

The renewed emphasis on this problem during the war makes it desirable to re-emphasize to administrators and general practitioners in the field of water supply control that these potential hazards are not likely to disappear of their own accord. It is essential, therefore, that their importance should be recognized and the proper administrative and legal procedures be established to avoid accident and resultant infections.

The reader is therefore referred to the report of the Committee listed on the preceding page for complete review of the essential features of the hazards and of the progress made in correction.

CONTRIBUTIONS OF VETERINARY MEDICINE TO MEDICAL SCIENCES

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Research investigations in veterinary science have contributed richly and importantly to scientific medical knowledge. A number of epoch-making findings and discoveries in the field of medical sciences have resulted from observations and studies of diseases of lower animals.

Modern medicine, surgery, and sanitation owe much of their remarkable development to the revelations of bacteriology. Bacteriology, in turn, owes considerable of its foundation and development to research in the veterinary field. It may be recalled that the first definite proof of the ability of bacteria to produce disease resulted from studies of anthrax in cattle. Likewise, the first evidence that the higher bacteria (fungi) were capable of causing disease came with the discovery in 1878 of *Actinomyces bovis* as the etiological factor in actinomycosis of cattle. Griffith Evans, working in India in 1880, discovered that surra, a disease of horses, is caused by a trypanosome. This was the first knowledge of the ability of trypanosomes to produce disease.

The first proof that those elusive disease-producing agents which we have come to know as filtrable viruses could cause disease in lower animals and man, resulted from studies with aphthous fever or so-called "foot-and-mouth disease" of cattle. Since that particular discovery, filtrable viruses have become a highly important group of disease-producing agents both as regards man and the lower animals.

The great importance of insects as vectors of various diseases is universal, common knowledge. Prior to the acquisition of such knowledge it was impossible to develop means for the control and prevention of diseases like yellow fever and malaria. It was the classical and epoch-making research investigations of Smith and Kilbourne in 1893, wherein they proved that "Texas fever" or piroplasmiasis of cattle is transmitted by ticks that gave rise to modern medical entomology.

With the development, over the years, of veterinary science important advances and contributions have continued to be made. While space will not permit of a review of all important accomplishments of recent years which might be mentioned, a few outstanding examples will be discussed.

Tuberculosis which has been so important from the standpoint of human medicine has likewise been of great importance among the diseases of lower animals, particularly in cattle, hogs, and fowl. While in early days the relationship of tuberculosis in man and lower animals was not well understood, research studies and investigations in the fields of both human and veterinary medicine finally eluci-

dated the subject. Those studies established the existence of the different types of tubercle bacillus and also that the human family especially young children, could be infected with the bovine type. Further, subsequent information indicated that man was not wholly immune to infection with the avian type organism.

In 1917 the Bureau of Animal Industry of the United States Department of Agriculture, in cooperation with the various States, initiated a bovine tuberculosis eradication program. This was a veterinary undertaking of enormous proportions and of profound importance, not only from the standpoint of the livestock industry of the country, but from a public health standpoint as well. The plan initially involved the establishment of "Tuberculosis Free Accredited Herds."² Such herds are those in which all animals of the herd have passed two successive annual or three successive semi-annual physical examinations and tuberculin tests by Federal or State veterinarians. In addition to their cattle passing such tests, herd owners agree to maintain their animals under proper sanitary conditions and to abide by various regulations governing admission of new animals to the herd, making retests, keeping of records, etc. Before starting tests for accreditation the owner executes a contract wherein he agrees to the slaughter of reactors. The "Accredited Herd Plan" was subsequently extended to include "Modified Accredited Areas." Under this modification, areas (counties, municipalities) are accredited when the incidence of bovine tuberculosis within the area is reduced to less than 0.50 percent.

In 1917, when this program was undertaken, bovine tuberculosis in the United States, according to estimates of the United States Bureau of Animal Industry existed to the extent of approximately 5 percent. Since then, and up to June 30, 1945, a total of approximately 3,900,000 tuberculous cattle have been detected and disposed of. At present the incidence of bovine tuberculosis has been reduced to less than 0.50 percent in all counties of the forty-eight States of the Union and approximately 6-million herds representing about 65-million cattle are under supervision as regards tuberculosis. The accomplishments of this tuberculosis eradication program carried out and now in force in the United States constitutes a veterinary achievement of the first order.

Since the observation by Evans back in 1918 that the organism of undulant or Malta fever in man was closely related to the bacterium of infectious abortion of cattle, a vast amount of research has been conducted with that group of diseases now known collectively as brucellosis. Considerable important progress has been made, particularly with regard to means for the diagnosis of the disease in animals and man, the isolation and differentiation of the various species of *Brucella*, and control and prevention of infectious abortion (Bang's disease), the common form of brucellosis in cattle. Bovine infectious abortion is widespread in the United States and in various other countries. From an economic standpoint the malady is very important, striking at the very source of the cattle industry by causing abortions. Early attempts to immunize cattle against infectious abortion involved the use of bacterins. These were soon found to be of little or no value. Later, in infected herds, virulent cultures were used in open animals with a view to protecting them against abortion when subsequently pregnant. While this procedure was found of considerable value in checking abortions, chronic infection developed in a rather large percentage of animals and the disease was carried on indefinitely in the herd.

