Fifty Years of Veterinary Entomology - 1946-1996

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The title of this paper, when I agreed to prepare it six months ago, didn't seem too imposing; but when I started to work on it, the adage, "fools rush in where angels fear to tread," came to mind. Fortunately, I had Sid Kunz's paper, "Highlights of Veterinary Entomology 1952-1977," which was published in the Bulletin in 1978, and one I had presented in Africa in 1987, "Highlights of Veterinary Entomology in the United States," published in the Nigeria Journal of Entomology, as starting points. The annotated bibliographies by Morgan, Thomas and Hall on the horn fly, stable fly and face fly were also very helpful. Ron Winslow reminded me that Bob Hoffman (ARS) had given a history of this conference in 1979 at College Station, but I missed that meeting. He also sent me a picture of the group at the 1960 meeting at Purdue, which I have placed in the back of the room.

It would be difficult to discuss history without providing names of the individuals who made that history. However, in doing that, you inadvertently leave out names very worthy of mention, and I apologize in advance for any of those oversights. Also, a presentation of historical events by one person is biased by the experiences of that person.

There are probably about a half-dozen of us old heads still in veterinary entomology who knew those people who were the movers and shakers in our field in the 50's, 60's and 70's. We could be termed overlappers, and the list would include Axtell, Butler, Cox, Drummond, Kinzer, Knapp, Kunz, Pennington, Steelman, Bud

Wright and me. We were the new kids on the block during some very exciting times, and we were exposed to some crusty people who were characters and about whom stories are still told.

Right after World War II, control of livestock insects became feasible economically because of the efficacy and longevity of the chlorinated hydrocarbon insecticides. The work by Laake (1946) in Kansas on the benefits of controlling horn flies with DDT astounded cattle producers. In some of those trials, weight gain benefits exceeded 50 pounds/animal.

During the next 10 years, insecticide evaluation trials were conducted all over the U.S. and Canada as well as Europe, Africa and South America against a whole plethora of livestock insects. Along with those efficacy trials, considerable research was initiated into the residues of the insecticides in animal tissues and in milk. The results began to raise a flag as to the side effects of the complex of the miracle pesticides.

ARS did much of the toxicity and residue work at Kerrville and later at College Station, Texas, for products that had potential for use on livestock insects. Rudy Radeleff and Jack Palmer probably conducted most of that research working with Drummond, Graham and the rest of the Kerrville staff. But Cutkomp at Minnesota and others at land grant universities also contributed to that data base. The books, "Toxicology of Insecticides" by Matsumura (1975) and "Veterinary Toxicology" (1964) by Radeleff cover much of that research, and those author's in the literature reviews for each chapter. A good many efficacy trials were also conducted by ARS

people—Drummond, Eschle, Graham, Harris, Hoffman, Kunz, and others were involved in trials on ticks, face flies, horn flies, stable flies, grubs, lice, and other pests.

Along with the new products came new methods of treatment, generally known as self-treatment devices. In the Great Plains, "oilers" were used for the control of horn flies which replaced spraying the cattle. The oilers were generally homemade and were constructed from fence posts, burlap and chains or wire. Cattle would rub on them and enough insecticide would get on the haircoat of the animal to control horn flies. This self-treatment method for horn fly control provided an opportunity for extension demonstration projects. Extension entomologists, Crenshaw and Loomis at California, Gunderson and Stockdale at Iowa, Moore at Illinois, Gates at Kansas, Roselle at Nebraska, Robb at Wyoming, and probably many others were involved in these trials. Those entomologists and animal health representatives joined with county agents and with 4H'ers to demonstrate the effectiveness of the oilers and sometimes the advantage of horn fly control by weighing the cattle at the beginning and end of the fly season.

Other exciting events during that time phase, at least from the standpoint of veterinary entomologists, include the introduction of the face fly into North America probably in 1952. In Europe the pest seemed to be of minor importance, but in the U.S. and Canada it caused quite a stir. The annotated bibliography of Morgan, Thomas and Hall (1983) covers 30 years of literature on the face fly. Prior to that, Smith et al. (1966) had published an annotated bibliography of the face fly in California (Vector Views) and followed that with several supplements containing literature reviews from the preceding year. The Canadians Depner, Teskey and Vockeroth; ARS researchers Fales, Jones,

Killough, Miller, Pickins and Thomas; and Land Grant University researchers Adkins at Clemson; Anderson and Loomis, California; Dobson and Sanders at Purdue; Dorsery, West Virginia; Knapp at Kentucky; Stoffolano and Matthysse, Cornell; Treece at Ohio State; Turner at VPI; and Wingo at Missouri and their graduate students conducted much of the early research on the face fly. Currently, Broce at Kansas State, Krafsur at Iowa State and Moon at Minnesota (members of NC-154) are still conducting research on the face fly, primarily on the overwintering aspects of the pest.

