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Veterinary public health: Past success, new opportunities☆

James Harlan Steele DVM, MPH

The University of Texas-Houston, School of Public Health, Center for Infectious Diseases, P.O. Box 20186, Houston TX 77225, United States

Abstract

Animal diseases are known to be the origin of many human diseases, and there are many examples from ancient civilizations of plagues that arose from animals, domesticated and wild. Records of attempts to control zoonoses are almost as old. The early focus on food-borne illness evolved into veterinary medicine's support of public health efforts. Key historical events, disease outbreaks, and individuals responsible for their control are reviewed and serve as a foundation for understanding the current and future efforts in veterinary public health. Animal medicine and veterinary public health have been intertwined since humans first began ministrations to their families and animals. In the United States, the veterinary medical profession has effectively eliminated those major problems of animal health that had serious public health ramifications. These lessons and experiences can serve as a model for other countries. Our past must also be a reminder that the battle for human and animal health is ongoing. New agents emerge to threaten human and animal populations. With knowledge of the past, coupled with new technologies and techniques, we must be vigilant and carry on.

Keywords: Veterinary Public Health; Food-borne illnesses; Historic outbreaks; Zoonoses

Animal diseases are known to be the origin of many human diseases. Jared Diamond (1997) states, "Infectious diseases like smallpox, measles, and flu arose as specialized germs of humans, derived by mutations of similar ancestral germs that infected animals." He contends that these emerging diseases appeared about 10,000 years ago after man changed from being a hunter to a

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farmer keeping animals in his midst. The people who domesticated the animals were thus the first to be victims. Those early humans then developed resistance to some zoonotic diseases that had emerged (Diamond, 1997).

The relation of animal diseases to human disease was observed in the ancient civilizations of Babylon, the Nile Valley, and China and noted by Leviticus in the Old Testament, and later by Hippocrates in Greece, and Virgil and Galen in Rome. Millions of people across Europe during the Middle Ages suffered from plague carried by rat fleas. The invasion of Europe by rinderpest in the 18th century disrupted commerce and government so much that the Papal authority created a medical commission to advise the Vatican on what measures should be taken to control the animal plague/rinderpest (Steele, 1964).

The movement of animal diseases into the Americas is believed to have been in the support of the settlements founded by Columbus in Santo Domingo in 1493. These livestock were the foundation animals for Spanish colonies in the Americas. In the next century, De Soto, the Spanish explorer of Florida and the Southeast, brought cattle, horses, and swine, as well as dogs that thrived. Farther north, the Virginia colonists brought animals to Roanoke Island, but none survived, neither humans nor animals. Later the Jamestown colonists imported domestic animals that survived and became valuable foundation stock, but no zoonotic diseases are recorded in any of these earliest settlements. Not until 1753 was rabies the first zoonosis recorded in the US colonies, and later as an epizootic in both the colonies and the Federation of States in the late 18th century (Smithcors, 1975a,b).

In 1798, the newly founded *Medical Repository* editors were the first to inquire about emerging diseases in the United States and territories. They asked for information on human diseases, diseases among domestic animals, accounts of insects, the condition of the vegetation, and even the state of the atmosphere. They hoped to put the facts together as an annual report on the status of health in the United States. Surgeon General Luther Terry (1963) of the US Public Health Service (USPHS) in his address at the American Veterinary Medical Association (AVMA) centennial called this report the first reference to veterinary medicine in support of public health. A few years after this report, Benjamin Rush called for the establishment of veterinary medical education at the University of Pennsylvania.

The United States Sanitary Commission, organized during the Civil War by public-spirited women, was concerned largely with sanitary conditions, including food hygiene. They were the first to call attention to the putrid meat and later embalmed beef sent to the Army. The commission was to be a forerunner of public health in the years following the Civil War (Furman, 1973). By the 1870s, there was interest in developing a national health service. Yellow fever epidemics were frightening as they spread up the Mississippi River from New Orleans. The possibility that yellow fever involved animals brought Professor John Gamgee, a famous veterinarian, from England to investigate the epidemic. He recognized the seasonal occurrence – that cold weather stopped the epidemic – and even suggested river traffic be limited to the colder months. However, he failed to associate the effect of cold weather with the decline of the numbers of mosquito populations, the vector of yellow fever (Furman, 1973).

The US Board of Health came into being largely because of the yellow fever epidemic and the morbidity and mortality that it caused. By the time of the board's inception in 1879, malaria was widespread in the south, and tuberculosis was a recognized disease. Typhoid fever and enteric diseases were also common. In addition, animal diseases were present, especially the spread of glanders and anthrax following the Civil War (Furman, 1973).

In 1879 the President of the US Board of Health, Dr. J.L. Cabell, asked James Law, Professor of Veterinary Medicine at Cornell University, to advise the board on how they should supervise the diseases and movements of domestic animals. Law's report (1880) was the first comprehensive recognition of the effects of zoonotic diseases upon public health published in the United States (Steele, 2000).

The organization of public health in the post Civil War period has been reviewed by Miles (1969), former historian of the National Institutes of Health (NIH). His report discusses the struggle between public health and agricultural interests in the decade leading up to the inauguration of the Bureau of Animal Industry in 1884. The interest of the Bureau was to protect animal health, and later to provide a meat inspection service for public health, international trade, and subsequently interstate commerce.

The Relation of Animal Diseases to the Public Health and their Prevention by Frank S. Billings (1884) was the first book to review the problems and the state of bacteriology as well as parasitology in the 1880s. Although the book is limited to trichinosis, hog-cholera, tuberculosis, anthrax, Texas Fever, rabies, and glanders, his knowledge of these diseases is remarkable for the time. Billings gained this knowledge through education in Berlin, where he learned about the history of animal diseases in the Greco-Roman period and the Latin origin of ''veterinarians,'' which he says first appeared in the 4th century writings of Vegetii. He also traveled extensively in Europe, where he observed veterinary activities.

Billings makes a strong plea for the development of veterinary public health to control the animal diseases that affect man. He stated that this could be accomplished only by having trained veterinarians who were scientifically educated. He was one of the veterinarians who was active in the early years of the American Public Health Association (APHA), during which discussions of trichinosis, tuberculosis and other animal diseases took place at the early annual meetings.

A true visionary of veterinary public health, Billings pointed out that milk from diseased cows is dangerous. He appealed to the government to set up laboratories to use the new science of bacteriology to find the cause of illness of milk origin. Food hygiene came into being only with the new science of bacteriology (Billings, 1884). The frightful toll of milk borne disease is reviewed by Stenn (1980). In his report, he cites the shocking figure of 400 deaths per 1000 births in New York City in 1880. Spoiled milk accounted for the deaths of thousands of children in the early 1900s, and in many other cities. The records of 1908, cited by Stenn, list many milk borne outbreaks of typhoid fever and diphtheria. He goes on to state that 16% of the milk cans sampled contained tubercle bacilli, and in cities, 50% of the milk had tubercle bacilli.

