CDC BULLETIN

OCTOBER - 1950

FEDERAL SECURITY AGENCY
Public Health Service
Communicable Disease Center
Atlanta, Ga.

CDC BULLETIN
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CDC Training Courses

Listed below are training courses, sponsored by Services of the Communicable Disease Center, to be held during the ensuing months. Further information on the courses may be obtained from the *Bulletin of Field Training Programs* issued by the Center.

TRAINING SERVICES

1. **FIELD SURVEY AND EVALUATION METHODS FOR MEASURING QUALITY OF HOUSING ENVIRONMENT**, December 4-9, 1950. One week. Atlanta, Ga.

2. **FIELD SURVEY AND EVALUATION METHODS IN HOUSING SANITATION**, November 13 to December 15, 1950. Five weeks. Atlanta, Ga.

3. **FIELD SURVEY AND EVALUATION METHODS FOR MEASURING QUALITY OF HOUSING ENVIRONMENT**, December 11-15, 1950. One week. Syracuse, N. Y.

4. **FIELD SURVEY AND EVALUATION METHODS IN HOUSING SANITATION**, November 20 to December 22, 1950. Five weeks. Syracuse, N. Y.

5. **ADVANCED TRAINING COURSE FOR STATE SANITARY CHEMISTS PRIMARILY CONCERNED WITH WATER POLLUTION INVESTIGATIONS**, December 4-15, 1950. Two weeks. Cincinnati, Ohio.

6. **BASIC RADIOLOGICAL HEALTH TRAINING**, November 6-17, 1950. Two weeks. Environmental Health Center, Cincinnati, Ohio.

LABORATORY SERVICES

1. **SEROLOGICAL DIAGNOSIS OF RICKETTSIAL DISEASES**, November 6-10, 1950. One week. Atlanta, Ga.

2. **IDENTIFICATION OF MEDICALLY IMPORTANT ARTHROPODS**, November 13-24, 1950. Two weeks. Atlanta, Ga.

3. **VIRUS ISOLATION AND IDENTIFICATION TECHNIQUES**, November 13-17, 1950. One week. Montgomery, Ala.

4. **LABORATORY DIAGNOSIS OF TUBERCULOSIS**, December 4-15, 1950. Two weeks. Atlanta, Ga.

By Special Arrangement:

LABORATORY DIAGNOSIS OF MALARIA, two weeks, Atlanta, Ga.; **LABORATORY DIAGNOSIS OF VIRUS DISEASES**, two to four weeks, Montgomery, Ala.; and **PHAGE TYPING OF SALMONELLA TYPHOSA**, one week, Atlanta, Ga.

VETERINARY PUBLIC HEALTH SERVICES

1. **LABORATORY DIAGNOSIS OF RABIES**, November 27 to December 1, 1950. One week. Montgomery, Ala.

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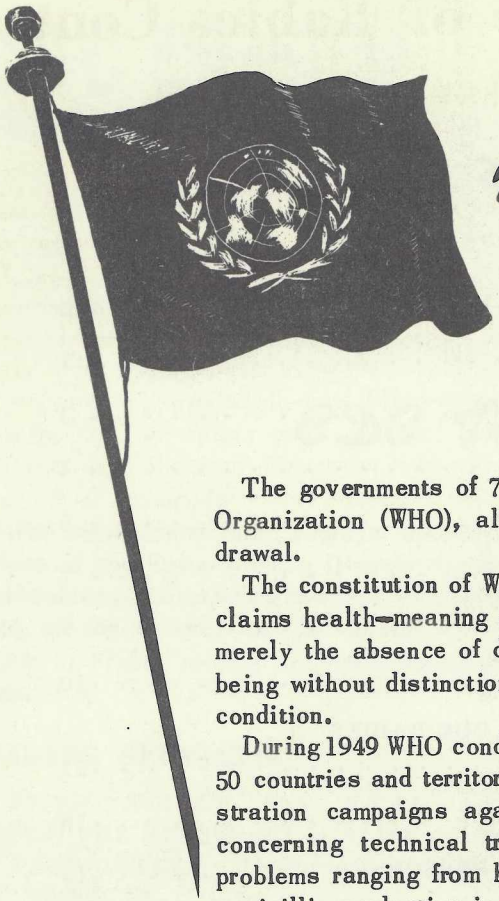
The printing of this publication has been approved by the Director of the Bureau of the Budget, January 19, 1950.



United Nations and Health

In observance of United Nations Day, October 24, 1950, the following* is published:

The governments of 74 countries have joined the United Nations World Health Organization (WHO), although the Soviet satellites have announced their withdrawal.

