ARTICLES

PRESIDENTIAL ADDRESS: THE BEST OF TIMES AND THE WORST OF TIMES[1]

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I was sitting next to a colleague at the conclusion of a meeting that had not gone particularly well recently, and we were muttering under our breaths our mutual disappointment with the entire experience and bemoaning the lack of a positive outcome. We were suddenly startled when one of our fellow participants enthusiastically rose to his feet and declared that this was one of the best and most productive meetings he had ever attended. I won't relate to you my initial reaction to this gratuitous testimonial, but after a while I began to give the matter some more serious thought. Isn't it interesting how the state of affairs for any given enterprise depends very much on the point of view of the observer? To some, all signals seem to point to a downward trend, if not extinction, of some organization or endeavor, whereas to others the signals appear to indicate rebirth and growth. Does this situation apply to vector control worldwide? Is the future bright and full of promise, or are we headed for disaster? As with the planning meeting I attended, I guess it depends upon your point of view. It is as Charles Dickens characterized the year 1775: It was the best of times, it was the worst of times (Dickens 1859). I suggest this characterization for 1989. The best of times because of unprecedented opportunity for modernization and improvement of vector control, the worst of times because of constraints on the exploitation of advances in vector control.

The recent history of American public attitudes seems marked by a tendency to fear unknown risks while remaining relatively indifferent to traditional, and thus known, risks. This tendency often produces ironic situations. Thus we find ourselves in a period of intense environmental activity in the world aimed at minimizing risks to human beings and indeed all vertebrate animals from industrial chemicals of various kinds, even at the expense of incurring risks from often fatal arthropod-borne diseases. In the United States, public policy decisions in the area of public health are confounded even more by intense competition for public funding and bipartisan efforts to reduce programs of all kinds. It is against this backdrop that we in AMCA are attempting to persuade the public that there needs to be more emphasis on vector biology and control, not less. Such an attempt can hardly be considered fun, even if one is an optimist. Nevertheless, I believe we have an obligation to call attention to the important issues that we face.

It occurs to me that four issues predominate the present and near future of vector control: (1) Vectors and vector-borne disease pose a continual threat to people everywhere, in spite of dramatic reductions in some locations; (2) public sentiment for protection of the environment, especially for the reduction in chemical pesticide use, is at an all-time high; (3) our capability for attacking problems in vector control is greatly enhanced by a number of scientific advances which have occurred during the past decade; and (4) our capability of exploiting these advances, in terms of trained specialists, is near an all-time low. For the next few minutes I would like to expand upon these four issues.

VECTORS AND VECTOR-BORNE DISEASE

On a worldwide basis, remarkable progress had been made toward control of the classical arthropod-borne diseases malaria, dengue, filariasis and yellow fever. These diseases have resurged, however, in some cases to levels as high or higher than those existing before World War II. Because of a number of complex factors including economics, politics and pesticide resistance, malaria has returned to very high levels in many areas around the world, including some areas where near eradication had once been achieved (Anonymous 1988). Strains of *Plasmodium falciparum* resistant to prophylactic drugs have appeared in many tropical areas including Africa, Southeast Asia and South America. Where just a decade ago a practical malaria

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vaccine seemed feasible and achievable by the end of the 1980s, such a goal now seems unattainable for some time to come. In spite of a rapid expansion of our knowledge of malarial immunology and the application of modern peptide chemistry to studies of host-parasite interactions, human vaccine trials of synthetic vaccines have yet to show evidence of immunity to demanding challenge (see, for example, Davis et al. 1989).

Dengue poses an enormous threat to public health in the Americas, including the U.S.A. In this hemisphere it is a changing and increasing disease, and amazingly few individuals seem to appreciate just how serious this disease will become. In Asia, dengue hemorrhagic fever moved from a sporadic manifestation of a largely benign disease to a major cause of hospitalization and death in children. The disease pattern in the Americas seems to be following this same course (Centers for Disease Control 1988). In the Americas, epidemics are occurring with greater frequency, more countries are experiencing dengue hemorrhagic fever, and the circulation of all four dengue serotypes is increasing (Centers for Disease Control 1986). Dengue is a vastly underreported disease, and cases in the Americas must surely be in the millions annually. Advances in recombinant DNA technology made the production of a safe dengue vaccine based on expression of dengue genes in vectors such as insect baculoviruses seem feasible and attainable in a relatively short time; however, we now know that complexities in antigen-antibody interactions make fast solutions to these problems unlikely.