The advent of the face fly and the restricted use registration for some of the more toxic and longer residual chlorinated hydrocarbon insecticides gradually brought about replacement of most of the oilers with dust bags. Although in the Central Sandhills of Nebraska where the face fly is not a problem, we still see some use of oilers. The dust bags generally provided better face fly control than did the oilers because, if adjusted to the proper heights, animals rubbed their faces on the dust bag as they passed under it. In areas where face flies were very numerous, entomologists built and evaluated dusting stations which shielded the dust from rain. Commercial companies developed salt holders with dust or oilers in them which treated the face of the animal when it was using the salt block. Later, mineral feeders were modified by adding dusters and oilers so they would also treat the face of cattle using the mineral feeder. Feed additives were also being evaluated during this era. In addition to phenothiazine (the old timer), rabon and methoprene were given federal registration as feed-through treatments for fly control. At present much of the product research is with systemic broad spectrum

parasiticides like Ivomec or with application methods with those products or third generation pyrethroids.

Another exciting occurrence and one very germane to this 35th Livestock Insect Workers Conference was the development of systemic insecticides for the control of cattle grubs. The first was ronnel (Dow ET-57), a Dow product; then ruelene; and, over the next few years, Chemagro alias Cutter alias Miles and, finally, Bayer developed three (Co-Ral, Neguvon and Tiguvon); American Cyanamid developed Warbex; Stauffer developed imidan or GX-118; and, finally, Merck received registration on the bioparasiticide Ivomec which probably will be followed by the Cyanamid and Pfizer products of a similar nature.

The development of the systemic insecticides for grub control was quickly accepted by ranchers and feedlot operators. At first these products were used as sprays and dips. Eventually pour-on and spot-on formulations were developed.

Gingrich and Drummond developed a novel method for quickly evaluating systemics. They established a rodent colony and a cuterebra colony and would evaluate the product on the infested rodent. The life cycle of the cuterebra is fairly short, so it didn't take long to get a preliminary evaluation of a product.

The people mentioned earlier from the Land Grant Universities were also generally involved in grub research. The Canadians included Rich, Khan and Weintraub; the latter developed a method of using tethered heel flies to deposit eggs on cattle. Lancaster at Arkansas; Scharff in Montana; Howell in Oklahoma; Pfadt, DeFoliart and Haws in Wyoming; and ARS people in Oregon (Rogoff, Roth and Gaines

Eddy) all conducted grub control research with the new systemic insecticides as they became available, in addition to the Kerrville staff who have already been mentioned.

The systemic insecticides have been so effective and extension programs so broad-based that cattle grubs have almost been eradicated in many parts of the U.S. We find it very difficult to find cattle with enough grubs to conduct research trials in Nebraska. It is now necessary to go to Third World States like Wyoming and Montana to conduct cattle grub research. We have had the opportunity on three different occasions to start with a herd of cattle that were grub infested; 60-70% infestation level and an average of 20 grubs per infested animal. After treatment with a systemic insecticide in the fall for three years, the grub infestation level fell below one percent with only one or two grubs per infested animal. In our most recent experience at the university ranch, where we had treated for four years, we have now encountered grub infestations of 20 percent, five grubs per infested animal after four years with no systemic treatments.

Grub treatment, like horn fly control with the oilers and dust bags, provided extension entomologists, county agents and 4H youngsters an opportunity for treatment demonstration projects. Dawson County's 4H Club, a big feedlot county in Nebraska, won a national USDA award for their demonstration project on cattle grub control.

Literally hundreds of grub trials were conducted in the U.S. and Canada in the 20 years following the registration of ronnel. I counted at least 18 trials by Drummond, Gladney and their cohorts. Thornberry eradicated grubs, at least temporarily, in Ireland, and there was at least partial eradication in the Netherlands. Mustock Khan did the

same in a Canadian Province, and, I believe, France has recently completed an eradication program.

