attempted to describe in brief and general terms the milieu that I think we would be operating in, if we decide to form an S corporation. Bringing anything to market will obviously be a lot more complicated than marketing an improved conventional type food product. The first job will be to get input from some of the people mentioned above, and others as appropriate, in determining which insects seem realistic without a huge investment in research and development. If we do in fact get one or more products to marketable stage, I have all kinds of connections to the media on this subject, and we should be able to reap a lot of free press publicity for it. In summary, after we've started exploring the biological and business details of various potential systems, we might come up blank and decide against a corporation, or we might start a revolution that would create agriculture/food history.

Gene R. DeFoliart
December 27, 1991

I received a letter from Pat, dated January 16, 1992, which responded to the immediate monetary need described in the above summary:

Dear Dr. DeFoliart:

Enclosed is a check from Agrecol Corporation in the amount of \$2500.00. This is an unrestricted gift to support the educational outreach program on insects as a food resource, under your direction.

We are fascinated by your work and consider it a very important contribution. Please let us know if we can help further.

Best regards,
(signed)

I sent a thank you January 23, 1992:

Dear Pat:

This is just to express my appreciation for the \$2,500 grant from Agrecol. As we discussed earlier, it will be used largely, and probably entirely for week-to-week clerical assistance and postage in responding to correspondence directed to the "Educational Outreach Program on Insects as a Food Resource." The grant averts a real crisis that had developed as the result of a rapidly increasing volume of such correspondence while formerly available funds have been drying up.

So, again, thanks for this help.

Sincerely,
(signed)

Almost four months passed before my next letter to Pat LeMahieu, dated May 14, 1992:

Dear Pat:

This is a quick interim report on feedback from contacts I made earlier this year on some insect food product possibilities, and a suggested next step.

First, wasp brood (pupae and prepupae)

Letter of January 16 from Jim Ryan (enclosed, pertinent part marked in yellow). Mentions having a paper wasp rearing system for which he hopes to interest pet shop clientele. In a letter of Jan. 24th I asked for more detail on the wasp rearing system and mentioned Agrecol, but haven't heard back from him.

Letter of Feb. 18 from Roger Akre of Washington State U. (enclosed, pertinent part marked). He states that collectors of yellowjacket adults for companies that extract venom discard the nests because they have no current value. The collectors might be interested in selling the combs for some extra income from the operation.

Letter of March 23 from Akre (enclosed, marked). Provides phone number of a venom extraction company, but thinks they might be reluctant to supply their list of collectors. Could probably line up collectors by placing an ad in the ESA (Ent. Soc. of Amer.) Newsletter.

Not much, as you can see, from the above unless Ryan does have a rearing system that he will be willing to discuss with Agrecol. Nevertheless, I suggest the following steps and relevant points for your consideration.

1) Before lining up a supplier network for wasp brood, if that should become desirable, we need to know what kind of final product would be desirable for marketing. Thus we need some input from experimental foods specialists and processing experts. Maybe you already have ongoing access to these specialties, but if not there is processing expertise in the Department of Food Science here, while, if I'm correct the nearest experimental foods department is at Stout. Anyway, to do any experimenting, they would need a supply of wasp brood.

2) We can get wasp brood for experimental use this summer. I've had a couple of conversations with Bob Jeanne, professor of insect behavior here and a wasp expert. He will have a student employ collecting wasp nests this summer, mainly July-September, for a project they are doing. Additional nest collecting could be piggybacked onto this if Agrecol wants to pay for the extra time spent. This is pure luck, having access to a set-up like this as a cheap source of experimental brood for processors to work with. The brood would be delivered on dry ice which is probably the way it would have to be done by collectors in any future network (they ship the adult wasps to the venom factories on dry ice).

There is no doubt that wasp brood is going to be an expensive delicacy at least initially, maybe \$10.00 or more for a 2-ounce can or frozen packet, strictly for the "hostess with the mostest." But that is probably the easiest way to achieve instant "status," and wasp fanciers swear by the flavor (see last Newsletter). Bob Jeanne has some ideas about the design of possible nest attractant sites and artificial housing that would reduce labor and thus cost in the future, but it's too late to begin any work on it this year (although he will make relevant observations as time and opportunity permit during other work this summer).

Honey bees. I wrote letters to two honey bee experts in January and February, but so far have received no response.

Grasshoppers

Letter of February 4 from Florence Dunkel of Montana State U. (enclosed). She suggests mass-rearing, although labor-intensive, is the way to go at present in order to assure a pesticide-free product, and invites us to visit the rearing facility at the USDA Rangeland Insect Lab in Bozeman. I'm not worried about a pesticide hazard if natural populations are harvested only in areas not pesticide-treated in a given year; a bigger problem might be in devising cost-efficient harvest methods for wild populations. In the early West, however, they used "hopperdozers" of primitive design for grasshopper control (they didn't get very effective control, but they got tons of grasshoppers). Mass-rearing would assure a more uniform product, however, and a reliable supply. My wife and I will be in Colorado and, maybe, Oregon in July visiting some of our kids and attending a wedding, and maybe I can arrange to get to Bozeman for a day or two to see the Rangeland Lab facility, get grasshopper production cost estimates, and determine whether they would furnish experimental material for Agrecol's food processing people.

Letter of February 25 from John Ledger, African Endangered Wildlife Trust (enclosed). Questions reliability of supply if wild locusts are harvested.

Though not mentioned in this letter, Ledger was formerly in contact with U.S. manufacturers of “bug zappers” (mobile or portable suction devices) and planned to develop a prototype model specifically for locust harvest. Ledger invites further contact if Agrecol is interested in other edible insect possibilities in South Africa. If you are interested in import possibilities, I can contact him relative to specific suggestions.

Caribbean beetle grubs of gourmet quality

Three species have a glamorous gustatory history in the Caribbean and northern South America (information on one of them is marked on the two enclosed xeroxed pages from an article in the July 1990 Food Insects Newsletter). We have an upcoming opportunity to get more first-hand information. Michelle Schwengel is a junior in the College of Ag & Life Sciences and an entomology major who will be spending the spring 1993 semester in Trinidad as part of an exchange program between the Ag College and the University of the West Indies. She took my course on insects as food during this semester just ending, and became interested in exploring the commercial possibilities of these beetle larvae as all or part of her project assignment in Trinidad. I have a contact in the Department of Zoology at the University there, Dr. Christopher Starr (an entomologist), who would undoubtedly be willing to act as her advisor and work with her on this. If Agrecol wishes to explore imports, I will talk further to Michelle and Starr. Again, this is a case where a small student stipend might be a good investment as I happen to know that she will be getting no monetary support from home during her stay in Trinidad.

I will be in New York all of next week, but after that expect to be freed up a little compared to how it's been the past five months. When I get back I will call to see if maybe you would like to meet with Bob Jeanne and I to discuss details of some of the above possibilities.

Sincerely,

(signed)

cc: Prof. Robert Jeanne, Entomology

I thought the above letter offered quite an exciting variety of possibilities that we could explore, and Mr. LeMahieu apparently expressed interest in at least one of them. My next letter to him was dated July 1, 1992:

Dear Pat:

In talking to Professor Bob Jeanne yesterday, I found that the student hourly working on Bob's wasp research project is already working full-time (40 hours/week). Nevertheless, he would be willing to put in extra time collecting wasp nests and processing them for our use.

Briefly, it would involve collecting the nests into plastic bags, bringing them into the lab in a cooler, freezing them in order to kill any enclosed adult wasps, then thawing the nests, discarding the adult wasps, and, using forceps, removing the pupae and prepupae (“brood”) into a clean container. I understand

that it's best to deep-fry the pupae/prepupae when fresh, but they can be refrozen for later use.

We aren't sure yet what the yield per nest will be, but, assuming that the student can put in as many as 100 additional hours during the peak season, late July, August and September, we should have enough brood to do further work with, such as determining best post-collection processing procedures, possibly obtaining a proximate analysis, and other analyses if deemed desirable, etc.

When I told you over the phone that, for about \$500, I thought enough brood could be collected to begin the assessment of its product potential, I was basing the estimate on 100 hours of student time as outlined above. If Agrecol is interested in making this initial investment, I suggest you call Bob Jeanne to give him the go-ahead within a couple of weeks if possible. As soon as I put this letter in the mail, my wife and I are headed for Colorado for our youngest daughter's wedding. We plan to hit a couple of other spots in Washington and Wyoming while we're out there, so I won't be back in Madison until sometime after July 20th.

Sincerely,
(signed)

My next written communication to Mr. Patrick J. Le Mahieu, President of Agrecol Corporation, was November 25, 1992, when I offered to him (and Bill Graham) the opportunity to indulge in "Pupae Puffs," a delicacy certainly worthy even of a president (the elegance of "Pupae Puffs" is described in Chapter 17):

Dear Pat:

You may remember that Agrecol gave us \$500 a few months ago to use for harvesting some wasp brood (pupae/prepupae). If you and Bill Graham have a spare hour sometime between now and about December 20th, we would like to come over and let you sample the product. It may be the first time either of you will have munched on a \$100 per ounce delicacy (I think our total harvest was about 5-6 oz.). We call this elegant food "Pupae Puffs."

A couple of weeks ago, we put on a "tasting event" in the Department of Entomology for which about 60-70 people (entomology faculty and students) showed up. Unfortunately, they could be allowed only 3-4 Puffs per person because of the limited supply. We had evaluation forms for about half of the tasters and the Puffs averaged slightly above 8.0 on a scale of 1-10. Copies of the promotional materials and results are enclosed.