In 1905 a milk borne typhoid epidemic occurred in Washington, DC, that caused President Theodore Roosevelt to order the USPHS to investigate the local supply. Surgeon General Walter Wyman ordered his staff to examine not only the Washington milk problem but to examine the national milk problem. The 1908 report *Milk and Its Relation to Public Health* by Milton Rosenau, issued by the USPHS, brought reform to the dairy industry and support for the Bureau of Animal Industry program to control bovine tuberculosis (Myers and Steele, 1969).

Pasteur took milk safety even further, changing science and veterinary medicine by creating a new concept of the origin of disease. No longer would the myth of spontaneous origin of disease guide society, although there were as many objections to scientific advances then as now. The 1984 centennial celebration of the rabies vaccine revealed in Pasteur a man of many accomplishments. He was a chemist who discovered the cause of fermentation and applied it to the beer and wine industries, a process that led to milk pasteurization. He was an artist who was known to the Impressionists of the 19th century as the man who prepared better paint colors. He was also a genius who gave public health the science and vaccines to combat 19th century diseases and prepare for the 20th century's emerging problems (Koprowski and Plotkin, 1985). Although the concept of pasteurization of beer and wine brought fame to Pasteur, the application to milk was less known, and it was accepted no more readily than the concept of evolution. It was asserted that all kinds of illness and changes in well being would ensue from pasteurization.

The eradication of bovine tuberculosis and brucellosis (Bang's Disease) insured a safe milk supply and protected the health of farmers, dairymen, veterinarians and the handlers of milk and milk products. The case for pasteurized milk and milk products is conclusive. In the late 20th century, a new array of milk borne zoonoses is of concern to public health and veterinarians. Some date back to the 19th century, such as Salmonella.

The Salmonella were identified in 1885 by one of the most distinguished public servants of the veterinary profession, Dr. Daniel Salmon. As the first Chief of the Bureau of Animal Industry (BAI) from 1884 to 1905, he assembled and trained a great staff. This included Theobald Smith, V.A. Moore and E.C. Schroeder, who solved the epidemiology of Texas Fever caused by *Babesia bigemina*, which is carried by the tick *Boophilus annulatus*.

Salmon was the leading proponent of veterinary public health in the 1890s. He asked for, and received from Congress, authority for a Federal Meat Inspection Service in 1890 to meet the demands of foreign commerce. However, his national program was circumvented by local interests citing states' rights; therefore, the Meat Inspection Act of 1890 was ineffective nationally. Salmon sought support from the APHA and the American Medical Association for these early veterinary efforts to protect public health. Unfortunately, these agencies did not support him (Schwabe, 1984a). The Federal Meat Inspection Service Act of 1906 came about only after Sinclair (1906) exposed the filthy conditions of the Chicago stockyards. Salmon was blamed for the local hygiene failure over which he had no authority and was removed from office. However, he is remembered today by the USDA's Salmon Award for Leadership.

In 1906, the BAI initiated tuberculin testing of dairy cattle in the District of Columbia, a demonstration that revealed an infection rate of almost 19%. This was the beginning of a successful tuberculosis control campaign that led to its eradication under John R. Mohler, BAI director from 1917 to 1943. The late Jay Arthur Myers memorialized the near eradication of bovine tuberculosis in his 1940 book, entitled ‘‘Man's Greatest Victory Over Tuberculosis’’ (Myers, 1940).

At the start of the 20th century, pathologists were greatly interested in comparative medicine. They were led by Karl F. Meyer, a Swiss veterinarian who was to become one of the leaders and outstanding scientists of the 20th century. He was among the early public health scientists to delve into virology as professor of pathology at the University of Pennsylvania (Penn), and in 1913 he may have been among the first to recover a virus causing equine encephalitis. As director of the Pennsylvania Livestock Sanitary Board Laboratory, he published on glanders, anthrax, anaplasmosis, sporotrichosis, paratuberculosis, septicemia, and many other diseases of animals. In 1914 he left the University of Pennsylvania to accept a position at the University of California's newly established Tropical Medical Center. The following year, he accepted an appointment to the George Williams Hooper Foundation for Medical Research at the University of California Medical Center. He remained there the rest of his life and become a legend. His lectures introduced medical students to the biologically active world, including the zoonoses, plant life, the atmosphere and all that is called the environment today. At The Hooper Foundation, Meyer researched a wide spectrum of animal diseases of public health importance. After being active in the investigation of human influenza in 1918–1920, he went to the field to define the epidemiology of malaria, dysentery, and even dental diseases. His study of the bacterial causes of abortion in animals resulted in bringing together *Brucella abortus*, *Brucella melitensis*, and *Brucella suis* in a new genus honoring David Bruce. Another important event was his report on *Clostridium botulinum* in nature. Botulism became a national concern in the 1920s when

California canned fruit and vegetables were found to contain botulinum toxin. The industry asked Meyer to resolve the problems and underwrote a laboratory to maintain surveillance.

Thereafter, Meyer was active in food safety, but he was also concerned with humane animal care in which he maintained an interest all his life. In 1933, Meyer and his long time lab associate Bernice Eddie began their series of psittacosis reports in birds. These reports eventually led to control 30 years later with tetracycline-impregnated seed. The same antibiotic is now used to prevent ornithosis in domestic fowl (Meyer, 1976).

One of Meyer's most memorable lectures was in 1931 when he called attention to the importance of the animal kingdom as a reservoir of diseases that endanger the health and welfare of people throughout the world (Meyer, 1930). In 1954, he first reviewed the state of the animal reservoir of diseases, by then referred to as zoonotic diseases, before the World Health Organization (WHO) General Assembly. He repeated the same theme before the WHO Expert Committees for the Zoonoses, Plague, Food Hygiene and for the Pan American Health Organization (PAHO) until his 90th year.

Meyer's work on plague was reported in the special supplement of the *Journal of Infectious Diseases* to commemorate his 90th birthday. This was underwritten by Max Stern, President of Hartz Mountain, which supported the psittacosis control investigations at the Hooper Foundation (Steele, 1974). Meyer died in San Francisco on May 19, 1974, less than a month before his 90th birthday. Larry Altman (1974), the medical editor of the *New York Times*, wrote a lengthy obituary from which the following excerpt is taken. It also appears on the fore page of the *Journal of Infectious Diseases* (Supplement), May 1974: ''Dr. Karl Fredrich Meyer was regarded as the most versatile microbe hunter since Louis Pasteur and a giant in public health [. . .]. Public health leaders yesterday called his contributions to medicine 'monumental.' His scientific work had such broad implications that it touched on virtually all fields of medicine.'' The obituary was placed in the Congressional Record that same month.

In 1980, Albert Sabin (1980) wrote a biographical memoir of Meyer for the National Academy of Science, of which Meyer was a member from l940 to 1974. Sabin explains that as a youth in Basel, Switzerland, pictures of the Black Death so fascinated Meyer that he became an outdoor scientist instead of following in the aristocratic business world in which he grew up. He told friends that in choosing to become a veterinarian he could ''be a universal man and study all diseases in all species.''