Without doubt the screwworm eradication project, set up by ARS with Knipling and Bushland as leaders but with Coppage, Graham, Hightower, and Snow as program directors—with literally scores of others in support—was the most exciting event to occur in veterinary entomology, if not all of entomology, during the 20th Century to date. The immensity of this program during the past three decades is hard to imagine, and it is still ongoing in the countries to the south of us. In this current age of measuring impacts of programs, this program alone would justify most of the expenditures of all of entomological science, let alone veterinary entomology.

I will make no effort to try to name all those historically associated with the screwworm program, although I knew many of them. They probably number in the hundreds by now. Screwworm research in the U.S. is currently conducted at the USDA/ARS Livestock Insects Midwest Laboratory located on the University of Nebraska campus at Lincoln, under the leadership of Dr. Gus Thomas, and south of the border by Dr. John Welch, Research Leader in Mexico, Costa Rica, and Panama. Programs are ongoing or in the planning stage for several Central American countries, and one was recently completed in Africa.

I would be remiss in any discussion of the past 50 years in the history of veterinary entomology if I didn't mention the professors who taught and were degree advisors for most of us currently in this entomology field. They include Lancaster, Arkansas; Loomis, Anderson and Mulla, California; Ted Atkins, Clemson; Matthysse, Cornell;

Knutson and Pitts at Kansas State; Burns at LSU, Combs at Mississippi State; Wingo, Missouri; Kinzer, New Mexico State; Axtell, North Carolina State; Howell and Hair at Oklahoma State; Dobson, Purdue; Price at Texas A&M, Turner, VPI; DeFoliart, Wisconsin; Haws and Pfadt at Wyoming; and, I am sure, others that I have missed.

As a result of these good and patient college professors and/or their proteges, we have Rutz at Cornell; Butler at Florida; Jones and Weinzerel at Illinois; Holscher at Iowa State; Monk and Broce at Kansas State; Moon at Minnesota; Hall at Missouri; Thomas and Campbell at Nebraska; Byford, New Mexico State; Rick Meyer, North Dakota State; Wright at Oklahoma; Williams at Purdue; Kunz, ARS, Texas; Bay, Clymer, and Hoelscher, Texas; Lloyd and Schmidtmann at Wyoming; Lysyk, Lethbridge, Canada; Scholl and Swinghammer, American Cyanamid/Fort Dodge; Riner, Fermenta/Boehringer-Engelheim; Meyers and Shugart, Mallinckrodt; and surely others in industry that I have missed. Quite a few of us also received quite a bit of training from ARS people like Bushland, Drummond, O. H. Graham, Hoffman, Knipling, Lindquist, McDuffie, and Schmidt.

Although courses in livestock or veterinary entomology were taught in several Land Grant Universities by the professors I have mentioned, there was no specific book available for the course. "Entomology in Human and Animal Health," Herms and James, and "Destructive and Useful Insects," by Metcalf, Flint & Metcalf were generally used as references. But in 1985, a book entitled “Livestock Entomology,” edited by Williams, Hall, Broce and Scholl, was published as an objective for NCR-99. I don't know how well it served the purpose, but several thousand copies have been sold.

This book was followed soon after by Lancaster and Meisch's "Arthropods in Livestock and Poultry Production" (1986); Bay and Harris's "Introduction to Veterinary Entomology" (1988); Drummond, George and Kunz's "Control of Arthropod Pests of Livestock" (1988); and Kettle's "Medical and Veterinary Entomology" (1989). I don't know why it took so long to put together a book on veterinary entomology, but once started, it seemed to become a popular thing to do.

I believe our greatest loss over the last 50 years has been in extension. Virtually all of the Great Plains and intermountain states that I am familiar with had extension entomologists who devoted considerable time to livestock. These entomologists worked with county agents and technical representatives from American Cyanamid, Chemagro, Dow, Cooper, Shell, Stauffer, and others side-by-side in the field with the rancher and feeder cooperators. Then the animal health companies hosted clientele meetings in the winter where extension personnel presented pest identification, economic loss and pest control efficacy data to the producers.

These programs provided a direct working relationship between the producers, extension personnel and representatives of animal health companies. At present, many of these states have little if any extension entomology time allocated for livestock; and there are fewer animal health companies in existence, and much of their technical representative's time is spent trying to get through EPA and FDA red tape and rules and regulations. Even those states that derive much of their agriculture income from livestock have extension entomologists with only 0.1 or 0.2 of their time assigned to livestock.