Marsha Lisitza, who used to be in my lab, is our project chef. She would be available on the following dates in December, Thursday/Friday, the 3-4th, 10-11th, and 17-18th (also Thursdays/Fridays in January). Let me know if any of these dates would be compatible for you and Bill, and any others (up to about a dozen) that you might want in attendance for such an auspicious occasion. Professor Bob Jeanne (wasp expert whose student did the harvesting) will come with us if his schedule permits.

If you should get ecstatic enough over Pupae Puffs, I have another proposal for an expenditure of about \$500-\$750 to explore some commercial possibilities with palm weevil larvae, an historic delicacy in the Caribbean region. Some time ago, I mentioned that one of our entomology undergraduates, Michelle Schwengel, will be spending 4-5 months (February – June 1993) in Trinidad as part of the West Indies Student Exchange Semester Abroad.

Michelle is very much interested in looking at the “traditional cuisine” possibilities of the palm weevils while she is in Trinidad. The protocol combines commercial development and marketing (a canned product?) with ecological goals, control of palm weevil damage and red-ring disease (a nematode) of palms which is transmitted by the weevils. Enclosed is a Newsletter article (from July 1990) that describes the hypothesis. I have had confirmation from Professor Chris Starr (an experienced entomologist in the Department of Zoology at the University in Trinidad) that he will be glad to work with Michelle. What it amounts to is another opportunity to get some cheap initial results by piggybacking our interests on to another program. I happen to know that Michelle is getting no financial help from home. Her estimated costs for the semester in Trinidad (enclosed) are more the \$4,000 so a small stipend to partially offset the cost would be very helpful to her.

I will call in a few days to see if any of the above dates are okay. All we’ll need is a place to plug in an electric frying pan.

Enclosed is a recent reprint that might be of interest.

Sincerely,
(signed)

Enclosures

P.S. Relative to the palm weevil idea, about a week or so ago, I received a long letter from a former USAID researcher in Indonesia advocating the same idea relative to palm weevil species that occur in southeast Asia and the Southwest Pacific.

We apparently talked on the telephone in December, judging from my next letter to Pat, which was on January 11, 1993:

Dear Pat:

This is to follow up our phone conversation in December regarding a date when you and Bill Graham might have 30-40 minutes when we can come over and treat you to some “pupae puffs” (wasp brood). Marsha Lisitza, our chef, is available any Thursday or Friday this month (and probably in February) except for January 28 and 29.

Also, relative to my last letter, have you made a decision yet on my proposal that Agrecol consider providing a \$500 stipend for Michelle Schwengel, the student who will be in Trinidad from February to June and will have the opportunity to investigate the potential of palm weevil larvae as a marketable food

product (tied to simultaneous weevil and red ring disease control), and possibly to ship us some samples to work with here.

It would be appreciated if you can give me a call on both of these matters as soon as conveniently possible. Michelle is scheduled to leave in three weeks.

Sincerely,
(signed)

I can't find any record that we ever got together for "pupae puffs," and I can't remember that we did. I also find no record of whether Michelle got her stipend; with no record, I doubt that she did. In fact I can find no record of contacts for more than a year. So this is a good time to bring up all the good newspaper publicity that had been happening for Bill Graham and his dream. We began this chapter by noting the October 20th, 1991 article in the Wisconsin State Journal. There was another long article, titled "One man's developing vision" in the March 29th, 1992 Money section of the Wisconsin State Journal. Yet another article, "Graham's vision makes him good bet to build ag center," appeared in the May 1, 1992 The Capital Times (the evening paper in Madison). These articles were about the probability that Graham would be building a World Dairy Center and a World Agricultural Center on his land on the east side of Madison. Oh yes, before we forget, there was another article in The Capital Times. It was on January 28th, 1992, by Joe Schoenmann, and the title was, "Tycoon: Bug grub is fare of future." We're talking front page here, and we're talking big colored picture of Bill and me in my lab, him sitting, me standing, both with a plate of bug vittles in front of us. The legend under the picture, a long one, said:

Insects as food is an idea whose time is coming, and William T. Graham (foreground) thinks it might be a potentially lucrative business. UW-Madison entomology professor emeritus Gene DeFoliart, behind him, publishes a quarterly newsletter that touts the benefits of eating bugs. Graham is holding a tequila-flavored lollipop, made in Southern California, that encases a roasted beetle grub. What look like nuts on the plate are roasted leaf-cutter ant abdomens from Colombia. Just above them are two dark silkworm pupae, eaten in Asia, and the white cocoons from which they are extracted. DeFoliart is holding canned silkworm pupae in his left hand and canned wasp grubs from Japan in his right. The grubs, he said, sell for about \$3 per ounce.

The text of the article was:

A Madison tycoon thinks there's a potential cash cow in the edible bug business.

William T. Graham, self-made millionaire, is edging his company, Agrecol, toward production of edible insects.

It's a slow process, but Graham thinks bugs as vittles is the market of the future.

"I probably won't see it in my lifetime, but I wouldn't turn down the opportunity if we could discover a market for insects," he said. "I would sure give it a shot."

In part to foster his bug-food ideas, Graham will fund “The Food Insects Newsletter,” a UW publication which was threatened with extinction due to lack of money.

“If I’m going to get in on the ground floors of a new business, and eating bugs is one of them,” Graham says, chuckling at his choice of words, “then I like to know all about it, and that newsletter is one way of doing it.”

Costs of postage and other clerical duties might total \$10,000 this year, Graham said.

The quarterly publication was started four years ago by Gene Defoliart, UW-Madison entomology professor emeritus.

Catching the eye of the national media, the newsletter quickly grew from a circulation of 100 to about 1,600 today.

Recent department cutbacks, however, meant less money to cover a growing postage bill. Defoliart also found that without clerical help, the newsletter started taking all of his time.

In the latest edition, he warned of a six-month delay or the end of the letter without additional funds.

That’s when Graham stepped in.

“Why let a growing thing die?” he said.

Even before the financial problems, Defoliart had made a believer of Graham when he let him read an eight-page proposal for possible insect markets.

“It was just fascinating reading, like science fiction,” Graham said. “He’s quite a writer.”

The proposal is more than just a list of good- and bad-tasting bugs. It also delves into the American psyche.

Americans, Defoliart said, will more easily take to the idea of bug-grub if first introduced to those that are “socially acceptable.”

Honey bees, take heed.

“Honey bees have a good public image in this country,” Defoliart said.

“They are important pollinators and they are nice, clean insects – not to mention that they are good (eating).”

Other potential markets: wasp larvae, nutty in flavor; crickets, which take on the flavor of whatever they are served with; and the roasted abdomens of leaf-cutter ants.

“In Colombia, if you walk into a theater, you can buy them in cellophane packages,” Defoliart attests. “They’re good; a little bit sweet.”

And all are good sources of protein. That’s a well-known fact in other countries but not well appreciated in the United States.

In that respect, Graham is again ahead of the crowd.

He learned insect nutrition the hard way, on the verge of starvation as a World War II prisoner in Germany’s Stalag 17.

“When we first got there, we would sit around and pick all of the bugs out of the soup,” he said.

“But after about a week, we were starving to death, and I’ll tell ya, you look at them things a little differently when you’re hungry.”

Camp doctors told the prisoners the bugs were probably the most nutritional part of the soup.

“After a while, you saw them, but ignored them,” Graham said.

Graham imagines the average American will have a much different experience upon eating their first bug.

“Just think about a beehive with all those holes full of honey,” he said.

“The baby bee is covered with honey and just eating honey all of its life. It’s got to taste good, don’t you think?”

Even though I can find no record of having had any contact with the Agrecol bunch for more than a year, I don’t remember that I was feeling any sense of estrangement when I wrote to Bill Graham on August 24, 1994. I did feel a sense of estrangement when I got no response to this letter. What might have teed them off I’m not sure, unless it was that I was mildly critical of Dean Wyse at one point in the letter. Anyway, this was my last attempted contact with Agrecol. When I get no response from someone, I never try a second time, unless it’s with someone who owes you a response in the official line of duty.

My letter to Bill Graham was as follows:

Re: A request for \$4000 of funding support for the food insects program

Dear Bill:

I’m sending this directly to you instead of my usual route through Pat LeMahieu in hope that it might save a few days in getting a response. I intended to contact you earlier but have been tied up the past month as the result of a terminal illness in my wife’s family in Florida.

When I “retired” three years ago, my Number 1 objective, other than keeping The Food Insects Newsletter going, was to complete a book which I considered about 75% completed at the time. The title is “The human use of insects as a food resource.” I believe the book will be a valuable source of information for researchers, educators and students at all levels, the mass media and the general public not only in this country but abroad, and will add significantly to the education momentum already generated on this important subject.

The problem is, after three years, there has been no progress on the book. My time is almost totally used up in maintaining the Newsletter and responding to requests for information that come from every direction, sometimes as many as 30-40 letters and phone calls per week. Too much of this time, too, is spent on business-type details (especially since I had to start charging a \$5 subscription rate for the Newsletter a year ago) and routine clerical-type stuff, leaving too little time for being creative.