The constitution of WHO has been called the "Magna Carta of Health." It proclaims health—meaning complete mental, physical, and social well-being and not merely the absence of disease—as one of the fundamental rights of every human being without distinction of race, religion, political belief, or economic or social condition.

During 1949 WHO conducted specific aid projects in the health programs of over 50 countries and territories. These projects included on-the-spot surveys, demonstration campaigns against major diseases, expert advice to governments concerning technical training schools, and operations directed toward solving problems ranging from how to control malaria in southeast Asia and increase penicillin production in Europe to how to improve garbage disposal in the United States.

In the time it takes to read this paragraph—approximately one minute—at least 20 human beings somewhere in the world will be dying of malaria, venereal disease, or tuberculosis. The experts of WHO believe it is possible through cooperation and the use of recent discoveries to reduce drastically the number of such victims. Malaria now strikes an estimated 300 million persons a year, of which 2 to 3 million die and others are so weakened that their productive capacity is greatly reduced. In some areas of Greece, WHO aid has helped to cut the malaria rate from 80 percent of the population to 5 percent; and as a result, food production in some of these districts increased as much as 70 percent.

WHO maintains an epidemic-alerting service through the use of world-wide broadcasting facilities. Eight powerful transmitters near Geneva, Switzerland, beam twice daily to every continent the latest official information on epidemic diseases and quarantine measures. A WHO intelligence post at Singapore provides special service for the Pacific and Indian Ocean areas.

* From "Facts and Figures About the United Nations," Department of State Publication 3930 (August 1950).

The Theory and Practice of Rabies Control

ERNEST S. TIERKEL, Veterinarian *

Rabies is probably one of the oldest known animal diseases communicable to man. Many concepts of the disease as described by Democritus and Aristotle in ancient times are the same as we know them today. As early as 100 A.D., Celsus cauterized the wounds of persons bitten by rabid animals. It was the work of Pasteur, however, that gave us our first insight into the nature of the causative agent, some understanding of the immunity mechanism, and the development of a new prophylactic tool, rabies vaccine.

Since its introduction on the North American continent from Europe in the middle of the eighteenth century, rabies insidiously has continued to exact its toll from the public health, agricultural economy, and wildlife conservation of the United States. In spite of its apparent entrenchment in large segments of civilized populations, it is NOT a disease "we have learned to live with." The inevitable termination of the disease in agonizing death has made it one of the most feared maladies affecting man. Furthermore, the unpleasant and expensive series of vaccinations indicated after exposure is established and the realization that these vaccinations are not always given without danger, have been the source of a conglomerate headache for the health officers of the country.

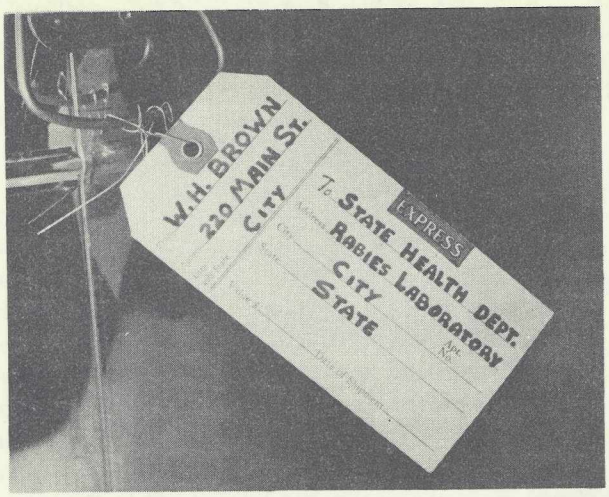
Examination of the epidemiology of rabies reveals that it is ubiquitous in geographical distribution. Climate and season have no influence on its occurrence. It is found in the arctic regions of Alaska and Canada as well as the tropical countries of the Old and New Worlds. By the same token, it may be present during any season of the year. The disease, in nature, is characterized by a relatively long and variable incubation period. The probability of human infection is dependent upon the concentration of the virus in the saliva of the biting animal, the site of the bite on the body, the depth of the bite, the multiplicity of the bite, and the possible interposition of clothing.