Some of those outstanding industry representatives would include Lucas, Wang and Zimmer with American Cyanamid; Danny Cox, Miles; Mozier and White with Chemagro; Ron Everett, Coopers; Limley with Diamond Shamrock; Lucas, Ludwig, McGregor, and McMartin from Dow Chemical; Haberman with Purina; Higgins, May, Miller, Young from Shell Chemical; Landrum and Winslow with Thuron; and many others. Several industry people and even a few university and ARS people have gone into consulting or have developed animal laboratories for discovery research.

Bob Pennington, a younger member of our group, probably typifies how those people operated in knowing the researchers, the parasite problems, the competition and rancher/feeder cooperators. He is currently using the expertise in the company he co-founded: Ecto Development Corporation. Included in this group would be Crenshaw from California; Clymer from Texas A&M; Del Miles from Chemagro; Young and Miller from Shell; Winslow from Thuron; Gladney, ARS and industry; Ron Evert from Coopers; and Drummond, ARS.

Today there are a few excellent livestock insect programs in progress. But in times past, we had some activity either in research, extension or both in most states. Now Lethridge, New Mexico and Wyoming are the only active programs in the whole intermountain area. California has the only activity on the West Coast, and New York and North Carolina serve the East Coast. There are very active programs in the North Central, Southeast, and Southwest areas, but there is little, if any, livestock insect effort made in at least 30 of the 50 states.

Consequently, the livestock producers are relying on sources other than extension entomology for information on arthropod parasites of livestock. The result of this reduction in extension and commercial personnel who interact directly with livestock producers has been a great loss to veterinary entomology, and this loss is reflected in lack of recognition by federal and state administrators who control the purse strings for agriculture research and extension.

Historically, events following the screwworm program appear a little pale, but they should not be overlooked. In the late 70's and early 80's, veterinary entomology developed a regional research planning committee (NCR-99) which was followed by the funded project NC-154. This project survived for 15 years and was joined by the Southern Regional project S-242. Currently these two projects are being submitted as one joint project.

The first National IPM Workshop for livestock arthropods, hosted by Charlie Pitts, was held in 1979 at Manhattan, Kansas. The proceedings of this workshop, which accessed research and extension needs for IPM implementation, was widely used to support the need for research and extension positions and grant requests, particularly at the federal level. Campbell (1994) reviewed IPM progress for livestock arthropod pests, and while we have made some progress, we need to improve.

The second National IPM Workshop, hosted by Thomas & Campbell, was held 15 years later at Lincoln, Nebraska; and its proceedings should be ready for distribution soon. We hope it will serve as well as did the first in supporting our needs. We have experienced a reduction in ARS, CSRS and CE staffing of about 30 percent in the U.S.

during the 15-year span between those two workshops. I believe there has also been a reduction in Canada and certainly in the animal health industry with the decline in the numbers of companies marketing animal health products.

Earlier I mentioned the self-applicator dust bags and oilers. Two other application methods that could be classified in this group are the insecticide-impregnated ear tags and boluses. Tom Harvey, Kansas State-Hayes and Bill Miller, Shell Chemical, were the first to look at the possibility of insecticide ear tags. They used pieces of Vapona no pest strips fastened to the ear with hog-nose rings (at least that is what I remember). These tags were originally targeted for the Gulf Coast Tick which, if controlled, would cut down on screwworm infestation. Hair and his cohorts at Oklahoma State were also working with insecticide-impregnated ear tags. The first commercial tags marketed by Shell contained Rabon dust which bloomed to the surface and rubbed on the haircoat, which provided pretty fair horn fly control for a few weeks. This tag had a few problems; it was too heavy which caused a necrotic wound at the attachment site causing gotch ear, and it lasted only about half of the fly season. However, the next tag contained fenvalerate and this tag was extraordinary. It was light, easy to attach and lasted the whole horn fly season, providing control in excess of 99%, as did tags containing permethrin. The farm press picked up on this revolutionary fly control methodology and, in the next few years, millions of ear tags were sold by several companies. Unfortunately, as we all know, the success was short-lived (at least for horn flies). Resistance to the pyrethroids in the ear tags was first noted in Florida and within the next few years spread throughout the U.S. and Canada. Management of resistance

could furnish at least one chapter in a book on the 50 years history of veterinary entomology.