This past spring semester, through and at the insistence of the Entomology Department, I paid a student hourly, a freshman named Laura Gerard, \$5.50 per hour for six hours per week. Laura has superb word-processing skills, is nearly error-free and unbelievably fast. Six hours per week turned out to be more time than she needed for typing correspondence, maintaining the mailing list, etc., so I

started her on transferring to a computer the book manuscript (which had been typed originally on my trusty programmable typewriter).

I would dearly like to have Laura back to continue this work, but she needs to work 20 hours/week or close to it this coming school year. She is good enough, however, that the Department wants to employ her for 10 hours per week (at \$6.00/hour), which leaves 10 hours for me if I can find a way to pay her. She would continue transferring book text to the computer, plus doing computer-based library searches for papers I have not yet seen, doing some leg-work to the campus libraries to make photocopies, initiating inter-library loans where possible, etc. Some of these quests will be difficult and time-consuming, but one of the Steenbock librarians who is familiar with this project has agreed to give her any help necessary. The reason I need to hear from you as soon as possible is that Laura will be returning for the Fall semester in a week or so.

My other problem is costs in responding to the voluminous requests for information that the program receives. With the current severe budget constraints, the Ag College and Department of Entomology are not the hospitable environment for this project that they once were. The Department now charges the program for all clerical services (see enclosed letter to John Wedberg, chair of Entomology). The Newsletter itself is now self-supporting or nearly so, but it cannot support the broader outreach demands it helped create but which have nothing to do with the Newsletter per se. I believe that these broader educational aspects are legitimately an extension responsibility of the College of Agriculture, but have gotten nowhere with Dean Wyse on that. I've enclosed what ended up as a one-sided and (I'm sorry to say) increasingly acrimonious correspondence with the Dean. The correspondence with Wedberg and Wyse also documents that the program has established high credibility in the scientific and academic communities here and abroad and among journalists and other media people, thus reaping plenty of good P.R. for the University. That the program is tapped extensively as a source of information by the press and other mass-media is further indicated in Part II, Outreach, of the enclosed program summary.

Since you rescued this program once before (\$2500 in January 1992), I'm hoping you might consider doing it again, with a grant of about \$4000. About half would be used to pay Laura, the other half to help handle the type of expenses noted in the preceding paragraph.

A centuries-old national bias can't be reversed overnight, but I believe that our efforts to shine a light on the nutritional, economic and ecological importance of food insect use in other countries, and the benefits particularly for many economically marginal populations is beginning to have a substantial impact on Western thinking.

Sincerely,
(signed)

Chapter 16. Trying to Convince the UW That Answering Requests From the Public for Information About Insects as Food Should be Budgeted as an Extension Responsibility

By 1993, my expenses were reaching the intolerable stage even though I was charging for the Newsletter (\$5 per year). Too much correspondence. We had a new Dean of Ag and Life Sciences and, remembering how helpful the former Ag administration had been, I thought it was about time I introduced myself so he would know who I was when I launched an appeal. I wrote to the new dean, Dean Roger E. Wyse on April 14, 1993:

Dear Dean Wyse:

I retired to emeritus status a year before your arrival here, so have not had an opportunity to meet you. My activity as an emeritus professor has focused on an informal educational effort called the "Educational Outreach Program on Insects as a Food Resource." The most prominent tool in this program is *The Food Insects Newsletter* with a mailing list of 2,000 and growing. A complete set of the *Newsletter* (mostly photocopied) is enclosed plus photocopies of four "overview" type articles and the last research paper on nutritional quality of insects that we published before my retirement.

A letter received last week from a USDA scientist makes me think it might be time to make you aware of this program inasmuch as it could conceivably begin to spawn research opportunities in the not distant future. His letter (enclosed) is the third communication I have had from palm experts in response to an article published originally in the *Newsletter* and subsequently picked up and reprinted in *Principes, The Journal of the International Palm Society* (reprint enclosed). It may lead nowhere. On the other hand there is the potential for immense impact on food production and agriculture in tropical countries, not to mention environmental ramifications.

I hope that you will have time to look over the enclosed materials. This whole concept of insects as food (and animal feed) has stirred up a considerable amount of interest among entomologists and others, both in this country and abroad, more than one might have expected in such a short span of time.

Sincerely
(signed)

cc Bill Graham, Agrecol
John Wedberg, Chair, Entomology

Dean Wyse responded under date of April 27:

Dear Dr. DeFoliart:

Thank you for the information on insects as food. Clearly your article on insects of the date palm has stirred serious interest. I was aware of your efforts when Bill Graham told me that he had interest in the project and I believe has partially defrayed the cost of the newsletter.

Please continue to keep me informed of this very interesting project that you have initiated.

Sincerely,

That seemed like a good beginning with the new dean. I wrote next to John Wedberg, Chair of our Entomology Department, November 23, 1993:

Dear John:

For the past year or so, I've been thinking about giving away the editorship of The Food Insects Newsletter - maybe at the end of 1994 (Vol. VII). The Newsletter and its associated correspondence and commitments have left no time for any progress on the book I had hoped to complete after retirement. Before looking for a new editor, however, I thought I should check first to see whether either the Department or the College has any interest in keeping the Newsletter here at the UW. I believe it has become a valuable piece of property, having achieved a high level of credibility as an educational tool both within the academic community and with the public mass-media.

Enclosed is an "inventory" for the past six years which I largely pulled together about a year ago, adding 1993 just a couple of weeks ago. Although incomplete, it indicates the broad range of contacts we get from the public news and educational media. Unfortunately, it gives no indication of the volume of contacts we get from students and teachers (at all educational levels, elementary to university), probably 75-100 per year, who want information for doing term papers, science projects, etc., or incorporating the subject into their biology and entomology courses. This penetration into the academic sphere is important because it should have a lasting effect.

We answer most requests from students, teachers and the media by sending a few Newsletters and one or more review articles (from among those listed on the last page of the inventory). I believe that the wide distribution of these printed materials is responsible, more than anything else, for the significantly higher quality of discussion that one now reads and hears on this subject. Because of the Newsletter and associated activity, the UW is without question the recognized leader in what could continue to develop into a formally recognized and globally important subdiscipline of entomology and agriculture.

My second question relates to finances. The Newsletter has been a basically free publication to subscribers and will continue to be free to some of them, such as Peace Corps Volunteers for one example. But, during the next year, we will be transitioning to more of a pay-as-you-go operation for most subscribers. Costs are currently running right at \$7,000 per year. One of our significant costs is in handling correspondence. The volume is such that the Department's short-handed clerical staff is unable to readily absorb it, so I am paying for a student hourly 6 hours per week at \$5.50 per hour, which comes to more than \$130 per month and more than \$1500 per year. This is going to be a back-breaker, at least during the coming year.

Is there any chance that Dean Wyse might be willing to inject an additional \$1500 into the Department's clerical budget specifically to take care of these typing costs? That isn't very much, considering the good "PR" that this program generates for the University.

Regarding the Newsletter's future location, I'm not looking for any finalized arrangements right now, only whether I should make any particular effort to keep it here. Let me know if you want any other information relative to any of the above.

Sincerely,

John responded promptly, November 30, to Emeritus Professor Gene DeFoliart:

Dear Gene:

Thanks for your letter of November 23, 1993. It certainly demonstrates that The Food Insects Newsletter has broad outreach impact for the college and our department. I understand your contemplation of passing the editorship to someone else; there are lots of other things you would also like to do.

As to asking for \$1500.00 from Dean Wyse, I believe this would be a waste of our time at this point. I am in the process of finding \$18,700 from our budget and returning it to the college. Every department has been assigned a "head tax" of 1-3%. Additionally, I haven't been able to get them to return any salary savings on our frozen classified position. We will also have a head tax levied during mid-year in 1994, and sometime in January or February I will be told what our share of the permanent base reduction will be. Therefore, Gene, we need to do a lot more preparation before we ask for anything. The Dean has a 3.2 million dollar debt to retire.

Under Roger's administration, department newsletters will have to carry their own costs via subscription charges. We should make our plans after you evaluate the success of the pay-as-you-go system. I don't believe you can afford the kind of personalization you give to subscribers, at the current subscription rates. We could visit with Associate Dean Ken Shapiro about the possibility of support to help carry international subscribers.

Sincerely,
(signed)

Only a few days later, I heard from John Wedberg again (dated December 8):

Dear Gene:

We are watching all expenditures very carefully, given the extremely tight budget situation. It appears that printing and postage for the December mailing of *The Food Insects Newsletter* will cost approximately \$1700. You have \$1690 in your account at this point. Laura Gerard is owed approximately \$66, and there is only \$6 left in your department postage account. That account will probably be used up by this Friday.

Gene, I hope you can shake a “sugar daddy” out of the trees. I fear the program is out of rope without one.

Sincerely,
(signed)

Reading the above eight years later (2001) in putting this book together, I was much impressed by the calm, patient way in which John stated what was obviously a serious financial situation, a crisis, in fact. I was also impressed by the fact that I was apparently continuing to operate full speed ahead with no visible underpinnings, as if what else is new. I was also greatly impressed in reading my response to John’s letter, dated December 18:

Dear John:

I’m not quite sure what you meant in your recent note (December 8) that the food program is “out of rope” unless a “sugar daddy” can be found. As far as the front office is concerned, the program has been out of rope for some time now. I pay for everything except the air I breathe down there. I did find out last week, however, that I will get a nice Christmas bonus this year. During the next month while the \$5.50 per hour typist is home on Christmas/between semesters break, I will get to pay \$8.40 per hour for anything that I have to have done by the office staff.