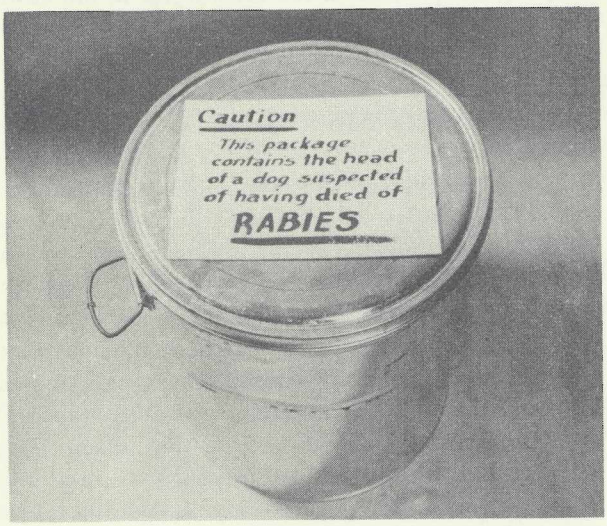
In another phase of the problem, our attention has been drawn in recent years to an increasing number of postvaccinal complications following administration of the prescribed series of rabies vaccine treatments in exposed persons. Laboratory research at present is attacking this serious problem by directing its efforts along two lines. First is an attempt at the development of a hyperimmune rabies serum. The second is the possible refinement of brain and nerve tissue vaccines by removing the so-called encephalitogenic factors by biochemical methods. The status of both of these activities still is experimental, although they have shown great promise in the laboratory. In the meantime, practicing physicians and health officials are being asked to exercise sound judgment in the management of suspected exposure to minimize the promiscuous administration of human rabies vaccine.

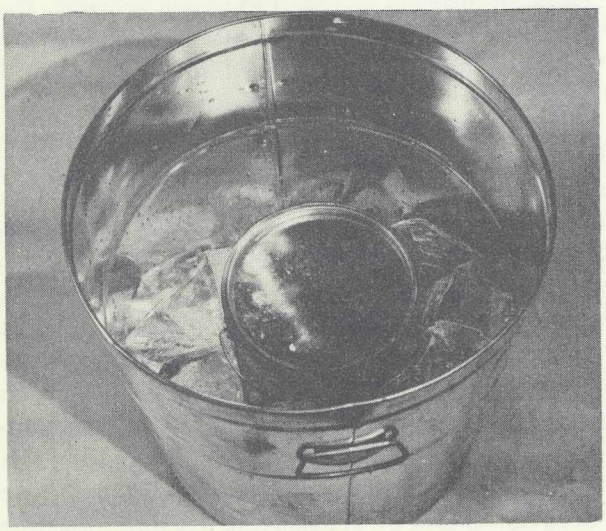
We are convinced that the ultimate solution to the rabies problem is predicated on the control and eventual elimination of the disease from animal populations. This may be accomplished by the setting up of transmission barriers such as animal immunization, restriction of animal movement, and the reduction of excessive numbers of susceptible wildlife. Extensive laboratory research and field projects have proved that these techniques may be applied successfully to eradicate the disease from a given area if integrated into a carefully planned and well executed program. Dramatic demonstrations of the effectiveness of such programs have been displayed in recent years in many parts of the United States. It is our desire to muster the forces of the remainder of the country to set similar machinery in motion for an all-out fight against rabies.

It is now an established premise that coordination of control activities is the keynote of a successful state-wide rabies control program. Experience has shown that this can be achieved if the administration of such a program is delegated to a qualified public health veterinarian at State level. The duties and responsibilities of the health department veterinarian in administering a state-wide program would include coordinating the efforts of local control by encouraging accurate reporting; studying the movement and comparative regional prevalence of the disease within the State and

*Veterinary Public Health Services, Communicable Disease Center







Heads shipped to laboratories for diagnosis should be placed in a small slip-top container, which in turn should be placed in another container large enough to permit ice to be packed between the inner and outer one.

alerting counties on the presence of rabies in neighboring areas; appointing rabies inspectors; improving methods for the shipment of specimens to diagnostic laboratories; surveying facilities for collection and impoundment of stray dogs; making canine vaccines available where needed; exchanging information with neighboring States having similar problems; preparing and distributing educational material throughout the State; and, by frequent visits, advising and consulting with local authorities on current policies and methodology of control practices.

Through professional societies, the State public health veterinarian is in excellent position to stimulate the interest of the private practicing veterinarians of the State and enlist the active participation of practitioners in local control programs. He can serve as an effective liaison officer between the State health department and other interested State agencies such as agriculture and game conservation.

The operational phases of a rabies control program are carried out at the local level. Field demonstrations have shown that local programs work best on a county-wide basis. Successful results cannot be expected if the program is limited to a city or town without including the surrounding suburban and rural areas of the county. The rabid dog often can run the length or breadth of the average American county, spreading the infection to each animal he bites in his path.