The 1930s were memorable for public health growth and scientific advances. The viral etiology of influenza was uncovered by Richard Shope and Thomas Francis at the Rockefeller Institute. The use of egg embryos was a new method of growing viruses that would lead to the chick-embryo rabies vaccine and other viral vaccines. The development of the Strain 19 Brucella vaccine and the Stern anthrax vaccine in South Africa were important to the control of brucellosis and anthrax worldwide. Earlier investigation of toxoids by Gaston Ramon, a French military veterinarian, led to the discovery of tetanus toxoid for both horses and humans. Discovery of the sulfa drugs and penicillin gave the clinician medication he had not dreamt of, a prelude to great advances in medicine.

To be a veterinary student in the late 1930s was both exciting and slightly dangerous. The brucellosis epidemic among veterinarians – both students and clinicians – raised epidemiological questions as to how brucellosis was spread. In 1938 Michigan State College experienced an epidemic among veterinary students and others in the bacteriology building (Holland, 1940). Up to then the disease was thought to be caused by direct exposure or ingestion of milk borne Brucella, and airborne Brucella was not given much consideration. The episode at Michigan State College would change that oversight. As a student in the brucellosis testing laboratory, I heard discussion of the means of spread being water borne and back siphonage. Professor I.F. Huddleson, whose research laboratory was the focus of this investigation, disagreed with the state investigators, who were public health scientists and engineers focusing on the water borne theory. These investigators suggested contaminated glassware was not being autoclaved properly, and in turn, viable Brucella was getting into the water system (Newitt et al., 1939).

The discussion of the epidemic, which affected most of the people in the building, along with other public health interests of Dean Ward Giltner, Professor H.J. Stafseth, Professor I.F. Huddleson and Dr. W.T.S. Thorp of the Michigan State University College of Veterinary Medicine, led me to think about a career in public health. Dr. Stafseth encouraged many students to consider public health as a career (Stalheim and Steele, 2005). When he learned of my interest, he and Dean Giltner worked out a program to make me eligible for a USPHS fellowship. I was excused from senior clinics to pursue the fellowship. My assignment was an internship at the Michigan Health Department. There I observed and learned from health department veterinarians, pathologists and bacteriologists how to remove and examine an animal brain for rabies and to inoculate mice to further confirm the diagnosis. Vaccinia were grown on the belly of a calf that had been shaved, scrubbed and disinfected. After harvesting the scabs, the vaccinia would be tested for contaminants. It was a lengthy procedure. The same high standards were maintained for the pertussis/whooping cough vaccine, equine antiserum for tetanus and rabbit pneumococcal antiserum. It was a learning period that would serve me well.

Dean Giltner and C.C. Young, the Director of the Michigan Public Health laboratories, put together my fellowship application to the USPHS and Harvard School of Public Health. Approval came the week before graduation, and my bride-to-be Aina Oberg and I were elated. We were married the evening after graduation, with many of the faculty and classmates in attendance Two days later I took the Michigan Examination to practice veterinary medicine.

The summer of 1941 was spent as an intern at the Petoskey Animal Hospital. There I learned about swimmer's itch—a common affliction of man and pets caused by an avian schistosome. I was exposed to the parasite while swimming in inland lakes. At Harvard it became my thesis subject. Later it was the first subject I reported on at the AVMA convention in Chicago (1942) with Dean Giltner in the audience.[1]

At Harvard, there was talk of war. President Conant addressed the incoming class with the admonition there would be important world changes during their student years. The School of Public Health's Dean Cecil Drinker, the faculty, and the students were stimulating. I was the only veterinarian, which attracted some attention, and the medical school librarian was delighted to know there was a veterinarian around. She showed me a remote section of the library that contained many old books on veterinary medicine—Harvard had a veterinary faculty from 1880 to 1910.

We students were delighted with our newly found classmates, and many of us would remain lifetime friends. To me, the academic work was not demanding except for statistics, which took much time. After all, in those days, we used hand-cranked machines for tabulations.

My wife, Aina, first worked at the Harvard co-op and then with the British American Ambulance volunteers. She enjoyed the students and compliments and being invited to fundraisers for the volunteers. Then tragedy struck. A sudden collapse with fever hospitalized her. The diagnosis was advanced tracheal-bronchial tuberculosis that would confine her to sanitariums and hospitals for the next 7 years, from January 1942 to April 1949. After

[1] Listing appeared in JAVMA 1942, 101:6.

innumerable surgeries, the newly discovered streptomycin saved her life after months of treatment. Eventually, we established a home and family with two sons, Jay and David, in Atlanta, Georgia, for 20 years. There Aina died from the complications of arrested pulmonary tuberculosis in 1969.

The new year (1942) brought unforeseen problems, mainly medical bills, even though student health expenses were covered to a lesser extent. I sought work at the Angel Memorial Animal Hospital, where I knew some of the staff. When Dean Drinker heard of my after-school work plans, he called me into his office and told me to concern myself with school and taking care of my wife. A check signed by Dean Drinker awaited me in his secretary's office, a practice that continued until graduation. The Drinker Society still honors his contributions at the Harvard School of Public Health, which we support.

As graduation neared, many of us knew we were going into uniformed service job opportunities. I was deferred by the Lansing Michigan Draft Board, but I volunteered for the Army Veterinary Corps and the Navy Special Services, an epidemiology unit. Both declined my services, and in the meantime, I found no positions of interest. I wanted to do epidemiology of the animal diseases affecting human health, but all the positions I was interested in required a medical degree. Finally I brought my dilemma to Dean Drinker's attention. Shortly thereafter, he asked me to his office to talk over my future. I was upset that it seemed I must have a medical degree to be an epidemiologist. Should I get an MD? Dr. Drinker and his wife, also a physician, heard me out. Their reply was to list my attributes: good student, industrious, good appearance, good speaker, and creative ambitions. That said, they followed with memorable advice: "Jim, fly under one flag."

Before leaving Harvard, I met KF Meyer who was lecturing at the School of Public Health. Some days later, I learned he had asked about me because he anticipated some research contracts with the US Army Epidemiology Board and would need staff. I was elated when he offered me a position, and Aina and I left Boston with high expectations. Some days later we arrived in Chicago, only to find out a week later that Meyer had not received the contract and had no funds to support the research position. I was depressed: no job and a sick wife.