I don’t buy the argument that the food program is some kind of giant parasite sucking on the Department. Relative to the three Newsletter mailings per year, the Department (Pat) furnished a print-out of the mailing list and the mailing labels, and Norma metered the foreign part of the mailing. That is it. The Department has covered none of the major expenses of printing or postage for the Newsletter or preparing it for the printer. The Department’s main involvement in the program has been typing correspondence, etc., which, according to Carol, has averaged 4-5 hours of secretarial time per week. The Department has also furnished the standard \$280 for postage in responding to correspondence, less than half the total spent each year, I might add. For the past year or so, except for the \$280 postage allotment, even these relatively minor expenses have been charged directly to food program funds.

I will also mention that the Department (the University included) contributed nothing to the cost and expenses of assembling and operating the traveling school exhibit, nor of giving the Department some visibility in a few other places such as the Wisconsin Science Teachers Annual Forum and the Dane County Regional Science Fair. The Department has contributed nothing toward expenses incurred in speaking to service clubs, etc., in Madison and as far away as Janesville. Out-of-state trips at the invitation of several professional groups from New York to the West Coast have given the Department added profile, while costing the Department nothing. The Ent. 324 course was taught one extra time after my retirement – at no cost other than the usual xeroxing of class materials. So give me a break when it comes to implying that the food program has been some kind of huge drain on Department resources.

The preceding addresses only Department costs and some local educational activity. The real impact of the food program, with the Newsletter as an important tool, is much broader and deeper although I'm not going into that further here.

Regarding your letter of November 30, I appreciate your thoughts about the futility of approaching Dean Wyse for any money right now. I've decided to approach him anyway, for about \$2000, while making it clear that I don't want any money that would otherwise belong to the Department of Entomology. As far as I am concerned, the food program has generated plenty of good PR for the University, both in the general public and in academia, and it is having some important educational impact (as I documented earlier for you). The CALS supported research on this subject for several years, but so far, the outreach program has cost them essentially nothing. They've always asked us to explain how our research would benefit the public. In this case, I can easily show them. So, before trotting outside looking for more "sugar daddies," I think it's time that I find out if there is any support for this program within the University, either in the Department or in the College, or maybe elsewhere.

I am in the process of making the Newsletter completely self-supporting (see current issue) and I expect to have achieved that by the end of 1994. In the meantime, it could be very, very tight and, depending on how Newsletter readers respond in the next couple of months, I face the possibility of having to write a few \$1000 personal checks before the year is out. If it comes to that, it comes to that. But, unless the Department has an unfavorable view of the program, I wouldn't mind seeing a slightly less vigorous enforcement of the "this is strictly business" policy toward the program. It's not as though the Department isn't getting anything in return.

Sincerely,

P.S. December 21. Carol and I had an impromptu discussion of some of the problems late yesterday after this letter had already been written. I had held up handing it to you until after the Newsletter was distributed. I'm leaving it unchanged, but if things are as tight as she says, someone should ask the Dean, "What the hell is going on?"

The above was followed by this brief additional note, December 23:

John:

The fifth paragraph of my letter of December 18th, about approaching the Dean, may not have been clear. I agree that, under the circumstances,, there isn't a snowball's chance of getting any money over there. But if the Newsletter goes bankrupt, I don't want him to be able to say, "Well, you don't get anything if you don't ask." For that reason, I want my own personal "no" from him.

Gene

After apparently taking a break for Christmas, on December 29 I wrote the Dean:

Dear Dean Wyse:

I am in the process of making The Food Insects Newsletter completely self-supporting, including for the rather prodigious amount of between-issues correspondence that it generates. I expect to have achieved that by the end of 1994 (see Editor's Corner, page 2, in the current issue enclosed). In the meantime, however, during this transition period, things will be very, very tight and I face the possibility of having to write some fairly hefty personal checks to help cover costs before the year is out. Thus, I am writing to ask whether it would be possible for the College to help underwrite this for the next few months, up to \$2000, if needed.

I believe the Newsletter has generated a lot of good PR for the University, both in the public at large and in academia, and is having significant educational impact in reducing our unwarranted and counter-productive cultural bias in this subject area. We furnish hundreds of informational packets and consultations per year to students and teachers (all educational levels from elementary to university), nature and science centers, environmental and hunger-related public interest groups, Peace Corps Volunteers and other Third World agriculturists, textbook and reference book writers, and mass-media people (see enclosed inventory). The program has been instrumental in exposing literally tens of millions of people (at least) to information about this previously little recognized beneficial aspect of insects, and the reception has been surprisingly positive.

For most of the decade prior to my retirement in 1991, the CALS and (to a lesser extent) the Graduate School supported research on insects as a food resource (see section on Technical Publications at end of the inventory). Except for \$1700 provided by the CALS a couple of years ago, however, the ensuing outreach program has been conducted at essentially no cost to the University. I hope to keep it that way if we can get by the next few months.

I'm aware that there are severe financial constraints at the present time, so I especially appreciate any consideration that might be given to this request.

Sincerely,

Things were quiet for awhile, as explained in the first sentence of the letter below, which I dispatched to the Dean on April 12, 1994:

Dear Dean Wyse:

I would appreciate the courtesy of a response to my letter of December 29, 1993.

The attached letters from the National Wildlife Federation and a Chinese university library, of some 12-15 letters received during the past week, show that this program has continuing educational and professional impact both here and abroad and is of some P.R. import to the University of Wisconsin. Other letters were from a specialty food importer in California wanting to know where he could obtain at least 100 kg of a certain kind of ant harvested in South America,

from a Purdue University nutritionist doing USAID-sponsored food research in Burkina Faso, and from a 7th grader doing a school paper in Ohio. In addition, there were telephone contacts from CNN and CBS, both of whom are planning television documentaries. From the documentation sent to you with my letter in December, you can surmise, correctly, that the past week was not out of the ordinary for this program in responding to requests for information.

After 3 ½ months, I would like a reply, whether it's positive or negative.

Sincerely,
(signed)

Enclosures

Cc: Neal Jorgensen, Exec. Assoc. Dean
Robert Steele, Assoc. Dean for Research
John Wedberg, Chair, Entomology

From the above, it is apparent that I was fairly impressed with the quality and quantity of my own mail during this stretch of years. I had used the same tactic, citing interesting requests for info received during the past week or two, two or three years before in dealing with the Center for Biology Education. The tactic hadn't worked against the CBE, and it wasn't going to work here, either, but I'll duplicate the two letters enclosed to the Dean anyway. The first (dated March 29, 1994) was from Deborah Churchman, Senior Editor of the National Wildlife Federation, Washington, DC:

Dear Dr. DeFoliart:

For your information, we are planning to write an article on cultures around the world that eat insects, to be featured in a forthcoming issue of our children's magazine, Ranger Rick. To illustrate this article, we've gotten a hold of some splendid photos by Peter Menzel. Our photo editor has decided to feature giant waterbugs in Japan and Mexico, grasshoppers in Japan, flying bedbugs in Mexico, and emperor moth larvae in southern Africa.

I'm writing in the hopes that you would have further information about these insect snacks. I'm particularly interested in obtaining your paper, "The Human Use of Insects as Food and as Animal Feed," which I saw mentioned in your splendid newsletter. I'd be happy to reimburse you for any expense.

Many thanks for sharing your expertise with our young readers. Once the article is written, would you be kind enough to review it as well? We want to make sure that the information is as accurate as possible.

Sincerely,
(signed)

More than ten years later, I still shake my head when I remember how the Center for Biology Education didn't consider this sort of stuff as evidence of successful educating. The letter from China, dated March 24, 1994, was from Shen Guanfu, Director of the Library, Nanjing Forestry University, Nanjing, P.R. China:

Dear Dr. DeFoliart:

We have noticed that you edited an excellent journal “The Food Insects Newsletter”. There are many professors of Zoology and Entomology here in our University who are interested in food insects. We would like to keep your “The Food Insects Newsletter” on the journal shelves of our library. Please send us all back issues of your journal and put our library on your mailing list.

Sincerely yours,
(signed)

From Dean Wyse, April 26, 1994, and straight to the point:

Dear Dr. DeFoliart:

Given the budgetary constraints that the College faces, we will be unable to provide resources to support “*The Food Insects Newsletter*.” This is consistent with our policy for removing support for other editorial services that in the past have been provided to the editors of scientific journals.

Sincerely,
(signed)
(copies to the same three that received mine)

My next letter to Dean Wyse was May 4, 1994, telling him he had missed the point, and enclosing two more letters, apparently unconvinced that this gimmick, burying the recipient under an avalanche of impressive documentation showing need, wasn’t going to work sooner or later.

Dear Dean Wyse:

Thanks for your letter which arrived yesterday. I believe, however, that I have not succeeded in clearly explaining the point I’ve been trying to make.

I’ve been aware for a year or more that the Ag College no longer supports newsletters. I now charge for our Newsletter and it is now self-supporting, or would be if it wasn’t absorbing a lot of costs that have nothing to do per se with producing and distributing the Newsletter. Too much of the money sent in by Newsletter subscribers is being used to cover the costs of responding to requests for information from teachers, students, environmental and other public interest organizations, the media, and you name it. A lot of this sort of activity was outlined in my earlier letters to you.