Local rabies control programs should be operated on the basis of three broad measures. The first is ANNUAL ANTIRABIES VACCINATION OF ALL DOGS. The importance of canine vaccination as the primary tool in an efficient control program is now a firmly established fact and needs only a well organized educational campaign to bring this fact to the public. The second is the IMPOUNDMENT AND DESTRUCTION OF ALL STRAY AND OWNERLESS DOGS. Needless to say, vaccination will not reach the stray dogs of a community, and it is the stray animal that very often is incriminated in the spread of the disease. This measure requires the operation of a local pound or humane shelter where strays may be kept for a specified period of time, and, if unclaimed at the end of that period, humanely destroyed. Strays should be collected by teams of dog wardens and assistants using trucks with proper enclosures. The third is REGISTRATION OF ALL DOGS. Registration of all dogs in a community is an important adjunct of a successful

Photo by Memphis-Shelby County Health Department

Intensified mass canine immunization techniques are paramount for achieving swift reduction of susceptibles.

control program. If properly enforced, it serves to defray the expenses of the over-all program, establishes responsibility of dog ownership, assures a reasonably accurate dog census, and identifies the unwanted or homeless strays.

The combining of vaccination and registration has proved in some areas to be a sound idea. It tends to make the control program less cumbersome. The dog owner usually appreciates the fact that he has only one trip to make when he can have his dog vaccinated and registered at the same time. The issuing of a single uniform tag for the dog's collar and a single uniform certificate, made out in triplicate, is tantamount to registration. In this scheme, a single fee can be charged which will be low enough to cover all classes of dog owners and high enough to defray the expenses of vaccination and control operations.

In contrast to those communities which have carried out effective mass canine immunization campaigns, we have had the opportunity to observe a few programs which were, at best, abortive in their execution. Careful analysis of the utilization of vaccination in the field has convinced us that it is useless to expect results unless the program has the necessary intensified character. In the face of an outbreak, SWIFT REDUCTION OF SUSCEPTIBLES MUST BE ACHIEVED by vaccinating at least 70 percent of the dogs in the shortest possible period of time. To this end, effective administration is paramount. Community interest must be organized through every available medium. Dog inoculation clinics should be held over a 1- to 2-week period throughout the county at strategic points based on population concentrations and geographic distribution of cases.

In areas of rabies outbreaks in wild animals, such as foxes, adequate trapping programs should be instituted in cooperation with the State game conservation authorities. Rabies in foxes tends to assume epizootic proportions in regions overpopulated with this species. If it becomes established in the susceptible wildlife of an area, it will run its ravaging course in a year or more; and in that time, the resulting mortality may decimate the fox population more completely than any trapping operation. The objective in trapping procedures is to reduce the number of susceptible foxes to a level which will not support an epizootic, and thereby prevent the occurrence of this disaster in the foxes themselves and the danger of its spread to man and domestic animals.

Human Exposure to Rabies

T. F. SELLERS, M. D.*

Fortunately, man is much less susceptible to rabies than are other warm-blooded animals. Even in areas where the disease is highly prevalent among dogs and other animals, the incidence of human rabies is exceedingly low. But so deeply rooted are the traditional misconceptions of man regarding this disease, that even in this age of advanced medical science we still are faced with a persistent anxiety complex that makes the management of situations of human exposures at times exceedingly troublesome and time consuming.

HUMAN EXPOSURE

Rabies can be transmitted from the rabid animal to man only by the direct inoculation of fresh saliva through the skin deep enough to come into contact with nerve tissue. Such inoculation only occurs naturally from wounds or bites made by the teeth of the rabid animal. This is the DIRECT exposure. ALL OTHER EXPOSURES ARE INDIRECT AND SHOULD BE DISREGARDED.

RABID ANIMAL DEFINED

As it applies to the management of human exposure to rabies, a rabid animal is defined as one which (1) is proved to be rabid by laboratory methods; (2) is clinically rabid by veterinary diagnosis; (3) disappears after biting and cannot be located subsequently; (4) bites without provocation and is killed before confirmatory brain lesions have had time to develop.

INDICATIONS FOR ANTIRABIC TREATMENT

For all direct exposures, that is, tooth wounds made by rabid animals as above defined, antirabic vaccine should be administered in amounts prescribed by the laboratory to suit the degree of exposure.

The vaccine also may be indicated for children in contact with a rabid animal but too young to give reliable testimony.

In cases of severe face wounds or severe and multiple lacerations about the hands, the vaccine treatment may be supplemented by hyperimmune serum which recently has become available.

As a first-aid precaution, all animal bites should be washed immediately and thoroughly for 15 to 20 minutes with a strong, warm soap solution. This can be done at home by the patient or family before the doctor is called.