A few days later I visited the USPHS Chicago Regional Offices to seek their help in finding work. I appeared unannounced and asked a secretary to see the director. While waiting, a medical officer appeared and asked if he could help. I explained that I was a USPHS fellow they had supported in getting an MPH, and my objective was to find a position where I could investigate the epidemiology of animal diseases that affect the public health. Dr. Henry Holle, the medical officer, listened and replied he never heard about such a situation. So he took me to see the medical director, Mark Ziegler, a tall, soft-spoken, southern gentleman. The availability of a young MPH graduate led them to call Washington. A week later after a review of my qualifications and evidence of my education, I was offered an internship as a civilian sanitarian in the Ohio Department of Health. There I would spend the next year, July 1942–October 1943. The challenges were milk sanitation problems, food borne diseases, diarrhea, typhoid, rabies and the Ohio River Flood, a great learning experience.

In September 1943, the US Army offered me a commission as a veterinary officer which I planned to tentatively accept. Within days, Medical Director Frank Meriwether told me since the USPHS had given me a fellowship, they should have a first call to commission me. I received a commission as a sanitarian on November 1, 1943. Afterward, I spent a short tour of duty in the Midwest region with Senior Sanitarian William H. Haskell, an authority on pasteurization methods and practice. He was one of the civil service veterinarians brought in by the USPH milk specialists early in 1924. In 1943, other newly recruited veterinarians Raymond

Helvig, Ray Fagan, and Ted Price were also commissioned as sanitarians. They were the only veterinarians in the USPHS except for a veterinarian who was an Animal Control Officer in World War I in 1918 and two parasitologists Willard Wright and Maurice Hall at the NIH in the 1930s.

From Chicago, I was ordered to report to Washington, DC, for orientation. There I learned of my assignment to Puerto Rico and the Virgin Islands where I was to be responsible for coordinating milk and food sanitation and evaluating any zoonotic diseases in areas that had been isolated by the war. Brucellosis and bovine tuberculosis were widespread. The diagnosis of Venezuelan Equine Encephalitis and bat rabies in Trinidad caused some concern in the islands but did not spread beyond Trinidad. Rabies was indigenous in the Dominican Republic and Cuba in the 1940s.

In March 1945, the Pan American Sanitary Bureau asked the USPHS San Juan, Puerto Rico, office to do an assessment of the post-war veterinary public health problems in the Dominican Republic and Haiti, neither of which had a functional veterinary service. I was directed to make a report on their problems. In the Dominican Republic, there were no reported diseases, but bovine tuberculosis, brucellosis and mastitis were known. No veterinary laboratory support existed, and the abattoirs kept no records. Rabies had been reported in dogs, and possibly in horses, and some years later there was an epizootic of equine encephalitis.

President Trujillo kept some racing horses near Ciudad Trujillo (Santo Domingo), and I was asked to examine them. These old horses were brought to the Dominican Republic before the war in 1939–1940. All were broken down and hardly fit to run. Regardless, the Dominican Republic officials thought I could repair their ailments. When I told them I could not, they complained that I was not cooperative to the U.S. Embassy, who then told me to be cooperative. Later I visited the trainer, who told me, "We will do what we can." Thereafter, I was anxious to leave and went to Haiti within a few days.

Port-au-Prince was a rundown but hospitable capital. The country had been ravaged by tropical fevers for decades; malaria and filariasis were widespread. Animal diseases were mainly fever and parasites, but an epizootic of anthrax in the early 1940s was still present in 1945: the disease was sporadic in the countryside. To my amazement, the dead animals were salvaged regardless of what they died from. There were no veterinarians in the government or in practice. Still, the abattoir in Port-au-Prince was an elegant open iron structure. The cattle were immobilized by pithing, in which a small blade severs the spinal cord after which they are bled and eviscerated. The procedure was done rapidly, usually late at night, and the meat was distributed early the next day. However, a serious shortage of animal products existed, and few shops had any meat for sale. All in all, my stay at Port-au-Prince and the rural areas was a distressing experience.

Some weeks later I was in Washington for further assignment as the war wound down. While there, I visited the Pan American Sanitary Bureau to discuss my report with Surgeon General Hugh S. Cumming who served the Pan American Sanitary Bureau for a decade, after retiring from the USPHS. At our meeting, I emphasized the need for a veterinary public health program to help in updating the animal health, preventing zoonotic diseases, and enhancing food safety. Dr. Cumming suggested I discuss the need for a veterinary public health program with his medical staff, where the proposal was enthusiastically accepted. The Veterinary Public Health program was initiated with Dr. Aurelio Malaga Alba, a Peruvian military veterinarian, as a consultant. Dr. Fred Soper, the post-war director of the reorganized PAHO appointed Dr. Ben Blood to organize a Veterinary Public Health program in June 1949. He carried on until 1960 and was followed by the outstanding public health veterinarian Dr. Pedro Acha.

The temporary duty in DC left my future uncertain. I was to be assigned to Kansas City to prepare for the problems that might evolve with the invasion of Japan. I took leave to spend some weeks with my hospitalized wife whose health was failing. The end of the war in Europe and the Pacific shortly thereafter changed my reassignment. I returned to DC to meet with Assistant Surgeon General Joe Mountin, whom I met earlier in Puerto Rico. Dr. Joe Dean, his deputy, had arranged the interview. After a few inquiries about my wife's health, Dr. Mountin came to the point: ''What are you veterinarians going to do for the public health now that the war is over?'' The follow-up to that interview is in the appendix of ''The 50th Anniversary of the Veterinary Medical Corps Officers of the U.S. Public Health Service.''

After the approval of a Veterinary Public Health section in the States Relation Division in December 1945, I spent some months at the National Institutes of Health. I also worked to establish liaisons with the USDA, BAI, federal agencies, congressional interests, state relations, the AVMA and APHA.

In September 1947 after Surgeon General Parran's approval of the veterinary medical officer cadre, Dr. Mountin felt my Washington activities were successful. He told me I was to be assigned to the newly created Communicable Diseases Center, formerly the Malaria Control in War Areas. There the Veterinary Public Health program was established as a division, but it was a challenge to integrate. The new director of the Centers for Disease Control (CDC) was Dr. R.A. Vonderlehr, previously Chief of the Puerto Rico Regional Office, who I served under. He gave excellent support as did his deputy, Dr. Justin Andrews, who succeeded Dr. Vonderlehr a year later.

Rabies was a national problem after the war. There was a great movement of people as war industries and encampments closed, and as a result, pets were lost or abandoned. The incidence of human rabies was the highest ever recorded, and unfortunately, human vaccine therapy was not always effective. Canine rabies vaccine protection was short, with the vaccines being given every 6 months. Therefore, rabies became the lead program of the Veterinary Public Health Division. To head the activity, Dr. Ernest Tierkel, a University of Pennsylvania graduate who had completed his MPH at Columbia School of Public Health in 1947, was recruited. He, Dr. Robert Kissling and Martha Eidson along with a staff of animal handlers became the nucleus of the national rabies program at the Rockefeller Rabies Investigation Center in Montgomery Alabama (Steele and Tierkel, 1949). The center was transferred to the CDC for $1.00. They successfully demonstrated the effectiveness of a new chicken embryo rabies vaccine in the laboratory (Tierkel et al., 1953) and in epidemic situations in Memphis, Tennessee (Tierkel et al., 1950).