I’ve enclosed yet a couple more letters for your inspection, one recent, one from about a year ago, which relate to medical matters. For the past year, it has cost me \$5.50 per hour for typing here in Entomology when I respond to letters like these. There is no justification for laying these costs on Newsletter subscribers who already are supporting a large number of free subscriptions for Third World scientists, Peace Corps Volunteers and libraries.

A couple of more examples, these from yesterday after your letter arrived. I had a call from Bonnie Coffey who hosts a call-in show on KLIN Radio in Lincoln, Nebraska. She wants to interview me live, for one hour, on her show, which I agreed to do. Beforehand, as is my usual practice with interviewers, writers, etc., I will send her a packet of materials that provide some backgrounding in the subject. I've found that this makes for interviews of much higher quality. The typical packet consists of selected back issues of the Newsletter and photocopies of one or two review articles I've written. Cost of printed materials, photocopying, typing and postage for these packets is usually \$2.00 or more. This is a broader educational cost that should not be borne by Newsletter subscribers.

Also, last night, after watching a little CNN (Global Forum with President Clinton) I was taking a little after-dinner snooze on the downstairs couch when my wife awakened me at 8:35 pm to take a phone call from Texas. It was from a fellow who had been looking for information on the biology of the "green tree ant" which happens to be an edible insect in Australia and southeastern Asia. He had finally called Texas Tech University and someone there told him that the person he should talk to is Professor Gene DeFoliart at the University of Wisconsin. This is the exact same introduction I get from dozens of callers and letter writers each year, from students to television producers. Obviously, a lot of people know that Wisconsin is the place to go for information.

It is true that the Newsletter was a key factor in stimulating and giving some identity to this expanding new field of scientific and public interest. I make no apologies for that. Neither do I make apologies for making the University of Wisconsin internationally recognized as the leader in pioneering this new field. I think, in fact, that re-educating America away from one of its damaging and best known biases is one of the better examples of the kind of "sifting and winnowing" that is supposed to be so sacrosanct at this University.

Although I'm still arguing my point, given the budgetary constraints I've heard so much about I'm no longer looking for any monetary support from the College. But, in the absence of any support whatsoever from administrative levels, I'm also less and less inclined to feel any responsibility for responding to problems such as those described in the attached letters.

Sincerely,
(signed)

(enclosures and copies again to Jorgensen, Steele and Wedberg)

Both enclosures this time were of a medical or public health nature. The first letter (March 11, 1994) was from Sally Ann Martone, Division of Allergy/Immunology, Rhode Island Hospital, Providence, RI:

Dear Professor Defolirat (sic):

Our Division is currently seeking information concerning the worm and/or larvae found in flour. There is a possibility that when inhaled or ingested, this worm may cause anaphylaxis. Do you have any information on this or clues as to

where I could obtain relevant data? Would you be aware of an FDA publication listing all the insect proteins? Also, it is my understanding that there is a *Food and Insect Newsletter* available that might provide more data on this topic. Perhaps, I could contact them for past articles on this subject. And lastly, I sincerely apologize if I have misspelled your name.

Thanking you in advance, I am

Very truly yours,
(signed)

The other, older, letter enclosed to the Dean, dated September 11, 1992, was from James R. Baker, Extension Entomologist, North Carolina State University, Raleigh, North Carolina:

Dear Dr. De Foliart:

I have had a request for information concerning mental health patients consuming green June beetle grubs, and I am appealing to you for some information to help the groundskeeper at this institution deal with a tense situation between him and his administration. The administrators and perhaps the families of the patients object to the habit the patients have developed of eating green June beetle larvae as they find the grubs during their recreation time in a grassy courtyard, a pleasant and secure area. Pressure has been put on the groundskeeper to apply an insecticide for green June beetle control. His concern is that the poisoned grubs may emerge from the soil, and the patients may consume pesticide contaminated grubs. I also have a concern that when the grubs die they may spoil so that the patients may get food poisoning as well as pesticide intoxication. I have consulted with Dr. Michael Waldvogel here and with Dr. Peter Adler at Clemson University. Our pooled opinion is that in the long run, it would be least harmful to allow the patients to continue eating the grubs and not to try to manage the grubs with pesticides. Dr Adler mentioned your name as a person expert in the human consumption of insects. If you have any information on possible problems with eating raw green June beetle larvae, I would greatly appreciate receiving it. I will also read gladly your opinion on whether to try to manage the grubs with insecticides or not.

Sincerely,
(signed)

I received a memo dated June 17, 1994, from Dr. Wedberg, re: Updating the mailing list for the Insect Food Newsletter:

It will fall on Pat Houtsinger to update the list, we have no one else left who can do this. My agreement to have the office work on the list is contingent on your assurance it is only a two hour job and if she is able to clear her desk of the load of proposals and manuscripts that historically get priority over all other departmental correspondence. Her ability to get to the list by July 7 depends on

how well our new temporary works out when she starts on June 27. We have only one word processor left and no summer help. We have only another one-half position (now vacant) to lighten the load.

My responding memo, June 20th, to Dr. Wedberg may or may not have been sent. "Not sent" was scribbled on one copy. Sent or not, I would guess that it rather accurately describes what I was thinking:

Are you telling me in your memo of June 17 that you might completely block the July mailing of the Newsletter rather than interrupt for even 2 or 3 hours the continuous week-after-week typing of manuscripts and proposals? I know things are tough, but it is also a fact that 1,000 people out there have sent money to the Department of Entomology, with checks payable to the Board of Regents. They paid for their Newsletter, and they expect to receive it.

On May 26, 1994, I sent another letter to Roger Wyse. As I read all of this, years later, I'm thinking that it's sort of surprising that I wasn't subpoenaed to appear before the University Committee or whatever other appropriate body to answer to charges of harassment of a Dean:

Dean Wyse:

Two more enclosures.

The one from Lincoln, Nebraska simply confirms a radio contact mentioned in my letter of May 4th.

The one from Eagle River, Wisconsin is another example of the kinds of requests that I may soon have to start forwarding on up to 140 Ag Hall for a response, for lack of any budget with which to respond from down here.

Sincerely,
(signed)

P.S. I find it interesting (for lack of a better word) that between 1978 and 1991, the CALS spent around \$100,000 of Hatch funds for research in this project (not to mention some of the time and effort of two nutritionists, Benevenga and Sunde, and two entomologists, myself and David Hogg, and not to mention about \$20,000 or more provided by the Graduate School and \$8,000 more from the Curricular Revitalization Program of the CALS, but you wouldn't spend \$2,000 to help ensure that the public will reap the benefits.

(Enclosures and copies to Jorgensen, Steele and Wedberg)

The first of the enclosures was a letter dated May 17, 1994 from Bonnie Coffey, hostess of "The CoffeyTalk of Lincoln" on radio station KLIN/EZ-107, Lincoln, Nebraska:

Dear Dr. DeFoliart:

What a great show! Thank you for taking time from your busy schedule to be with me on “The CoffeeTalk of Lincoln” today . . . I had a terrific time! And while we didn’t have a lot of calls while you were on the air, we had a lot after the show! I guess they were just a little squeamish about the whole subject and had to warm up to it. The interest is definitely there; time will tell if the idea catches on.

Again, thanks – good luck on your future endeavors and studies! If I happen to run across the Reese canned insects, I’ll be sure to let you know.

My best,
(signed)

The second enclosure was a penciled note, dated May 23, from Phil Pellitteri. The best way for me to identify Phil Pellitteri is to mention that, back in the days when I was department chair, I used to consider it useful to mention once in awhile for the benefit of several profs who had a distorted perception of the relative value of basic science profs to applied science profs that if the University should someday be told to reduce entomology staffing to one person, the person kept would be Phil Pellitteri. Phil ran (and runs) our Pest Diagnostic Lab, and in my opinion is the best in the country (at least of anyone I have met) in telling people how to solve whatever insect pest problem they may have. He’s on the radio a lot and probably most people in Wisconsin have heard him or heard about him. His note to me said:

Gene,

Could you send 2 or 3 copies of old Food Insect Newsletters to Kristy Knutson, c/o Northline Pines School District, 1800 Pleasure Island Rd., Eagle River, Wisconsin 34521 (check accuracy of this zip). She will be feeding her 5th grade students waxworm Brownies and potato salad this Friday. Thanks, (signed)

After all these exchanges with my department chair and the Dean, I was obviously not feeling very kindly toward the University on October 6, 1994, when I wrote as follows to Chancellor (of the Madison Campus) David Ward:

Dear Chancellor Ward:

I’m sorry, but I must decline your request that I serve for third and fourth years on the Retired Faculty Committee. My experiences as a retired faculty member trying to keep a unique, productive (and next-to-nothing in costs) outreach program going have, for the time-being at least, completely soured me on any further commitment to the administrative levels of the University of Wisconsin. Therefore, please accept my resignation from the Retired Faculty Committee.

Sincerely,
(signed)

cc: Pat Elsner, Secretary of the Faculty
Dean Roger Wyse, CALS

(Blind copies also went to Jorgensen, Steele and Wedberg)

I was after the poor Dean again, April 10, 1995:

Dean Wyse:

The attached program of the International Symposium on Biodiversity in Agriculture, to be held in Beijing, China, shows that 11 of the 30 presentations by researchers in Asia, Africa, Europe and Latin America pertain to insects as food (pages 3, 4, Attachment). During the past year and a half, I have tried to tell you that the concept of insects as a food resource of global significance shows strong signs of emerging as an important new field in agriculture, and that Wisconsin is the recognized leader (p. 2, Attachment). It's too bad that, for lack of any budget support whatsoever from your office (specifically the measly \$2000 I asked for in December 1993), on top of the Entomology Department's practice of charging me \$6 to \$9 per hour for clerical services, I've finally had to give our Wisconsin outreach program away to another land grant institution as of the end of this year.