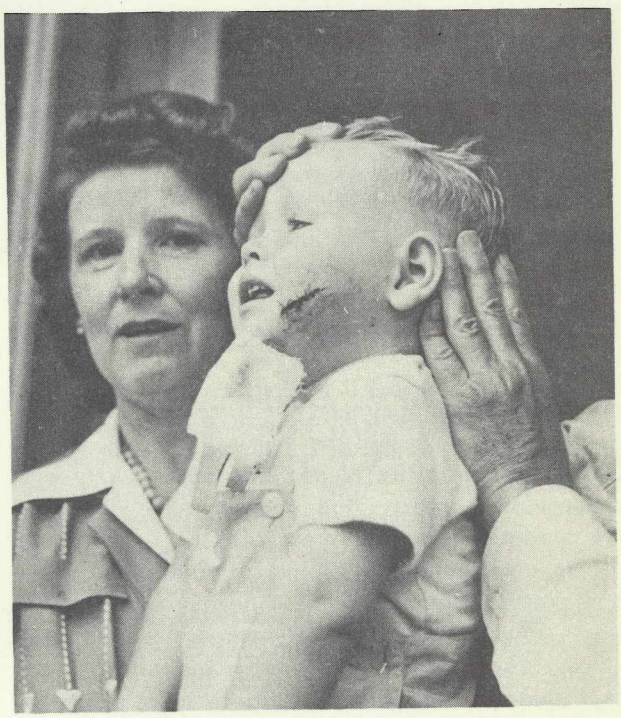


Photo by Memphis-Shelby County Health Department

Severe bite wounds of the face constitute the greatest exposure hazard and should be treated accordingly.

CONTRAINDICATIONS FOR ANTIRABIC VACCINE

The protective value of the vaccine for rabid animal bites is unquestioned and should be used without hesitation. But the physician should bear in mind that occasionally the vaccine itself may cause reactions. The most important type of reaction is vaccine paralysis which, while rare, is often serious and sometimes fatal. Therefore the vaccine should not be used for indirect exposures or circumstances such as:

*Director, Georgia Department of Public Health, and Consultant, Communicable Disease Center

1. Contact of saliva with the unbroken skin anywhere on the body, including face or mouth
2. Contact of saliva with preexistent wound already scabbed over
3. For tooth wounds through clothing which is not torn
4. Handling or petting the suspected animal but not bitten
5. Handling objects contaminated with saliva
6. Drinking the milk of rabid cows or goats
7. If the biting animal is still alive and normal one week after biting
8. Merely to satisfy the anxiety of parents or family but otherwise not indicated
9. For persons previously treated, the vaccine retreatment, if used at all, should be limited to not more than six doses

Not all situations of human exposure will fall in the categories as herein outlined, nor will the physician be able to cope successfully with every case of anxiety complex. But he should bear in mind constantly that antirabic vaccine of itself can cause serious complications and therefore that it should not be used unnecessarily.

Rabies in the Americas

BENJAMIN D. BLOOD, Chief, Veterinary Public Health Section, Pan American Sanitary Bureau *

Rabies is a zoonosis which is widespread in the Americas, and emergency control measures frequently are necessary to cope with outbreaks. The disease recognizes no political boundaries, nor is it subject to terrestrial or climatic influences. Rabies is reported from the frigid regions of the Arctic to the sultry atmosphere of the Tropics; in the congested quarters of Chicago, Rio de Janeiro, Lima, Bogotá, and Mexico City, it exacts its toll. Uncounted hundreds of persons die of rabies each year in the Americas, while thousands of others go through the ordeal of multiple prophylactic injections of vaccine after exposure. It should be added that considerable funds are allocated annually from public health budgets to cover the cost of human antirabies treatment. An indication of the magnitude of this item may be seen by the fact that in Mexico alone from 80 to 100 liters of human rabies vaccine are used monthly.

Rabies is not only a problem of public health, it is also a very important economic problem in many areas of Latin America. Large numbers of cattle and other livestock die each year of paralytic rabies, sometimes diagnosed properly but usually simply called "paralysis." The disease is known to have been prevalent in Mexico for at least 40 years and has caused tremendous losses of livestock (1). It has persisted in Brazil, and at times, rabies epizootics have claimed 60 percent of the cattle in some districts of the states of Matto Grosso and Santa Catarina. In Paraguay, it has existed for a number of years, with an attack rate (and corresponding death rate) of 50 percent of the cattle in some areas. Livestock populations of Bolivia, Colombia, and Venezuela also are attacked by this disease. A fatal paralytic bovine disease is known to have been widespread in Central America for several years; laboratory diagnosis made in 1950 at the CDC Rabies Laboratory, Montgomery, Ala., on material submitted from the Republic of Honduras, confirmed the disease as rabies.