Dr. Mountin had learned from the public health authorities of Indiana, Michigan and others that brucellosis in man was of concern. They went so far as to say that as the sanitariums lost tuberculosis patients, brucellosis patients would take their place. The Indiana Health Department was to be a brucellosis project site under Dr. Sam Damen, the Director of Laboratories. The goal was to determine what action the health agencies should take. The Federal Bovine Brucellosis Control Program was active in all states, so it became apparent that if the health authorities gave their support, the Federal State Brucella Control Program could eliminate the animal source of the human disease. Late we brought the problem to the attention of Dr. Herman Bunderson, Chicago's dynamic health officer who remembered the struggle to eradicate bovine tuberculosis in the Chicago milk shed, which included dairy herds in six midwestern states. In 1928, he had required all milk coming into Chicago to be from TB-free herds regardless of whether the milk was to be pasteurized. He recognized the Brucella problem and shortly thereafter instituted the same standards for the elimination of bovine brucellosis in the 1950s.

The Brucella Eradication Program was supported by the USPHS milk code, which required that all Grade A milk be from disease-free herds (US Public Health Service, 1943). The Chicago Brucella control program was soon adopted by big city health authorities, which gave impetus to the joint State Federal Brucella programs. As a result of these efforts, human brucellosis declined rapidly in the midwest from a high of thousands of human infections to hundreds in less than a decade. Thereafter most of the human cases were of occupational origin, in travelers or in people using raw milk in rural areas.

In the 1950s there was a scare of brucellosis at Dugway Proving Grounds, a military research center in western Utah. Dr. Herbert Stoenner investigated the alleged contaminated area and found the problem to be a rodent disease caused by *Brucella neotoma*. This organism does not cause disease in man or domestic animals, but will cause antibody formation in cattle (Stoenner and Lackman, 1965).

After World War II, there was great interest in the application of atomic energy for civilian use. Professor S.F. Gould (1953) at Wayne State Medical School initiated studies on the use of irradiation to destroy Trichinella. He persuaded the American Medical Association to host a Trichinosis Symposium in 1953 in which the CDC participated. The evidence was conclusive that gamma radiation was effective at low doses (Gould et al., 1954). This was the beginning of my interest in promoting food irradiation, but it was not until 1985 that irradiation for commercial use was approved by federal agencies. The Zimmerman Human Tissue survey 1966–1970 revealed the lowest rate of Trichinosis ever (Zimmerman et al., 1973). Modern pig raising, the prohibition of garbage feeding of swine, and consumer education are all contributing factors in the decline of the disease in pigs and humans (Steele, 1982). Trichinosis has continued to decline in the States except in wild animals especially bears.

Other veterinary public health studies of parasitic diseases involved creeping eruption, also known as cutaneous larva migrans. This condition is due to the common dog hookworm larva *Ancylostoma caninum* entering the skin and causing intense itching. This disease was common in the southeast states among persons exposed to damp, sandy soil; children playing in sandboxes; bathers at the beach, and utility men (Cypess, 1982b). Toxocariasis or visceral larva migrans is another parasite due to the dog, and sometimes the cat, roundworm larva migrating in the body of a foreign host, human beings (Cypess, 1982a). Dr. Peter Schantz confirmed these findings as a world health problem.

Toxoplasmosis was recognized as a human infection, and the domestic cat is recognized as a common source of human infection. Infection is more likely to be caused by consumption of raw or undercooked meat. Irradiation is effective in destroying this oocyst in meat (Gould et al., 1953).

In the early 1950s, a large equine encephalitis epizootic in central California required the assignment of all CDC veterinary officers. Later another equine encephalitis epizootic occurred in New Jersey in 1959. Since then there have been only occasional epizootics of the equine encephalitides. Although the principal reservoir is birds, there is also survival of the virus in mosquito eggs that over winter. The CDC-Fort Collins laboratory has been at the forefront of these investigations. The most recent mosquito born disease is the introduction of West Nile Virus into North America in 1999. Wild birds and common city birds are the reservoirs, and the *Culex* mosquito is involved in the transmission. Horses may show clinical signs. Control of the vector mosquito breaks the transmission cycle.

Plague, primarily a disease of rodents, is sporadic in the United States. The appearance of plague in domestic and feral cats and squirrels has brought the ancient scourge to households in the western states (Poland and Barnes, 1979). However, dogs were never identified as carriers of the disease to man.

An unusual epidemic of anthrax caused alarm in animal and human public health circles in the 1950s. The anthrax was introduced by contaminated bone meal used in animal feed to improve lactation in sows. A radio announcer in Cincinnati raised the question if cows' milk could be a vehicle for anthrax to be carried to humans. A search of literature found that milk was never a vehicle or cause of human or animal anthrax disease because the high fever of the disease stops lactation (Steele and Helvig, 1953).

Salmonellosis was a recognized public health problem early in the 1920s as well as during World War II and afterwards among the civilian populations (Galton et al., 1964). After the war, investigators demonstrated it was widely disseminated. Dr. Phil Edwards led the way at the University of Kentucky and later at the CDC. Mildred Galton, Chief of the Veterinary Public Health Laboratory contributed with her unusual ability to find evidence that others had overlooked. She demonstrated Salmonella in many animals. Her studies of transported pigs revealed how stress caused latently infected pigs to become shedders. The same reaction was found in other species. Her work on raw eggs and meats led to the pasteurization of egg slurry used in baked or cooked products. She was among the first to find Salmonella in raw milk 50 years ago, and her work on the frequent presence of Salmonella in poultry led to the Federal Poultry Inspection Program in the late 1950s (Steele and Galton, 1967).

Thirty years before Weil described leptospirosis in humans in 1880, animal leptospirosis was identified as its own problem. A record of an 1898 canine epidemic in Stuttgart, Germany, exists, but the etiologic agents were not determined. 30 years after the canine epidemic, it was discovered that microorganisms morphologically identical caused the disease in both dogs and humans. Leptospirosis proved confusing to all health professionals partly because ''isolated serovars were given names denoting the clinical signs observed in the patients from whom they were isolated'' (Torten, 1979). Therefore, it was thought that serovar grippotyphosa would cause signs similar to catarrhal fever, and serovar icterohemorrhagia would cause hemorrhagic jaundice. It was not recognized that both serotypes are capable of causing both signs (Torten, 1979). In the US, there were numerous outbreaks among animal handlers, veterinarians and swimmers as well as people whose occupation exposed them to contaminated waste water in the 1950–1970 period. Leptospirosis is now recognized as a problem associated with disasters such as flooding and earthquakes. There is wide agreement that vaccination of cattle and dogs has reduced environmental contamination (Stoenner et al., 1956). Galton (1966) edited the ''Leptospiral serotype distribution list'' through 1966, and Sulzer (1975) carried it up to 1973. They were truly dedicated in keeping these records.