Sincerely,
(signed)

cc:

Neal Jorgensen, Assoc. Dean, CALS
Robert Steele, Assoc. Dir., CALS
Jane Knowles, Asst. Dean, CALS
George Sledge, Retired Faculty, CALS
John Wedberg, Chair, Entomology
David Ward, Chancellor
W.T. Graham, Agrecol

And finally, one last shot at the Dean, September 19, 1995:

Dear Dean Wyse:

I thought the Ag Administration might be interested in the attached trans-Africa food event, coming as it does on the heels of the international symposium in China.

Sincerely,
(signed)

(Enclosure and copies to Jorgensen, Steele, Knowles, Ken Shapiro [Internat. Ag. Programs], Sledge, Wedberg, Graham)

The announcement enclosed to the Dean was dated 24th August 1995 from J.P.R. Ochieng-Odero, Programme and Planning Officer for RANDFORUM, The Research and Development Forum for Science-Led Development in Africa, Nairobi, Kenya:

Dear Dr. DeFoliart:

SYMPOSIUM AND EXHIBITION ON INSECT FOR FOOD

I am pleased to inform you that the Research and Development Forum for Science-Led Development in Africa (RANDFORUM) is holding an Africa-wide Exhibition on Indigenous Food Technologies. A committed group interested in promoting the use of insects for food and other human uses under the aegis of a center for indigenous knowledge systems is hoping to mount an elaborate exhibition on African Insects and human use during this exhibition scheduled for 13-17th December 1995, in Nairobi, Kenya. We also hope to have an opportunity to have a one-day symposium with some of the participants.

I hope you can highlight this in your newsletter as well as during the forthcoming Beijing Conference. We hope people who wish to exhibit, both from Africa and without can attend. We are interested in people willing to present brief papers. They should contact the undersigned.

With best wishes for Beijing,

Yours sincerely
(signed)

Chapter 17. Miscellany: Pupae Puffs, Edible Insects as Art, Etc., Etc.

The invitation sheets posted on every floor of Russell Labs (home of the Department of Entomology) announced, “You Are Cordially Invited To An ‘Entomological Event,’” and described it as “The First Official Tasting Of ‘Pupae Puffs.’” There was no charge, of course, but once in the conference room, those in attendance quickly learned that they were about to partake of the most costly delicacy any of them had ever tasted. Harvest costs made pupae puffs worth about \$100 per ounce. The July 1993 *The Food Insects Newsletter*, Volume VI, Number 2, reported on the event as follows, under the title, “Wisconsin entomologists give ‘thumbs-up’ to ‘Pupae Puffs’”:

Pupae puffs in this case were pupae and prepupae of two kinds of wasps, the relatively large bald-faced hornet, *Dolichovespula maculata* and the smaller German yellowjacket, *Vespula germanica*. The term, “Pupae Puffs,” was coined by the chef for the occasion, Marsha Lisitza, formerly in the medical entomology laboratory and now with the Wisconsin Eye Bank. About 60-70 people (faculty and students) showed up on October 30, 1992, for the afternoon tasting event in the Department of Entomology conference room. The pupae were deep-fried in peanut oil for about 15 seconds. In their unseasoned natural state, the Puffs had a mild nutty flavor. Optionally, garlic salt could be added.

A rating form had been devised, but unfortunately, only 35 copies were available. The Puffs averaged a rating of slightly above 8.0 on a scale of 1-10, with 24 tasters rating them at 8, 9 or 10, and 11 tasters rating them at 5, 6 or 7. Three people rated the two species separately, two slightly favoring *Dolichovespula*, and one slightly favoring *Vespula*. To the question, “In your opinion would additional flavors, such as lemon-pepper, Cajun, or others, enhance the product?” 14 respondents checked “yes” for lemon-pepper, 16 “yes” for Cajun, 5 wrote in “garlic,” 2 wrote in “salt,” and 3 wrote in other flavors.

Comments (with the rating given by the person making the comment in parentheses) included: “They were delicious plain!” (10); “These are the most extremely tasty creatures I have ever had.” (10); “A bit greasy, how about air popping?” (10); “Fried more deeply would be better.” (9); “They would make good appetizers.” (9); “Thanks. It’s only weird when their eyes look at you.” (8); “Very rich, couldn’t eat too many.” (8); “Would be very good for breakfast.” (8); “Surprisingly good!” (8) I have tried drone bee larva in Indonesia, it was better.” (7); “Just don’t look them in the eye!! Good!” (7); “Need to add some seasoning.” (7); “I would like them better if they were crunchier.” (6); “I guess I would like them better if they were a little crispier. More like a potato chip.” (6); “[They need] lemon or fine herbs added such as parsley, basil, oregano, etc.” (5).

The pupae became available as the result of a small grant from the Agrecol Corporation which was used to motivate a summer student employee in Professor Robert Jeanne’s social insects lab to put in some overtime nest collecting.

[Provide some kind of lead-in to the next paragraph on Lou eating a cricket]



Usually, when I was giving a seminar on campus, one of the students would prepare some treats to take along. People were curious about what insects taste like. Most of the time, the samples were garlic-flavored crickets. This is what I was passing out after a seminar in the Department of Entomology. My youngest daughter, Linda, who was a graduate student at the time and attended the seminar not only sampled one or two there, but took six or eight home with her. Home at the time happened to be with her mother and I. I will never forget the scene. Linda had sat down facing her mom in our rec room. She remarked that the seminar was good, and she mentioned that dad had handed out some garlic-flavored crickets at the end, and they were really good. Mom should try one, and Linda handed her one. Lou just held it for awhile while Linda continued to say how good they were. Finally, Lou nibbled off a small piece. Linda was looking at her intently. "They're good, aren't they," she said. Her mother said, "Well, it's okay." Linda said, "Here, have another." Her mother said, "Oh, no, I'll have to rest awhile first."

Less than two years after "Pupae Puffs," edible insects were again involved in an event on campus. Chris Merritt, who seemed to have no limits to the variety of endeavors in which she might be the organizer, or, if not that, a participant, told me she was organizing an art show and would I be willing to include my edible insect exhibit, the one I had been taking around to elementary schools a couple of years previously. I told her I didn't think insects pinned in rows in a glass-topped box really qualified as art. It sort of degenerated into a "Yes they are," "No they aren't" argument that ran on for several weeks. I knew insects could be art. I had a shadow box at home on one of our walls in which I had arranged six or seven of those large beautiful iridescent blue *Morpho* butterflies from South America among some dried flowers that Lou was about to throw out. I had even taken that creation to an art show at our church, feeling compelled, however, to post beside it a small notice saying that all of the specimens were more than 25 years old and had been collected long before any *Morphos* started appearing on endangered species lists. Anyhow, Chris was so insistent that I finally gave in and said "Okay, but I still don't think they qualify as real art."

The announcement cards noted that the exhibit was organized by Chris Merritt, it would be held June 18 – July 22, 1994 at the Wisconsin Union Galleries and was in conjunction with the UW-Extension Seminar, "Spirit in the Land." There will be a reception Monday, June 20, 7 p.m., Douglas Hill, player of the Native American flute, will perform original compositions. Chris never let up. The announcement said the exhibition included work by, and named about a dozen artists of whom I was one. I thought, "Oh boy, now they're going to think that I think those insects are art." The Capital Times, Madison's afternoon newspaper, on June 30, published art critic Kevin Lynch's long review, titled "Art show ties environment to human growth":

"Spirit in the Land," currently at the Wisconsin Union Galleries through July 22, begs comparison to the eco-art exhibit "Fragile Ecologies" at the Madison Art Center last winter, especially because solutions to environmental problems remain hotly debated.

"Fragile Ecologies" documented activist artists who work to make art or technical collaborations for environmental betterment. That idea seems good –

new creative ideas will be needed to overcome a pervasive and perhaps cataclysmic problem.

But right from that show's title on down to most every artist's conception, it betrayed age-old arrogance, now in the guise of righteous activism, saying "Look what we can do to save poor, helpless nature. Our big brains will come up with big ideas. We can show ecologists and governments how to do things."

This seems the flip side of the mentality that exploits the land for the "good" of humans, that never learns from natural "disasters" and inexorable cycles that show how our free wills don't make us controllers of the undeniable patterns of planetary forces. Even if we end up destroying our planet, another cycle of some sort will kick in.

This is not to argue that artists shouldn't creatively work for environmental benefit. But amid malicious cultural politics, it may be more important for artists to show more convincing art than unconvincing eco-designs, less political presumption than a way for humans to best fit into schemes of nature.

"Spirit in the Land" suggests how humans can grow in the know, and go with the flow, how they can adjust their attitude by understanding their relationship to the land, by living for something greater than heedless consumption. It amounts to an ecologically preventive attitude rather than a prescriptive one. These artists seem to work to change paradigms of behavior.

Consider the artist statement of Madisonian Jean Stamsa: "I come from the earth and will, in time, return to it. And even though at the moment I am 'temporarily not soil,' my thoughts are of the land. Not panoramic vistas or fields or forests, but rather the earth directly beneath my feet."