The development of resistance to the pyrethroids used in ear tags probably hastened the registration of boluses. Hair and others at Oklahoma State and Miller and colleagues, ARS, Kerrville, had been working on boluses for some time and had perfected them to the point that they could be marketed pretty quickly. The two boluses contained two novel insecticides: Dimilin, a chitin inhibitor, and methoprene, a juvenile hormone analog. The boluses and dust bags and oilers were generally recommended in lieu of ear tags for horn fly control in areas of resistance until the commercial companies started marketing phosphate impregnated ear tags and soon thereafter the third generation pyrethroids. The slow-release technology has been evaluated in the past by Kunz, Miller, Bud Wright and others and is being employed in the fly and mosquito control area now. Several new kinds of slow-release systems are currently being researched by animal health companies, ARS, and probably others.

Historically, trapping always seemed to have potential for control of the mobile insect pests of man and animal. Practically, traps have served very well for population monitoring, but they generally fell short of achieving control status. The New Jersey mosquito trap, the Manitoba tabanid trap, Williams' fly trap and its modifications, and the Missouri walk-through horn fly trap and the Australian horn fly trap are a few examples of traps. The pyramid traps of Pickins and Miller which trap both the face fly and the stable fly and the various screwworm traps are newer and probably a little more efficient.

Research in the past few years by Butler at Florida with attractants-repellants and the reported success in Kenya and other African countries with tsetse fly traps that employ location, shape, chemical and visual attractants or mixtures thereof, give an indication that traps still have great potential. It seems that the more we learn on the biology, ecology, movement, etc., on a particular pest, the more likely it is that a trap can be designed that might become a control tactic. Traps that employ biologicals, pesticides, pheromones, and semiochemicals like those being developed by Troy Biochemicals and other companies may be successful in the future. Trapping certainly has public appeal from the standpoint of being environmentally friendly and from the standpoint of a safe food supply.

I believe another historically important aspect of research in veterinary entomology in the 1970's, 1980's and into the 1990's was the determination of the economic impact of some of the arthropod parasites on animal performance. Two or three things probably contributed to this either new or renewed effort to determine the economics of livestock insects: Drummond's chastisement of all of us at the 1971 LIWC, Steelman's paper in the Animal Review of Entomology, and the Kansas State IPM Workshop, which all clearly highlighted the lack of knowledge on the cost of livestock insects to animal agriculture. In this effort we were able to convince animal science and administrators that we needed livestock for research that were restricted to entomology rather than some secondary trial superimposed over an animal science or range management trial. Consequently, research by CSRS, ARS and Canadian scientists has shown the impact of ticks, horn flies, face flies, mosquitoes, stable flies, cattle lice,

scabies and cattle grubs on cattle performance; scabies, lice and flies on swine performance; sheep ked, nose bot, and flies on sheep performance; as well as specific losses from poultry pests. Drummond et al. have reviewed the economic losses in livestock from arthropod pests in the CRC series by Pimental and in the Merck Symposium on the economic impact of parasitism in cattle. This does not imply that more research isn't needed because more data is needed for specific areas of the country under different livestock management systems and for the newer types of livestock breeds that are currently in use as well as for those pests for which we do not have data.

Not only have we made progress on the economic impact of livestock insect losses, but research efforts at Kentucky and other locations are now being directed to the metabolic processes within the animals that cause the reduced performance. Other research is being directed to the animal immune system in an effort to correlate this with genetic research efforts of Steelman and cohorts. Hopefully, genes or genetic lines that are antibiotic or reduce or tolerate the impact of parasitism on the performance of the animal can be found for the various species of livestock. In addition to research in the U.S. and Canada, Australia, New Zealand and several countries in Africa are conducting research in this area.

There has been considerable interest in biological control of the livestock insect pests for a long time. This interest was probably stimulated by Carson's "Silent Spring," but considerable research was conducted prior to that. Anderson, Legner, Steinhaus and their students at California; Axtell and students, North Carolina State; Fincher,

Morgan, Patterson and Peterson, ARS; Hall, Thomas and Wingo, Missouri; and Stoffolano in New York, could be considered the leaders in this biological research. Rutz, Cornell; Green, Kansas State; and Geden, Hogsette and Petersen, ARS, are currently very active in the biological control field. Two publications, "Status of Biological Control of Filth Flies," edited by Patterson and Morgan; and "Biocontrol of Arthropods Affecting Livestock and Poultry," edited by Rutz and Patterson, summarize this topic.