Listeriosis was first recorded in 1926 in sheep, and the first reported human case was in Denmark in 1929 (Bomer et al., 1979). Prevention of listeriosis is still not possible with the knowledge available, as there are no immunizing agents of proven worth. Killed bacterins have been disappointing, and living attenuated vaccines have not been evaluated properly nor have they shown promise in limited experiments. Good physical hygiene is essential to prevention (Bomer et al., 1979). Groups at high risk of infection are pregnant women, neonates, diabetics, alcohol dependents, persons with neoplastic disease, or those being treated with corticosteroids or antimetabolites. Among animals, ewes are at the highest risk late in the first pregnancy. Sheep in late pregnancy should not be fed ensilage of doubtful quality nor be exposed to severe cold or inclement weather and crowding (Bomer et al., 1979).

Improved measures for preventing and controlling human listeriosis depend on increasing awareness of its diverse clinical manifestations and an increasing index of suspicion. Because *L. monocytogenes*, the causative agent of listeriosis, is sensitive to most antibiotics, their early administration, once the diagnosis has been established, significantly decreases mortality.

Cortisone and its derivatives may, however, cause asymptomatic listeria infections to become overt (Bomer et al., 1979).

After the end of the war in Europe, the breakdown of food hygiene there allowed salvaged food to spread zoonotic diseases. At the same time there were numerous cases of listeriosis reported in France that caused abortion, stillbirths and reproductive tract disease (Seeliger, 1961). The disease remains prevalent in western Europe to the extent that all midwives and obstetricians alert their patients to report symptoms. Since 2000 there has been a steady decline of reported cases.

Food borne listeriosis elsewhere was virtually forgotten until 1981 when an outbreak occurred in the Maritime Provinces of Canada and was associated with consumption of contaminated coleslaw (Schleck et al., 1983). Then 2 years later, a major outbreak in Massachusetts between June and August of 1983 was epidemiologically linked to consumption of a particular brand of pasteurized whole and 2% milk (Fleming et al., 1985). Although questions have been raised about the adequacy of the epidemiologic study (Ryser and Marth, 1991), no other food has emerged as the vehicle that transmitted *L. monocytogenes* in this outbreak.

In 1985 Mexican-style cheese made in a factory near Los Angeles was definitively linked to a large outbreak listeriosis (Linnan et al., 1988). This was followed in 1987 by the linking of consumption of Vacherin Mont d'Or, a variety of cheese, to an outbreak of listeriosis in the Canton of Vaud in Switzerland (Bille et al., 1988). In recent years, food borne outbreaks continue to be reported in North America and Europe. During the 1990s, many more human cases and deaths were reported in the United States. The vehicles reported as contaminated were cold cuts, canned meats and frankfurter sausages. Worldwide, listeriosis is a problem mostly in the temperate zones.

Another emerging zoonotic food borne disease is *Escherichia coli* O157:H7, the enterohemorrhagic strains as well as those characterized by cytotoxins. These *E. coli* and others of human origin are major causes of the human enteric disease. However, they are less causative in food producing animals that may be infected but show few or no clinical signs. Pasteurization of milk is effective in the control of *E. coli* spread. Irradiation has proven effective for pasteurization of food of animal origin for the protection of the public health. Recently improved inspection and hygiene have reduced reported human diseases, even though toxic *E. coli* is wide spread among cattle.

The same can be said for newly identified emerging food borne zoonotic diseases. *Cryptosporidia parvum* is a coccidian protozoa found worldwide. *Giardia* are found in numerous animals, and during the late 20th century, the flagellate protozoan was identified worldwide as a water borne disease of humans and animals.

Old problems new to the States are *Taenia saginata* and *T. solium*, largely found in immigrant workers. The tapeworm cysts found in meat, beef and pork are easily destroyed by irradiation, a technology that slowly is being accepted in the southern countries where tapeworm disease is recognized as both an economic as well as a public health problem.

The acceptance of veterinary public health internationally by the PAHO has been previously discussed. The inauguration of veterinary public health as a national program in the USPHS in 1945 stimulated interest worldwide, especially in the newly created international agencies. The United Nations Health Office organizing committee chaired by Surgeon General Tom Parran met in New York in June 1946 to further public health worldwide.

The Public Health Service officers and personnel were asked by the Surgeon General's Chief of Staff, G.L. Dunnahoo, to suggest topics. Veterinary public health was new, but a few weeks before the organizing group was to meet, I was directed to make a veterinary public health presentation and answer questions at the Surgeon General's staff meeting.

After the meeting, I asked Dr. Dunnahoo if he would be interested in a recommendation for a Veterinary Public Health program for the WHO Organizing Committee. He urged me to give him a memo recommending a Veterinary Public Health Activity. That May 7, 1946, I wrote a memo paraphrased as follows: ‘‘Regarding our conversation and your encouragement, I propose that in the organization of the United Nation's Health Office there be a veterinary public health (VPH) program. The VPH program would be concerned with animal diseases transmissible to man. The VPH would carry on liaisons with veterinary activities in the agriculture agencies and collect information on animal health.''

Some months later I asked how the VPH recommendation was received. Dr. Dunnahoo said there were no objections or discussion: the VPH item was accepted and placed in the records.

Years later I learned an American veterinarian, Martin M. Kaplan, was recruited by an English physician with whom Kaplan worked with in the United Nations Relief and Rehabilitation Administration (UNRRA) in Greece. In 1948 Kaplan came to the newly established WHO in Geneva, Switzerland. He developed a VPH program in the communicable disease division that is a model for a public health program in the developing world.

During the next 20 years, he organized the Expert Committee meetings and Technical Reports. The first was in l950 (WHO, 1951) to review tuberculosis, which was a major disease problem in humans and animals at the end of World War II. An American tuberculosis authority, Dr. Franklin Top, a US Army consultant, had reported that 30% of the human cases in occupied Germany were caused by *Mycobacteria tuberculosis bovis*. The problem was referred to the WHO Expert Zoonoses Committee by the WHO Expert Tuberculosis Committee. There was no consensus on what recommendation to make. The Danish veterinarian Dr. Plum spoke for the classical tuberculin test and identification. The French urged the use of bacille Calmette-Guérin (BCG) vaccinations. The success of bovine tuberculosis eradication in the United States was recommended as the ideal method. Eventually the committee recommended test and removal, with the caveat for developing countries to try other methods, including the BCG vaccination, which had no success in field trials.

A number of other diseases were reviewed with the recommendation for control. There was a consensus on the following: Q fever, anthrax, psittacosis, and hydatidosis. Another issue was to settle on a definition of veterinary public health. A current definition of public health is summarized as diseases that are naturally transmitted between animals and man.

The following year, 1950, WHO called together a panel of rabies experts, including E.S. Tierkel of the CDC (WHO, 1950). Tierkel and others who followed from the CDC, namely George Baer, Keith Sikes, Jerry Winkler and currently Charles Rupprecht, contributed to rabies control and prevention.