In 1925, Buck, of the U. S. Bureau of Animal Industry, showed that the most efficient of virulent cultures of *Brucella abortus* was in calves. However, while it was found that such young animals could be substantially immunized against subsequent abortions, occasionally the vaccinated animal became a carrier. A few years later, however, there was isolated a strain of *Brucella abortus* of reduced

virulence (Strain 19) which Buck and Cotton utilized in a series of calfhood vaccination tests with excellent results. It was found that Strain 19 vaccine, administered to calves in 5 cc doses between the fourth and eighth months of life, was very effective in preventing infection when these animals were exposed during their first pregnancy. Following these observations the U. S. Bureau of Animal Industry, in 1936, put on a 5-year field trial with calfhood vaccination in 260 heavily infected herds. The results were highly favorable, abortions being held to less than 1.5 percent through the period covering one, two, three, and four pregnancies. As a result the Bureau, in 1940, gave official sanction to the use of Strain 19 vaccine for calfhood vaccination in the United States. This vaccine has been, and is being used on a rather large scale in the United States and in a number of other countries and reports indicate it is an important agent in the control of bovine infectious abortion.

Within the past fifteen years encephalomyelitis of virus origin has become the most important equine disease in this country. The malady is important because of the extent to which it has occurred among horses and mules with considerable mortality, and also because the human family is readily susceptible to it. The extent to which the disease might occur among susceptible animals was indicated by the approximately 185,000 cases reported during the outbreak of 1938.

Research investigations with equine encephalomyelitis have been very fruitful. They started with the classical work of Meyer, Haring, and Howitt, who in 1931 definitely proved that the etiological factor in the disease was a filtrable virus. Then followed the finding (Giltner and Shahan, and Ten Broeck) that two immunologically distinct viruses existed in the United States, a so-called "Western" and "Eastern" types. Since then, a "Venezuelan" type has been identified but so far has not occurred in the United States.

It was generally assumed that equine encephalomyelitis was commonly spread through direct or indirect contact, with infection probably occurring by way of the alimentary tract. It fell to the author's lot, however, to prove for the first time the ability of mosquitoes to transmit the disease (Kelser 1933). This finding has since been abundantly confirmed and at present a dozen or more species of mosquitoes have been proved capable of transmitting equine encephalomyelitis. The transmission is not mechanical but occurs only after the virus has undergone maturation or multiplication within the mosquito. Ordinarily, it requires 5 or 6 days following an infectious meal before the mosquito is capable of transmitting the disease but after becoming infectious it transmits the infection for weeks or months, possibly for the remainder of life of the average mosquito. This finding was not only of importance in connection with the epizootology of the disease in the equine species but constituted knowledge of great value in connection with control and preventive measures in outbreaks of the malady in the human family. Further, additional studies inspired by the finding resulted in the uncovering of evidence strongly indicating that the "St. Louis" type of encephalitis in man is mosquito-borne.

Very excellent results in the immunization of animals have been obtained with a vaccine prepared through propagation of the virus in developing chick embryos. This vaccine consists of a formalin-inactivated suspension of virus-bearing embryonic tissue. The vaccine is administered intradermally, two doses being given 7 days apart. Very excellent results are obtained with the vaccine in protecting horses and mules. Further, a similar vaccine can be used for the protection of man in instances where it may be needed.

Rabies is another disease of veterinary importance and also of definite interest from the standpoint of human medicine. While one of the oldest known diseases

and the subject of a vast amount of study over a period of many decades, considerable advance has been made in recent years, particularly as regards the improvement of vaccine for the prevention of rabies. Present day vaccines used for the immunization of dogs, in many places on a large scale, are more potent, and uniformly so, than was the case some years ago. This also applies to vaccine for human use. This improvement has been brought about through an increase in the inactivated virus content of the vaccine, better methods of inactivation of the virus, and finally making it a requirement that each lot of vaccine pass the Habel potency test.

Studies of influenza and influenza-like diseases in lower animals have resulted in some very interesting and valuable findings. Equine and swine influenza have a number of things analogous to their counterpart in the human family. The same can be said of canine distemper which to all intent and purpose is canine influenza. In these diseases of the lower species the primary etiological factor is a filtrable virus and, as in the human disease, there are frequently secondarily associated several types of bacteria. The study of canine distemper by Laidlaw and Dunkin was largely responsible for the introduction of the ferret as a valuable laboratory animal for virus research. Further, Laidlaw's work with canine distemper was undoubtedly of considerable value in his subsequent work with Smith and Andrewes in demonstrating the virus causation of human influenza.