Even where excellent vaccines are available, mosquito-borne diseases have persisted. The most effective vaccine against any insect-borne disease is that of yellow fever. Nevertheless, this viral disease is still endemic in both the New and Old Worlds, and serious epidemics continue to occur. In late 1986, one of the largest epidemics in many years occurred in eastern Nigeria, with several thousands of cases, many of them fatal. In the spring of 1987, in western Nigeria, 805 cases with 416 deaths were officially reported, followed in the fall by an epidemic in northern Nigeria with 644 reported cases and 149 deaths (Nasidi et al. 1989).

In many parts of southeast Asia, China, and the South Pacific, filariasis remains a scourge. Of about 900 million people at risk to this disease, more than 90 million are infected with either *Wuchereria bancrofti, Brugia malayi*, or *B. timori* (World Health Organization 1984).

In addition to these well-known diseases, we must now add newly emerging arthropod-borne diseases. Lyme disease has in just a few years assumed major importance in the U.S.A. and overseas. California serogroup virus infections in the U.S.A. occur annually, with few options for control presently available. Rapid urbanization in many parts of the U.S.A. is now bringing people in large numbers into contact with what were formerly rural or sylvatic disease cycles. In California, urbanization is one of the most dramatic of all changes on the landscape. In areas such as Los Angeles, Orange and San Diego counties, the pace of urbanization is very high; and it is these counties which have seen epidemics of St. Louis encephalitis and malaria in this decade.

THE DEMAND FOR A CHEMICAL-FREE ENVIRONMENT

The political climate in the U.S.A. and in most other industrialized nations has been toward a gradual avoidance of risks from chemicals of all kinds. Spurred in part by our ability to detect trace quantities of chemicals in samples of all kinds, federal and state laws are moving toward ever greater restrictions of chemical applications to soil, water and air. Reporting on the "Alar crisis," Margaret Carlson wrote in *Time Magazine* (Carlson 1989) "What the Alar alarm and the fruit furor do show is that certain risks—those that are up close, personal and capable of capturing the public imagination—make regulatory decisions politically easy. But while all the fuss was being made over the slight possibility that some fresh fruit had been poisoned, hundreds of other perils—less interesting, less photogenic, more complex, and difficult to address—were overlooked." In this latter category she mentions acid rain, filthy rivers, decrepit nuclear plants, polluted air and overflowing trash dumps. May I suggest that vectors and vector-borne diseases should be included also?

A revised Federal Insecticide, Fungicide, and Rodenticide Act was passed in 1988; and the U.S. Environmental Protection Agency is currently working on a label restriction plan for protection of endangered species. Several clean air and water laws are being considered by Congress that have implications for the use of pesticides. In the long run, it probably won't be the direct effect of regulations which takes chemicals away from the arsenal of mosquito and vector control personnel; economic considerations will do this. The enormous cost of assembling a data package needed for EPA registration coupled with the relatively small market represented by vector control has reduced the number of new insecticides for public health use to a trickle. When existing registrations come up for review and possible reregistration, many will probably be dropped because of lack of profitability. In California, chlorpyrifos (Dursban), propoxur (Baygon), fenthion (Baytex), parathion and temephos (Abate) may disappear from the mosquito control scene within the next year or so because of decisions of manufacturers not to seek reregistration. The use of conventional pesticides for mosquito control are already down to only 10% of 1958-levels in California (Eldridge 1988), and malathion may soon be the lone survivor among chemicals of this type. There are other costs associated with the use of chemical pesticides that are usually borne by the public. Training, certification and retraining of pesticide applicators is a growing expense everywhere. Disposal of unused materials, washing of equipment, disposal of empty containers and related functions are becoming more complex and expensive. Tighter control of fuels, lubricants, solvents and carriers is probably down the road. Is it any wonder that many individuals see the eventual abandonment of conventional chemical pesticides for vector control in all but emergency situations?