The first of the WHO Expert Committees on the Zoonoses was followed by zoonoses study groups in 1958, which Meyer chaired in Stockholm (WHO, 1959). He was most effective in leading the committee, and in his closing remarks he passed the leadership to James Steele.

At the next meeting of the WHO Zoonoses Expert Committee in Geneva in 1965, I was the chairman (WHO, 1967). The next meeting in 1974 was chaired by Calvin Schwabe (WHO, 1979), Professor of Epidemiology at the University of California School of Veterinary Medicine and the School of Human Medicine. Schwabe (1984b) summarizes the WHO Veterinary Public Health in his monumental third edition of *Veterinary Medicine and Human Health*: ‘‘The final objective of veterinary medicine does not lie in the *animal* species that the veterinarian commonly treats. It lies very definitely in man, and above all in humanity.''

We in veterinary public health recognize the contributions of Acha and Szyfres (1980) for their invaluable book, *Zoonoses and Communicable Diseases Common to Man and Animals* in

Spanish and English. It has been the foundation of veterinary public health epidemiology and surveillance in the Spanish speaking countries of the Americas.

At this time, Dr. George Beran is to be recognized as one of the consultants to PAHO and WHO, and for his work in the Philippines. He has carried on in admirable style for more than 50 years in teaching, research, health promotion and consulting, and as author and editor. He has updated the Chemical Rubber Company (CRC) *Handbook of Zoonoses* series (Beran, 1994) and the PAHO Zoonoses reports, and hopefully will continue to do so. He is a historian of veterinary public health.

In closing we pay tribute to the American veterinarians who demonstrated and promoted veterinary public health in the United States. Most of these early pioneers 60 years ago were recruited by the CDC and assigned to states that had zoonotic disease problems, mainly rabies. A few states had staff veterinary consultants. In the late 1940s Georgia State Health Department Laboratory Director Dr. Tom Sellers recruited Dr. Leland Starr, an experienced veterinarian with an advanced degree in epidemiology and public health experience. The New York State Health Department had enlisted Dr. Alexander Zeissig from the Cornell faculty. New Jersey's rabies control officer was Dr. J.S. McDaniel. The California Health Department, with prompting from K.F. Meyer, had sent Dr. Ben Dean to Johns Hopkins to earn an MPH in 1945.

Among the early CDC recruits assigned to a state was Ernest Wine. He was sent to Pennsylvania, where he remained for 30 years, rising to the position of state epidemiologist. Oscar Sussman went to Arizona, and later the New Jersey Health Department recruited him, where he built an outstanding program. Martin Baum served Colorado for many years after leaving the CDC. John Mason served in New Mexico. Art Wolff did excellent service in Michigan before returning to Washington, where he became a leader at the USPHS in environmental health as a radiation authority and Assistant Surgeon General. Herbert Stoenner went to Utah and Raymond Fagan to Indiana as described earlier. Monroe Holmes followed Stoenner to Utah, and John Scrugs went to Indiana when Fagan went to the Harvard School of Public Health. John Winn, Francis Abimanti, Don Mason, and Lauri Luoto were among the early investigators of Q fever in California. Stoenner, in addition to his investigation of brucellosis and leptospirosis, was also a leader in Q Fever studies. Don Mason, John Richardson, and Paul Arnstein worked on the control of psittacosis in K.F. Meyer's laboratory at UCSF. Dick Parke, Joe Held and Robert Huffaker kept the CDC office responsive to many inquires and provided service to the states. James Glosser closed his career at the CDC in 1971. His work coordinating the Venezuelan Equine Encephalitis epizootic and epidemic with the U.S. Department of Agriculture Veterinary Services earned him the United States Department of Agriculture's outstanding service award. The veterinarians service to public health in the 20th century resulted in better health in all humans and animals. What are the 21st century challenges?

Animal medicine and veterinary public health have been intertwined since humans first began ministrations to their families and animals. Dr. William Foege, former director of the Communicable Disease Center and professor at Emory School of Public Health and now consultant to the Bill Gates Foundation Center, expressed this more forcefully in saying that we cannot have good public health unless we have good animal health. We can invert that and say we cannot have good animal health unless we have good public health. In the United States, the veterinary medical profession has carried on effectively in eliminating those major problems of animal health that had serious public health ramifications, namely bovine tuberculosis and brucellosis. In recent years the advances in rabies immunization have eliminated the disease from our pets, and humans have benefitted. The new human cases that occur are mainly the result of bat exposure.

Looking beyond that, we can see there is a sizable list of parasitic diseases, namely trichinosis and tapeworms, that have been brought under control in the United States. However, tapeworms are now being introduced by the recruitment of workers from Mexico, Central America and South America. These problems affect society in the United States, but it is apparent that we have an obligation to share our knowledge with our neighbors of the Americas as well as Africa and Asia. All of these countries face the same problems the United States, solved in the past century.

Now as we move into the 21st century, the technology for controlling these diseases is available. These proven effective procedures in the United States can be used worldwide. Some challenges exist, however, for methods that control bovine tuberculosis. There is a continuous demand for vaccines to prevent tuberculosis in animals, but there is little evidence there is any value in routine vaccination. These procedures are quite costly, and the best examples are in Europe in the past 50 years. After World War II, tuberculosis was a major problem in central Europe especially in Germany, eastern Europe, what is now Russia, and western Europe. There has been an uncalled-for degree of confidence in the tuberculosis vaccine, BCG, but with constant pressure from the World Health Organization, the World Animal Health Organization (OIE), the Food and Agricultural Organization and United States agencies and consultants, the use of vaccines has been put aside. The old test and removal strategies have proven to be the most successful. To introduce that method into Mexico, Central America, South America and Asia is difficult at this time because they are hopeful that a good vaccine will be developed. Unfortunately we have lived with that hope for 100 years. The major problem that remains is to compensate farmers for diseased animals that are removed. The neighboring countries of Mexico, Central America and South America have the opportunity to further their own disease control by employing the proven techniques used in the United States, Canada and Europe.

The control of brucellosis in the developing world is a much bigger problem than tuberculosis. In 1960 veterinary epidemiologist George Baer described the human disease in Mexico and said that most rural people who had reached the age of 40 had evidence of past infection with brucellosis. The same can be said for the countries of Latin America where goats have a high rate of *B. melitensis* infections. To control *B. melitensis* is a difficult task and is a matter of the governments facing up to the issue. A new vaccine developed in the United States, the RB 51 rough strain, had been researched for 50 years or more before the United States Department of Agriculture veterinarians were able to find a solution to producing an effective vaccine for cattle. The vaccines have not proven valuable for goats and sheep. The control of widespread brucellosis in North Africa and the Middle East across Asia has been given little attention.