Paralytic bovine rabies, known also as derriengue or mal de caderas (literally, "sickness of hips"), is transmitted by the bites of blood-lapping bats (genus *Desmodus*). Although bat-transmitted rabies is primarily a disease of livestock, it can involve the human population. Eighty-nine human deaths resulted from an outbreak of rabies, with the bat as proven vector, in the island of Trinidad. Subsequent anti-bat measures employed there have demonstrated the effectiveness of elimination

*Regional Office for the Americas of the World Health Organization

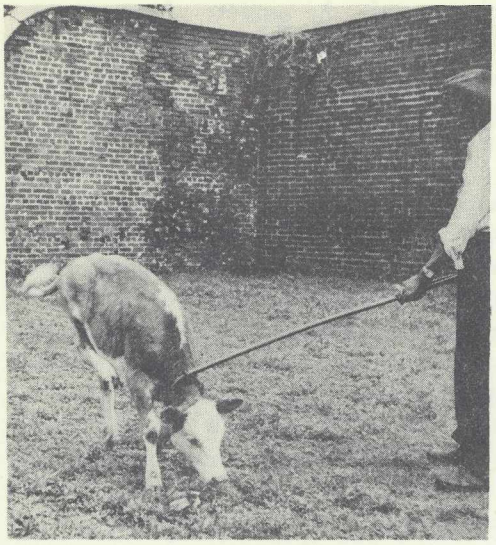
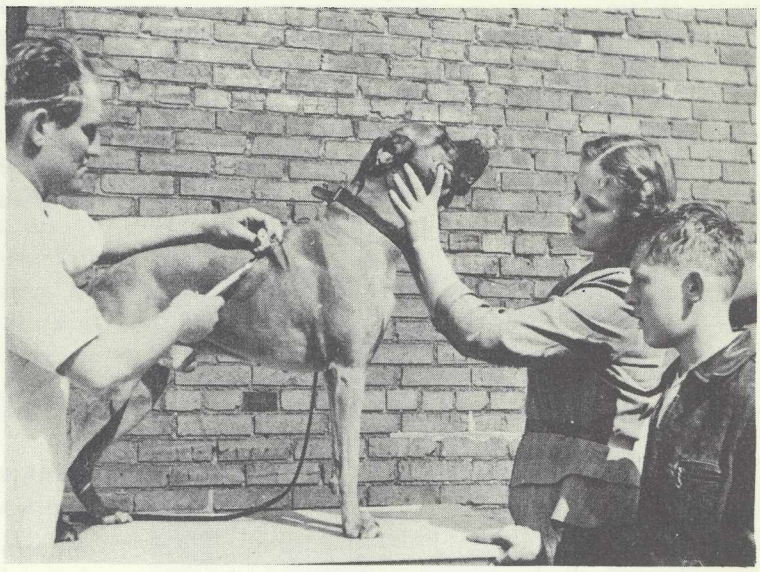


Photo by Memphis-Shelby County Health Department

Rabies in cattle and other livestock causes staggering economic losses in the Nation. Above is a rabid calf just before paralysis and death.

Canine vaccination, when properly integrated in an over-all control program, serves as an essential tool in the fight against rabies.

Photo by Memphis-Shelby County Health Department



of that vector of rabies.

INTER-AMERICAN RABIES CONTROL

Various communities have demonstrated very effective rabies control programs, yet it is often true that neighboring communities have ineffective programs or none at all. This inconsistency allows the extension or reintroduction of the disease over wide areas. Where one State employs a certain type of control procedure, the State to the north of it employs another system which conflicts with the strategy and tactics of its neighbor, while the State to the west may have no planned program at all. Antirabies measures must be integrated and coordinated, whether such measures are taken by townships or nations. The rabid animal respects no political boundary line, but is driven by pathological impulse to roam for great distances and spread his disease from one area to another.

The Mexico-United States Antirabies Program was initiated as a result of the agreement signed in Nogales (1949) by health authorities of the two Nations. Since that time, the tempo of the antirabies campaigns in the southwestern United States and in northern Mexico has been increased greatly. Facilities for modern laboratory diagnosis have been provided in areas where none were available; canine vaccination programs are being completed in selected localities; wildlife control services have been established and are operating where none previously had existed. The results of these activities cannot be measured yet, but there can be little doubt of their ultimate effectiveness.

The international aspects of rabies control also have been emphasized in other parts of the Americas. Pan American Sanitary Agreements, between Argentina, Brazil, Paraguay, and Uruguay (1948), and between Chile and Argentina (1948), both make specific provisions for concerted measures against this disease. These agreements provide a firm basis for definitive action.

The most recent international development in rabies control in the Americas was the Caribbean Rabies Conference, which was sponsored by the Pan American Sanitary Bureau in Kingston, Jamaica, in August 1950. Delegates from insular areas of the Caribbean formulated recommendations for concerted antirabies measures between their respective governments.

REFERENCE

(1) Johnson, H. N.: Derriengue. Vampire bat rabies in Mexico. Am. J. Hyg. 47, 189-204 (1948).