NEW DEVELOPMENTS

But surely there must be a bright side to all of this. Indeed there is. Advances in both the biological and physical sciences have opened many doors to significant and exciting advances in vector control. The computer revolution is aptly named. Processing power of incredible magnitude is available to vector control organizations with the most modest of budgets. Information transfer, decision-making, accounting and training are some of the functions which can be done more economically, faster and with greater accuracy and precision than ever before. Our ability to model biological and physical systems presents us with great opportunities to optimize control equipment and strategies. Advances in molecular biology make it possible to study in detail molecules, genes, cells, tissues, organs, organisms and populations. This can lead to vaccines, the ability to predict disease outbreaks and strategies to avoid insecticide resistance. Some may disagree with this, but I think it is wrong to suggest that advances in molecular biology have been overrated and that they are occurring at the expense of advances in fields such as genetics, ecology, systematics and evolution. To the contrary, new approaches in molecular biology offer unparalleled opportunities in these areas and, thus, unparalleled opportunities in development of practical new control strategies. The fallacy, in my view, is the belief that molecular approaches should replace studies of populations of organisms. The question is, are we in the arena of vector biology and control taking advantage of these opportunities? If not, what is slowing the incorporation of these advances into vector control programs?

SHORTAGE OF TRAINED BIOLOGISTS

In the light of all these basic scientific advances, why haven't we seen the vector control equivalent of a man on the moon? Why haven't we seen the long promised new classes of selective insecticides based on intimate knowledge of reproductive physiology of vectors? Why haven't we seen the development of expert systems to assist in the making of complex control decisions? In my view, the advances that have been made by a relatively small number of scientists working in the area of vector biology and control with very limited resources is remarkable by any yardstick of measurement. The key words here are "small number." Where are the vector control professionals to do the adaptive research necessary to develop the next generation of control strategies? Where are the teachers to train them? They have passed from the scene and have not been replaced by individuals of similar interest and training.

This, then, is a very prominent fly in the ointment; the great disparity between the threat posed on a worldwide basis by arthropod vectors of disease, and the number of individuals currently active in the business of vector biology at all levels. In the U.S.A. the story of retirement of a medical entomologist at a college or university followed by recruitment of a new faculty member in a different area has been repeated with dreary monotony. How can one blame biology departments for this? The number of students wishing to take courses in medical and veterinary entomology (and most other entomology courses, unfortunately) is often not enough to fill a good-sized living room. At present, there isn't even a medical entomology textbook in print to use in medical entomology courses. At one time, the excuse was that there weren't enough jobs available for graduates in this area. This is no longer the case. The U.S. Army and Navy have been crying for qualified entomologists for the last two years. It is difficult for the National Institutes of Health to designate qualified reviewers for the small number of research proposals it receives in the area of vector biology. We find ourselves in a downward spiral of lack of jobs followed by lack of students followed by lack of trained professionals to fill job vacancies.

What can be done about all this? In the words of past-president Oscar Fultz, what is the bottom line (Fultz 1986)? The answer, in my view, is embodied in a sign I saw on the campus of Oregon State University a few years ago: "Give a damn, don't walk on the grass." Forget about the grass for now, but respond to the first part. Communication is critical. I can't state it any better than Jimmy Olsen did in his 1984 presidential address (Olsen 1984). As a society we must continually strive to do a better job of communication, and I'm proud of the improvements AMCA has made in this area in the past 2 to 3 years. We should join in efforts such as the American Society of Tropical Medicine and Hygiene to help strengthen the U.S. capacity to address infectious disease problems. Many of these are arthropod-borne, and I would encourage you to learn about the activities of their Committee on Public Affairs and Political Action cochaired by Stephanie Sagebiel and Jack Frenkel. We should assist the Society of Vector Ecologists in their attempt to solve the vector control professional problem. Harvey Scudder chairs a committee which is conducting an analysis of manpower needs in medical entomology and is developing options to meet these needs. The American Committee of Medical Entomology and Section D of the Entomological Society of America have also begun steps to address these problems. Surely there must be some way to bring these groups together to exert greater influence. I know that many of you belong to one or more of these societies, and some of you belong to all of them.

Finally, I believe we must divert some of our resources to means of staying informed on pending legislation. Other special interest groups are doing an outstanding job of this. We represent the special interest of public health, but our efforts at organization and influence have been less than effective, to put it mildly.

I hope very much that we can begin to be heard at local, state and national levels of government and that our efforts will result in a more balanced approach to the solution of problems in public health. What a waste it will be if public funds continue to be diverted to the new, the trendy and the feared at the expense of highly successful and scientifically sound vector control programs. Then vector-borne diseases will again be the new and feared scourge. In my view, its simply a matter of "pay me now, or pay me later."

Thank you for your support this past year. It has been one of the busiest in my life. I hope I can continue to work with you in the coming years in the cause of vector biology and control, and public health.

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