That sense of being with and of the land is what permeates the work of these artists. So tis is less eco-art than nature art, but not the numbing, hackneyed kind that merely prettifies and idealizes nature, though a few works here tend toward that.

.....

This is also the rare art exhibit with the interdisciplinary openness to include the work of non-artists.

Notable here is the work of Jim Scherz, a professor in the Civil Engineering Department at the UW-Madison, who displays maps of the Wisconsin Indian mounds. And even more fascinating are the crunchy "delectables" of Gene DeFoliart, a professor emeritus, from the Entomology Department at the UW-Madison.

He is internationally distinguished in his specialty of endangered species study, specifically in human uses of insects as food.

DeFoliart displays several cabinets full of large creepy crawlers who are works of art themselves. DeFoliart, who served up cooked insects at the show's opening reception, allows reconsideration of creatures that humans may dismiss as pests, or abhor, or kill off arbitrarily.

Astonishing and beautiful is the walking leaf, delicately graced with translucent membrane on all parts of its body, by contrast to spiked apparitions such as “Eurycantha horrida,” which looks like it sounds. But each beetle has nutritious meat that other cultures prize.

Animals crawl all over a life-size human bust by Marge Williams titled “The Good Earth.” One arm is a muskellunge, and on the figure’s back is the head skin of a wolf. This is an icon of a human who has found a balance between nature as adornment and cohabitant. His head is missing. This is to imagine the person who need not depend on the human cranium if he found other forms of intelligence to live with and by.

And technological art need not be shunned by this nature art aesthetic, as photographer Zane Williams proves. His superb Wisconsin scenes possess a serene clarity of focus that never becomes prying or hard-edged, as if he holds the land’s breathing forms and textures close in the cup of his lens.

Until reading Lynch’s review, I was unaware that I was internationally distinguished relative to endangered species. Also, it was Chris Merritt, not me, who cooked the crickets for the reception. They were flat-out delicious, and I watched any number of people making return trips to the table for additional helpings. I was of course elated at how well the edible insects had fared in Mr. Lynch’s critique, both for their astonishing features (and innate beauty of some) and their ready acceptance as nutrients. I don’t remember now, but I surely must have apologized to Chris for having ever questioned her confident assessment that edible insects are art – absolutely.

Chapter 18. Correspondence, the Media and Educational Progress: the Late 1980s and the 1990s

I tend to think of a letter dated May 16, 1989 from Dr. Walter I. Knausenberger as indicative of the wider recognition and improved status of edible insects by that time compared to the situation existing 15 years earlier. Dr. Knausenberger, headquartered in Washington D.C., was a Pest Management Specialist with the U.S. Agency for International Development. He wrote:

Dear Dr. DeFoliart:

The “insects as a food resource” issue appears to be taking on a life of its own, in the sense that it is coming to my attention more and more often lately (in the context of my new position here at USAID Africa Bureau). First, AID/S&T approaches me about my reaction to your proposal; then I see your fine review article in the ESA Bulletin; then I learn that Noel Vietmeyer (National Research Council) has a file on entomophagy larger than my own (and he loans it to me); then another colleague shows me your Food Insects Newsletter (and he isn’t even an entomologist!). Perhaps I was in Africa too long?

In any case, could you please add me to the mailing list to receive The Food Insects Newsletter, and if possible, would it be possible to get a set of back issues (Vol. 1, Vol. 2, No. 1)? I shall be glad to remit any payment necessary.

Also, I shall appreciate receiving reprints of your article “The Human Use of Insects as Food and Animal Feed”, in the English, French and Spanish versions, and if possible, five copies of each, for use in promoting the subject during my travels.

As I get a chance, I have been pursuing a thread of contacts concerning additional resource people for the African angle, but I have not come up with anything concrete yet. In any case, it would seem that the program for the December informal conference is already well established (although I have not been in touch with Bill Rush during the past few days regarding the funding from S&T).

I trust that all is well, and that you will be able to accommodate my requests.

Sincerely, (signed)

Chapter 19. Thank You, NIH

I had so much trouble getting outside funding for our ideas on insects as food, detailed mainly in Chapter 4, but alluded to in many other chapters of this book that it seems only fitting to thank the National Institutes of Health (NIH) for providing the infrastructure that made it possible to conduct our food studies, and, especially our food outreach efforts. This was unintentional on the part of NIH, but inasmuch as the research program they were paying for continued to meet or exceed their expectations for productivity, I think they would have felt good if they had known about the bonus yield in results. The NIH-supported research program I am talking about was initially called “Arbovirus- and Host-Relations of Wisconsin Arthropods,” but beginning with the first renewal became “Transmission and Control of California-Group Viruses.” Totally, NIH supported this project (#AI 07453) for 23 consecutive years, funding the original application for a period of five years, and then five renewals, each of three or four years’ duration. In each and every case, we were awarded the number of years and dollar amounts of support that we requested. The record of renewals with dollar amounts initially awarded and the highest single year award in each renewal period is shown below, although awards during the second and third renewals were subsequently increased from the \$116,081 shown below to \$135,721 and from 177,830 to \$187,914, respectively:

5	01-05	1966-71	\$144,864	\$30,981
3	06-08	1971-74	92,829	33,272
3	09-11	1974-77	116,081	42,183
4	12-15	1977-81	177,830	46,969
4	16-19	1981-85	245,066	66,788
4	20-23	1986-90*	295,349	79,326

Funding was approved for the Year 1985-86 but there was a lag of seven months before it became available. To cover the lag, the UW Graduate School provided interim support of \$32,500. Also, because of my impending retirement, no further renewals were sought, and approval was given to use any Year 23 funding that might remain in Year 24 to close out the program.

The above amounts were for what are called “direct costs,” the amounts actually available to the laboratory for conducting its research. In addition, however, there are what are called “indirect costs” or “overhead” that is paid to the university for such things as keeping the gas and electricity turned on. The overhead rate (which is based on salaries and wages, supplies, etc., but not new equipment purchases) increased during the life of this project from 40% to 44%. Overhead was a very good deal for university administrations. For example, the overhead awarded to the UW administration for each of the six funding periods shown above was, respectively \$50,724, \$36,690, \$54,830 (based on \$135,721 direct costs), \$75,761 (based on \$187,914 direct costs), \$88,720, and \$105,960. No part of these amounts was available to us for actually conducting our research.

I want to emphasize that never did we seek NIH funds to meet food insects research objectives, but they did provide the infrastructure that permitted the food program, especially the outreach portions, to happen.

I became involved in mosquito/arbovirus research at the urging of Professor Robert P. Hanson, a virologist in the Department of Veterinary Science. The reader may recall that it was a Robert Hanson who invited me to be on the Symposium on Unconventional Sources of Protein away back in 1975. This was the same Robert Hanson. Bob had conducted extensive studies on viruses in Wisconsin wildlife, also on scrapie virus in sheep, [psychodid ? work] [mention some others that I can't think of right now]. In [year] he was elected to the National Academy of Sciences. Bob was Co-Principal Investigator on my NIH project from 1966 to 1974; Tom Yuill, a former graduate student in Bob's lab and who later became a professor in the Department of Veterinary Science served as Co-PI from 1974 to 1990. From 1961 to 1971, I served as Co-PI on a project for which Hanson was the PI, "Wildlife Reservoirs of Diseases of Man and Livestock" (NIH #AI0071). Funds from this project supported some initial entomology studies related to its project objectives. Hanson was also the PI on a Department of Defense-Air Force grant from which medical entomology drew up to #10,000 or more per year for several years in the early and mid-1970's. This was titled: "Association of Vertebrate Pathogens with Ecological Perturbation of Tropical Forests."

In addition to Hanson, Yuill and me, there was another lab at the UW conducting research on encephalitides, Wayne Thompson (PhD) in the Department of Preventive Medicine. Thompson et al (1965) made the original isolation of La Crosse virus from the brain of a child who died of encephalitis in 1960 in a hospital in La Crosse, Wisconsin. Virus isolations and human clinical cases have occurred throughout the upper Midwestern states with strong foci in Ohio and Wisconsin, and serologically confirmed human cases in Nebraska and most of the states contiguous with or east of the Mississippi River. Research at UW quickly focused on determining the identity of the vector (transmitter) of this virus inasmuch as it appeared to be probably more important than any of the other mosquito-borne viruses as a public health problem in Wisconsin.

Mosquito-borne arboviruses are of global public health importance, there being, worldwide, more than 200 such viruses (see cited reviews by DeFoliart et al 1986, 1987). They are the etiologic agents of such diseases as yellow fever, dengue, Japanese encephalitis, and scores of other major encephalitides, including four in North America (five now with the introduction of West Nile virus). Prior to the early 1970's when we scored a rapid succession of research breakthroughs on La Crosse (LAC) encephalitis virus, it was not known how any of these mosquito-borne viruses survive the winter in temperate zones or the dry season in the tropics although numerous theories and hypotheses had been advanced during the preceding 40 years. Then, Watts et al (1972) (Doug Watts was one of our graduate students) put the capstone on previous laboratory and field work on LAC virus (most of it at the University of Wisconsin) by demonstrating that *Aedes triseriatus* is an extremely efficient laboratory transmitter of the virus, thus establishing with certainty the identity of the major vector. Then, with this virus-mosquito system, Watts et al (1973) provided the first conclusive experimental demonstration of transovarial transmission of an arbovirus by a mosquito. We followed up on this by demonstrating (Watts et al 1974) that the diapausing egg of *Ae. triseriatus* is the overwintering mechanism of LAC virus.