Rabies Diagnosis

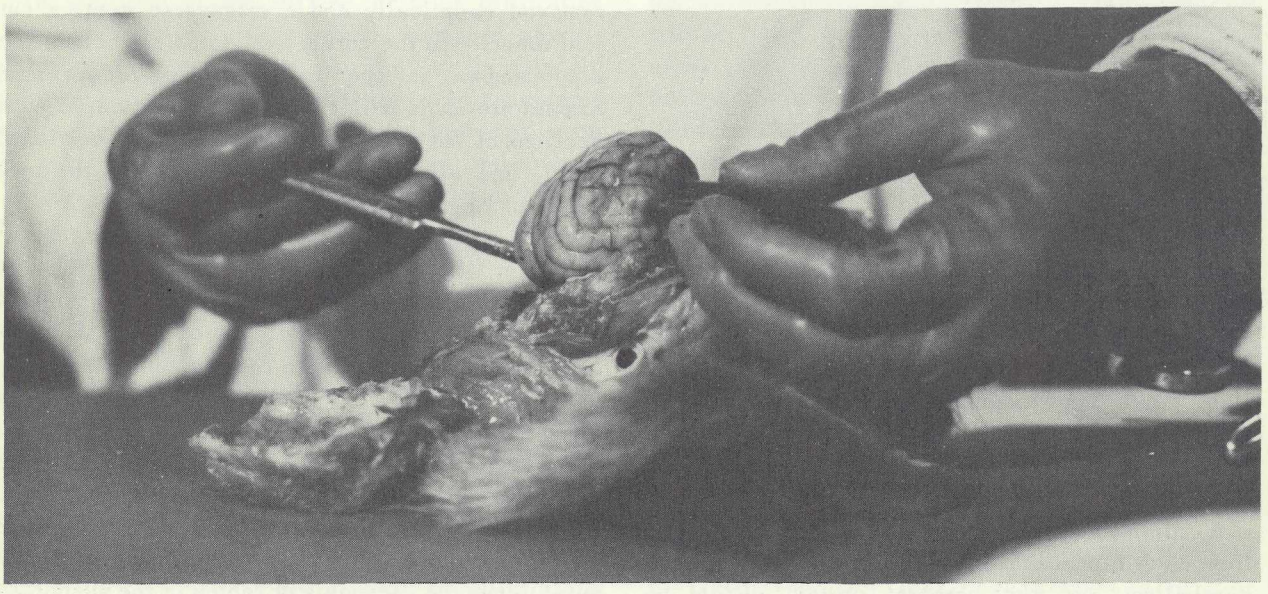
M. E. EIDSON, Bacteriologist
H. RUBIN, S. A. Veterinarian
R. E. KISSLING, Bacteriologist (Veterinarian)*

The laboratory diagnosis of rabies is primarily dependent upon the demonstration of Negri bodies, the pathognomonic inclusion of rabies, in central nervous tissue. This may be done on the original material or after passage through susceptible animals.

Heads of animals suspected of rabies should receive immediate attention upon arrival at the laboratory, so that, if indicated, treatment of exposed persons may be initiated. The brain should be removed aseptically so that animal inoculations may be performed. The skin is incised along the midline over the cranium and laid back. After removal of the temporal muscles, the skull is painted with tincture of iodine. Using sterile instruments, the calvarium is removed by sawing through the skull from each side of the *foramen magnum* to the frontal bones. These two cuts are united by a transverse cut through the frontal bones. The calvarium then is lifted off. After removal of the meninges and cutting the *tentorium cerebelli*, the brain is lifted out onto a petri dish or paper plate.

Negri bodies, if present, are most numerous in the hippocampus. This structure is exposed by a longitudinal incision into the lateral ventricles. In the case of the dog, this cut is made on the dorsal surface of the cerebral hemispheres parallel to and about one-half inch on either side of the midline of the brain. The hippocampus is recognized as a glistening white cylindrical structure.

Small transverse sections are cut from the hippocampus, and also from the cerebral and cerebellar cortices. These portions are placed, cut surface up, on a paper towel or wooden tongue depressor. A clean microslide then is pressed gently against the cut surface, using enough pressure to produce a thin impression of brain tissue on the slide. At least three impressions may be made on one slide. While still moist, the tissue is stained by pouring Sellers' stain from a drop bottle onto the slide, letting it remain for about 10 seconds, then washing under running tap water. The slide is allowed to air dry and is then ready for microscopic examination.



After removing the calvarium and cutting away the meninges, the entire brain is lifted out and placed onto a petri dish or paper plate.

*Virus and Rickettsia Section, Laboratory Services, Montgomery, Ala.