Prior to the work of Laidlaw and Dunkin with canine distemper no satisfactory means existed for the control and prevention of that scourge. As a result of their studies the prophylaxis of canine distemper and the disease in commercially reared foxes has become a well-established, satisfactory veterinary procedure.

Swine erysipelas, caused by *Erysipelothrix rhusiopathiae*, is becoming increasingly important in the United States. While the disease is commonly one of hogs a wide variety of species can become infected. These include cattle, sheep, dogs, ducks, pigeons, turkeys, and other fowl. Man may likewise become infected, occasionally in severe, serious form. Research studies of this disease have yielded several important results. In the first place, considerable improvement has been made in procedures for the diagnosis of the disease. A reliable rapid agglutination test (plate test) has been developed as well as the conventional type of tube agglutination test (Schoening, Creech and Grey; Grey, Osteen, and Schoening). Further, encouraging progress has been made in making available means for immunization against swine erysipelas. The U. S. Bureau of Animal Industry in cooperation with several States has been testing the simultaneous use of antiserum and culture for prophylactic purposes. Finally, recent research indicates that penicillin is very efficacious in the treatment of the disease in lower animals and man.

An eye malady of horses known as periodic or recurrent ophthalmia has existed in the United States and various other countries for many years. In the United States, at least, it has been responsible for more blindness in the equine species than all other causes combined. Clinically and histo-pathologically the disease is a recurrent iridocyclitis. Because of the importance of the disease among military animals research investigations were undertaken with it several years ago at the Veterinary Research Laboratory at the Army Remount Depot at Front Royal, Virginia. These studies have made possible the following important conclusions with reference to periodic ophthalmia.

Striking similarities between the ocular lesions of experimental riboflavin deficiency in laboratory animals and those of periodic ophthalmia suggested that riboflavin deficiency might be involved in the equine disease. Numerous experiments subsequently completed have further strengthened this theory. However,

considerable evidence has been accumulated to indicate that additional factors also may be involved. For example, it has been found that under certain experimental conditions, riboflavin is synthesized in the intestinal tract of horses. It appears that the amount produced may not be adequate under all conditions. More work is needed upon the exact dietary requirements of horses for riboflavin and other essentials. The use of riboflavin and many other dietary supplements in the treatment of established cases of periodic ophthalmia has met with little success.

Since November 1943, crystalline riboflavin has been added to the ration of a group of 130 horses at the Front Royal Remount Depot. No other changes were made in the feeding or management of these animals. Prior to starting this supplementation, this group had an annual new case rate of 109 per thousand. Since supplementation was started, no new cases of periodic ophthalmia have developed. In contrast, the case rate remained essentially the same in other animal groups which were kept as controls. In June 1944, supplementation was extended to some other animals at Front Royal and, by the end of 1944, all animals were receiving crystalline riboflavin. Not one new case has developed at Front Royal up to the present time. This appears very significant since Front Royal for several years has had the highest rate of any Army installation in the United States.

The amount of riboflavin added to the ration has been relatively large, and future experience may indicate that the dosage can be reduced. Riboflavin has been used at the rate of 40 milligrams per horse per day. This is added to the grain ration. One convenient method has been to add 80 grams of riboflavin to each ton of bran, then allow each horse one pound of bran per day. The cost is not prohibitive, being just over one cent per horse per day. Crystalline riboflavin is readily available since it is used in large quantities for enriching bread, and is also used in many poultry rations. The use of other supplements or riboflavin-high feeds may prove desirable but, at the present time, these methods have not proven effective in the control of periodic ophthalmia.

It appears that the use of crystalline riboflavin is a practical and effective means for the prevention of periodic ophthalmia.

Veterinary research and results with various other diseases and conditions might well be discussed if space permitted but it will not. Studies and accomplishments in the field of veterinary parasitology would furnish sufficient material for an essay on that subject alone. Then, much has and is being done in the field of animal nutrition, affording considerable material of general interest.

What I have related with regard to the contributions of veterinary medicine leads me to the following closing thought: The field of the medical sciences covers a broad expanse. Many of the problems and difficulties of one branch are likewise those of another branch. The accomplishments of one often shed light on questions of the other. Thus, as research in the realm of human medicine has contributed to the welfare of our lower animals, so has research in the field of veterinary science contributed to the welfare of mankind. This is as it should be and I am certain that the closer the alliance the greater will be the benefits to both.

Duración de las visitas.—Seis médicos privados de una zona industrial, en conjunto tuvieron 318 periodos de consulta, comprendiendo 1,602 enfermos durante el primer trimestre de 1944. El promedio de tiempo dedicado a cada enfermo varió de 12.2 a 21.3 minutos. Durante ciertas horas de consulta en que se atendían más enfermos, el tiempo empleado en cada uno disminuyó. Esto sugiere que el médico se da cuenta del número de enfermos en la sala de espera, y trata de graduar la apidez de su trabajo.—Pub. Health Rep., 1113, sbre. 21, 1945.