Several of the biological control studies may have been instrumental in bringing about some excellent research on the biology and life history of several of the major pests of livestock. Or the reverse may have been true; studies on the biology and life history of such pests as the horn fly, face fly, house fly and stable fly may have stimulated research on the parasites and predators of these species. Research on the horn fly by Kunz et al. at Kerrville; and Thomas and Hall at Missouri, certainly increased our knowledge of that pest. The same was true for the stable fly by Thomas and Hall at Missouri and Thomas and students at Nebraska. I have already mentioned the research on the face fly.

Integrated pest management (IPM), although far behind progress in the crop area (but they outnumber us 10 to 1) has been utilized successfully in a few instances. The mosquito program, initiated by Steelman at LSU, the feedlot programs at Nebraska, the dung beetle project research by Fincher and other ARS staff, which has been used in Texas, California, Georgia and a few other southern states; the Mackinaw Island project and the Florida racetrack problem which used integrated tactics to control stable flies

created from horse waste are examples. IPM programs currently ongoing include the New York Dairy program, the Wyoming sheep ked project, the Illinois, Kansas and Nebraska feedlot programs and the Louisiana mosquito program. I think I could interpret IPM in a manner broad enough to include the horn fly insecticide resistance management approach in the ongoing programs as well. Shepard's project with soldier flies in Georgia and the North Carolina poultry IPM program developed by Axtell and others certainly are worthy of mention. This latter one is probably the most complete of all of them.

The habitat management programs in Texas, Oklahoma and other southern states where brush control or burning increases desirable grazing vegetation production and reduces tick and perhaps some diptera numbers is certainly an example of integrated pest management. Most of our IPM programs would greatly benefit from an economist's long-term and short-term benefit analysis.

We or I, at least, tend to be a little apologetic when IPM is mentioned. But we have had some rather difficult barriers with which to deal. In the original extension pilot fund initiative, animal agriculture wasn't even mentioned. I remember in the first National IPM Workshop at which grant recipients were to report on progress, 93 of the reports were on pests of crops; and two, our feedlot project and a black fly project from Idaho, were the only two funded for pests of livestock.

Funding looked up a little when regional IPM research grant funds were made available, but livestock research was funded only in the southern region and the north

central region; and some years animal agriculture was excluded from both of those regions.

Historically we have always had to struggle to make our voice heard at agency administrative levels, both federal and state. Fortunately we have always had a few strong (or should I say loud voices) who have helped keep our oar in the water. However, we are at a point when all of us must do a better job of public relations with our clientele and in being political adversaries with fund competing elements of agriculture.

Currently all of agriculture, whether federal, state or commercial, is targeted for downsizing and reduced budgets. We will have to counter attack with the success story of American agriculture to which we certainly have contributed and must continue to do if we are to survive.

Technical capabilities available today are creating opportunities for very sophisticated research currently in progress in our field. Examples include: 1) evaluation of resistance to arthropod pests in various breeds of livestock including gene mapping; 2) developing disease and/or parasite immunity via vaccines; 3) biological control including gene manipulation (lethal or competitive); 4) studies in insect biochemistry to determine insect immunological systems; 5) modeling pest management systems; 6) parasite effects on animal metabolic systems; 7) effects of insect parasites on animal behavior; and many others (probably including transgenic research like we see for plants that serve to make our field an exciting one in which to spend our time.

Some mention should be made in discussing the history of this group concerning the Coopers-Mallinckrodt Outstanding Achievement Award. As I recall, we started this award among our group; I think maybe Fred Knapp and/or Ed Loomis started it with a tongue-in-cheek name like the Buffalo Chip Award and, I believe, Dobbie Dobson was the first winner. But then it got dropped until Cooper's followed through and it has been presented each year since our meeting in Montana with the first winner being Ed Loomis. We all appreciate the contribution Mallinckrodt makes in our behalf with this award.

I realize that I have probably missed several important milestones and people in this discussion of progress in the past 50 years in veterinary entomology. Consider my age, I.Q. and the fact that I have served my entire career in the Northern Great Plains when judging this presentation and forgive me any trespasses and omissions I may have made. I feel very fortunate to know or to have known most of the people working in veterinary entomology over the past 50 years in the U.S. and Canada and even a few from New Zealand, Australia, Africa and Europe.

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