Spielman (1975) of Harvard, and others, have referred to these in terms such as “landmark discoveries,” and they have indeed had a significant impact on mosquito-borne arbovirus research around the world. After the mid-1970’s, we largely concentrated on mining the new territory opened up by those breakthroughs, identifying and quantifying parameters that affect the relationship of vertical (transovarial) and horizontal (via mosquito bite) transmission of LAC virus. The early stages of this follow-up phase was described in the Study Section critique sheet for our 1981 NIH renewal as follows:

This is a long-term project which has sustained a high level of productivity for many years. . . During recent years, this project has not enjoyed some of the major break-through-type of discoveries that typified their efforts in the early 1970s. Still, they have continued to chip away on all fronts in order to develop an understanding of the LAC viral system in the important enzootic areas in southwest Wisconsin. As a result, the understanding of this arbovirus far exceeds any other and continues to provide important leads for many other workers.

From the above and other critiques, NIH appeared to fully share our own assessment of the value of the research directions we had taken after the early breakthroughs. This assessment was further strengthened by a letter I received, out of the blue, in March, 1982, from Dr. William R. Horsfall of the University of Illinois at Urbana-Champaign. Professor Horsfall, by then retired for several years, was the author of the well-known “Mosquitoes: Their Bionomics and Relation to Disease,” 723 pages, 1955; also the author of a widely used medical entomology textbook and a couple of other volumes on mosquitoes, as well as a renowned researcher in his own right. Considering the scientific stature of Dr. Horsfall, and the fact that I had not had that much personal contact with him, his letter is unquestionably my most prized piece of professional correspondence:

Dear Gene:

Recently I have occupied myself reworking the literature on arboviral pathogens, and, of course, I ran through that on LAC virus. The striking thing to me was the sequential development of the studies that came from your laboratory. Your group saw through the steps necessary to make a quite complete picture of this pathogen, its focality and biotic elements essential to its perpetuation. Then your group proceeded to make each part clear. In my file the picture of a pathogen and its maintenance is best illustrated by your work. Orderliness such as this should be studied by other laboratories as a model. While none of this is news to you, this expression lets you know that others know as well.

Very truly yours,
[signed]

With statements like these, plus others we could haul out if more was needed, all taxpayers can rest assured that NIH was never short-changed even though we were diverting some of our thinking and energies toward other objectives. Drawing from a later renewal to show continued NIH satisfaction, and adding a different dimension, our 1985 NIH Study Section critique stated:

This project, which serves as a focus for doctoral student training and dissertations in medical entomology and virology, continues to be highly productive . . . Professors De Foliart and Yuill are to be congratulated for developing and integrating a highly innovative and productive research program into a graduate educational program.

Since the main aim of this chapter was to show that, just because I couldn't get any outside grants on food insects that didn't mean that I couldn't get outside grants when I was working with a decent subject. In the late 1950s and early 1960s prior to our long-term funding on mosquitoes/arboviruses, I had four small NIH grants (all for under \$10,000 direct costs) for work on black flies, also a small grant (less than \$10,000) for work on mink myiasis from the Mink Research Foundation, and several small grants (each less than \$5,000) for dairy farm fly control studies from Dow Chemical Company, McLaughlin Gormley King, Shell Chemical Company, Union Carbide and Chemagro Corporation. These small grants were more useful than they might seem because, during the early 1960s, I had a State assistantship which provided the stipend for a graduate student. Other grants included two U.S. State Department Fellowships, one on black flies for one year in 1960 and one on arboviruses for three years beginning in 1969. Other grants later included one in 1973 (\$10,205 direct costs, \$4,620 indirect costs) for one year from the Department of Defense-U.S. Army for work on "Human biting activity of rain forest *Culicoides*," and one in 1978 (\$18,703 direct costs, \$7,560 indirect costs) for one year from NIH for a study on "Man-biting activity of Colombia bloodsucking Diptera." Once #AI 07453 had begun to look firmly established though, we simply hadn't spent much time looking for other funding, for medical entomology that is. As you know, we were beating our brains out trying to find a few dollars for food insects objectives.

As long as we're devoting a few pages to NIH and medical entomology, I want to expound a little beyond just the funding game. One day sometime during the early 1970s, my head lab technician, I believe it was Dottie Mosely at the time, asked me who was the biggest person in the field (the field of medical entomology). I told her that if she could just wait a couple of weeks, she would get to meet him. I'm not sure how it got started but during the early 1970s and continuing for at least a decade or more, every other year George Craig, world renowned mosquito geneticist at the University of Notre Dame, would gather up all his grad students, postdocs, etc. (he always had an army of them) and bring them up to Madison for a days' visit with me and my students. In the alternate years, my students and I would trek to South Bend. These were stimulating sessions indeed. They centered mainly around research developments pertaining to La Crosse virus. George Craig was certainly one of the most productive biologists that I ever had the pleasure of associating with. His enthusiasm seemed always to instill enthusiasm in everybody around him, and to bring out the best in everybody.

After George's first visit with all his troops to our lab in Madison, Dottie Mosely said to me, "I see what you mean." She was referring back to her earlier question about who was the biggest in the field of medical entomology. I'm not sure how much George weighed, but it had to be somewhere between 300 and 500 pounds. So Dottie was convinced that she had indeed met the biggest person in medical entomology.

I have to tell one more story about George Craig. He was an avid sports fan, especially when it came to Notre Dame. Some of my students insisted that they had seen George on TV at Notre Dame football or basketball games. Anyway, I was raised in Arkansas from age 10 years until I headed off to college. I became an avid Razorback fan which continues pretty strong even to this day. The Razorbacks had a great football season in 1977, going 10-1 in the regular season with only a 13-9 loss to unbeaten Number 1-ranked Texas marring the record. They met the Oklahoma Sooners in the 1978 Orange Bowl. Oklahoma had also lost only one game – to Texas – but had looked unbeatable the last two-thirds of the season, rolling up big scores on everybody they played including Nebraska. The Fighting Irish of Notre Dame also had a fine football season and went to a bowl game. My memory is a little hazy about who they played. Despite slaughtering unbeatable Oklahoma 31-6 in the Orange Bowl, Arkansas finished only third in the final AP rankings. Notre Dame finished ahead of them, and I was not at all hesitant about telling George Craig that Arkansas was a better team than Notre Dame, but would have to be three times better to ever outvote the Irish. Both Arkansas and Notre Dame also had good basketball teams that year, and I told George that I would bet him that if Arkansas and Notre Dame happened to meet in the NCAA Tournament, Arkansas would win. He took it. It was a bet. Five or ten dollars, I don't remember which.

As it turned out, believe it or not, they both made it to the Final Four. Arkansas met Kentucky in the first game and lost 64-59. But Notre Dame also lost their first (semifinal) game. In those days they played a consolation game for third place nationally. The final score was Arkansas 71, Notre Dame 69.

A few weeks later when George and his troops arrived in Madison for our annual conflag, my first question after we were all seated was “Where's my five bucks?” To skip all the parrying, like “What five bucks?,” George reached into his brief case, handed me a small beribboned package. I unwrapped it and found myself holding a coffee mug in Notre Dame colors, blazing green and gold. Printed on one side was the Notre Dame football schedule of the preceding year; on the other side in big words was printed Notre Dame Fighting Irish, National Champions, 1977. My five-dollar bill was stashed inside all of that.

The sudden and untimely death of George Craig in December 1995 was a tragic loss for the field of medical entomology and for entomology in general. Dr. Karamjit Rai has summarized the research and other professional activities of this imminent scientist and remarkable man in the book, “Four Decades of Vector Biology at the University of Notre Dame.” Craig founded the Vector Biology Laboratory there in 1957, and in recognition of its pioneering contributions in the field of *Aedes* mosquito genetics, in the mid 1960s the lab was designated as the World Health Organization's (WHO) International Reference Centre for *Aedes*. As one of its functions the lab maintained more than 150 strains of mosquitoes, including 22 species, geographic populations, mutant strains, etc. (Rai 1999).

In addition to our annual visits to each other's labs and the \$5 bets, George and I interacted in other ways. I gave a seminar at Notre Dame in 1972 and George gave one in our department at the UW (I don't remember the year). When I became Chair of the Department of Entomology in 1968, the first thing that the Dean, Dean Genn Pound of the College of Agricultural and Life Sciences said to me was, “Gene, I want you to take

that department to the top.” I told the Dean that if he would help me bring George Craig here, we would be the top entomology department in the country. We had ranked fourth in the most recent Council of Education rankings – behind the University of California-Berkeley, Cornell University and the University of Illinois-Champaign/Urbana. Much to my surprise, the Dean meant it. He gave me the green light to negotiate and find out what it would take. I’m not sure whether George Craig could have been lured away from Notre Dame, but technically the effort broke down when we could find no way to meet his need for 5,000 square feet of laboratory space. In 1974, Paul Grimstad, one of my prized students, accepted a postdoctoral position at Notre Dame. He was later made a member of the faculty, and, upon Craig’s death was named by NIH as Principal Investigator to oversee the remaining years of Craig’s then-current grant.

[Check on details of the manpower Conference in DC]

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