The WHO, through their consultancies and expert committees on rabies, has spread the knowledge of dog vaccination throughout the world. We can say with some degree of pride that the technology developed by veterinarians at the Communicable Disease Center and carried to other parts of the world by authorities such as the late Ernie Tierkel and others who worked with him and George Baer have made a great contribution to the world scene. We do see the light at the end of the tunnel for worldwide control of canine rabies. Other efficient rabies vaccines have been developed in South America and Europe.

Looking at the parasitic infections of the world, there is certainly a great deal of interest in control of trichinosis, which has been fostered through scientific congresses every few years. The world wide results are favorable today with a drastic reduction in North America and Europe. Unfortunately new problems have arisen in connection with the disease in wild animals, especially those found in the arctic zones of the world. *Taenia saginata* and *T. solium* are receiving more attention as we face worldwide problems with the measurements of disease. In the

Americas the problem has been carried from one country to another by human carriers and then spread to animals. New foci have been established in North America, where there have been meetings to plan for initiating a worldwide control program. In my own way of thinking, the control of *T. saginata* is a measurement of good hygiene and good waste control in any country where it is present. Dr. Peter Schantz has advocated world control of tapeworm and hydatid disease with the goal of eradication.

Many other new problems arising in zoonotic and parasitic diseases are constantly coming to our attention. The continuous migration of workers seeking better opportunities in industrialized countries also carries the risk of infections being brought with them. The Surgeon General has spoken for the globalization of public health. The Veterinary Public Health program of the CDC has been active in globalization of veterinary public health, namely in the control of rabies, parasitic diseases and food borne diseases. Many of the veterinary officers have served on WHO Expert Zoonosis committees have carried out detailed missions for WHO. The CDC program has been supportive of PAHO veterinary activities with assignments of veterinary officers to Mexico, Panama, Peru, Argentina, and most recently David Ashford and Hugh Mainzer to Brazil for Foot and Mouth Disease control and other problems.

The number of emerging diseases increased in the latter part of the 20th century. Infectious disease scientists have found that Acquired Immune Deficiency Syndrome (AIDS) is a disease that makes people more susceptible to zoonotic diseases, including bovine tuberculosis and related mycobacterial infections, toxoplasmosis, cryptosporidiosis, food borne Salmonella and enteric infections including Campylobacter, Listeria and Yersinia. It is possible that other zoonotic diseases that are dormant or infrequent may emerge in individuals with AIDS, Human Immunodeficiency Virus infection, or other immune-compromised conditions. Related latent or nonpathogenic viral diseases have been described in tropical cats of Africa including lions as well as domesticated cats. In Australia and Malaysia new diseases which also affect humans have been reported in horses and swine. These diseases are caused by the morbilliviruses, a measles-like virus that causes canine distemper and rinderpest. Another virus that killed the wild felids in the Cairo Zoo has not been identified. Could this be another form of distemper? Some of the emerging viral diseases that have a rodent or unknown animal host have caused fatal, devastating diseases in humans in Africa and South America, namely Lassa Fever and South American Hemorrhagic diseases in Argentina and Bolivia. In Africa, Ebola Virus hemorrhagic fever and Marburg hemorrhagic fever virus infection, linked to monkey disease, caused disease in medical personnel, handlers and people who had only casual exposure. An incident that surprised us many years ago was the deaths of workers in Middle East abattoirs caused by Crimean Hemorrhagic Fever carried by ectoparasites. One example of developing, emerging, or relatively unknown diseases is Severe Acute Respiratory Syndrome (SARS), a disease that erupted a few years ago in China and was carried to many parts of the world. Recently information has suggested that bats are a natural reservoir of a SARS like coronavirus. Even though SARS may have been an occasional emerging disease that disappeared as rapidly as it appeared, there may have been other infections from bats that have been around the world for millenia.

Naturally, an infection that has been given much attention now is where we stand with the influenza virus. Are wild birds the true reservoir? Apparently, birds are the reservoir based on the information we have gathered showing that wild birds transmitted the virus to avian domestic flocks. All this new information is challenging. The emerging diseases of the world are reasonably covered in the table of the last chapter of Merck Veterinary Manual's ninth edition Zoonosis Section, 2005.

In addition to infectious diseases, we have a new class of diseases that are caused by prions—proteinaceous infectious parties that transfer diseases without any DNA or RNA. Transmissible diseases are not the same as infectious diseases which are characterized by replication of DNA or RNA. This is certainly a bewildering situation especially when we read that saliva may be a means of transfer. Immediately veterinarians think of rabies which is transmitted by saliva. Is it possible the prion of the diseased brain can be secreted through nerve fibers that innervate the salivary gland? The prions are of great and continuing concern as a cause of concern as new types of diseases. Our associates in chemistry, physics, and physiology may offer clues to other neurological diseases.

One last subject I want to mention is humaneness. It is important that we abide by sensible, humane policies, but humaneness can be carried to such an extreme that it destroys values that we hold so high for protecting our pets, farm animals, and the wild animals around us. Periodically we all read about overpopulations in different areas. Society calls for conservative measures for population control that applies to all pets, wild animals and domestic animals. In a broader sense, it has applications to the human race. We are aware of the collapse of earlier civilizations that have overpopulated their given area or were destroyed by natural events such as starvation. So I say all veterinarians, especially those in public health, have a responsibility in developing humane regulations for animal population control and public guidance.

In the United States, 80–90% of veterinarians treat our animal associates or pets for various diseases. It is important that veterinarians have a broad, basic knowledge of public health issues and are alert for new public health issues that can be resolved with tender loving care, new antibiotics, and new procedures. The 76,000 or more veterinarians in the AVMA in the United States are key to the control of zoonotic diseases by public health agencies. The health of our animal population is tied to the emotional and mental well being of those humans who are close to animals in their lives. Animals are vital companions to those homebound, and animal health becomes a family concern.

An area I have stressed is the need for basic veterinary science. We see in current publications that most research is based on support from NIH. At the AVMA meeting in July 2000, the speaker US Senator Hatch of Utah spoke highly of the public health activities of veterinary medicine. He went on to say that there may be a NIH Veterinary Institute in the future. It behooves us all that the agricultural interest in public health be recognized as an important issue to the American public. I think highly of the importance of animal health in providing good public health. Public health should not be guided by economic interest but by the welfare of all society. I go back to my earlier statement that animal health and public health are of great importance to all, and we must have good animal health to have good public health. Good public health provides a means for good animal health.

As we look to the future, we have to have open minds and think in terms that anything can occur in biology. I would like to quote my dean from Michigan State, Ward Giltner, who said the only thing about biology we can accept that remains a firm truth is there always is new information that provides exceptions. Looking at it broadly, all infectious things in nature, and prions which may cause disease are always looking for a new host. I like to say they are seeking social security, as most of the world is.

Carry on in the 21st century. I wish I could continue to be a part of it, but it seems time has a way of saying, "You have been here. You have enjoyed it." I especially enjoy the recognition of 60 years of public health service, I am elated. To the audience, especially to the teachers of public health science, thank you. Carry on.

Conflict of interest statement

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