Sellers' stain has the advantage of fixing and staining in one operation. It is prepared as follows:

Stock solutions:

2 grams methylene blue dissolved in 100 milliliters absolute methyl alcohol (acetone free)

4 grams basic fuchsin dissolved in 100 milliliters absolute methyl alcohol (acetone free)

Working stain:

25 milliliters absolute methyl alcohol (acetone free)

15 milliliters stock solution methylene blue

2-4 milliliters stock solution basic fuchsin

The methyl alcohol and methylene blue solution are mixed in a drop bottle, and 2 milliliters of the basic fuchsin solution are added. A trial stain is made using methyl alcohol-fixed brain smears, which may be kept for this purpose. If, in the trial stain, the thicker portions appear bluish, basic fuchsin is added in 0.5 milliliter amounts until the properly stained smear appears reddish violet in the thinner areas, shading into purplish blue in the thicker portions.

Mixing the working solution of Sellers' stain.

Examination is carried out under oil immersion. With Sellers' stain, Negri bodies appear purplish red to purplish pink, in contrast to the light blue staining of neuron cytoplasm, dark blue nuclei, and copper-colored red blood cells. The matrix is light pink. Negri bodies contain basophilic inner granules which stain dark blue, and are the distinguishing staining characteristics of the Negri body.

A minimum of six brain smears, including one from each hippocampus, one from each side of the cerebellum and the cerebral cortex, should be examined. If Negri bodies can be demonstrated, the diagnosis of rabies is established.

If no Negri bodies are found upon microscopic examination, the possibility of rabies is not excluded, since at least 10 percent of animal brains examined microscopically in the laboratories and found Negri negative have been proved to be positive for rabies upon animal inoculation.

Small portions of hippocampus, cerebral cortex, and cerebellum saved at the time of brain dissection for staining, plus the medulla oblongata, are pooled and ground in a sterile mortar and pestle into a homogeneous paste. To this, enough sterile saline is added slowly to make a 10 percent brain suspension, which is centrifuged at 2,000 r.p.m. for 10 minutes. If evidence of bacterial contamination is found upon microscopic examination, or if the animal has been dead for quite a while, an antibiotic is added to the suspension before intracerebral inoculation into mice, to prevent death of mice in 2 or 3 days from bacterial contamination. Addition of 500 units of penicillin G (sodium salt) and 2 milligrams of streptomycin to 1 milliliter of the supernate of the centrifuged brain suspension and allowing to stand at room temperature for 30 minutes before mouse inoculation is sufficient to prevent the death of the mice from bacteria. With a ¼-milliliter syringe and a 27-gauge needle, .03 milliliter of the supernate is injected intracerebrally into at least four mice. Observations are made on these mice daily for at least 21 days, and symptoms of tremors, paralysis, humping, weakness of hindlegs, and death are recorded. As soon as the mouse is found dead, its brain is removed aseptically and a transverse section cut just anterior to the cerebellum so as to include the hippocampus in the cross section. Impression smears are made with this cut section just as with sections of the original brain, stained with Sellers' stain, and examined microscopically for the presence of Negri bodies.

Even though no Negri bodies were present in the brain of the suspected animal, if the virus of rabies were present in that animal, intracerebral injection of this brain will produce clinical symptoms of rabies in mice, with the constant occurrence of Negri bodies. The incubation period of rabies after the intracerebral inoculation of mice varies, with deaths occurring from the sixth day until the twentieth day, and in rare cases even longer. Finding of Negri bodies in the brains of mice dying after showing the above-mentioned symptoms establishes the diagnosis of rabies in the suspected animal. If mice remain normal for a period of 21 days after inoculation, the suspected brain is considered negative for rabies virus.

Histopathology of Rabies

R. E. KISSLING, Bacteriologist (Veterinarian)*

The inflammatory response of the central nervous system to rabies is very much the same as with other viral, bacterial, chemical, and physical irritants. The distribution of lesions is rather constant in rabies. The most severe changes are observed in the thalamus, pons, and medulla. These areas of the brain show neuron degeneration, necrosis, and neuronophagia. There is moderate diffuse infiltration with microglia and occasionally polymorphonuclear leucocytes.

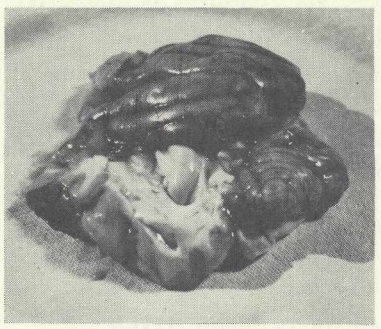
The blood vessels of the brain stem present the swollen endothelium, and lymphocytic collars so common in any pathological condition of the central nervous system. This lymphocytic exudate usually is confined to the adventitial spaces. Petechia and perivascular hemorrhage is common and often quite extensive in the thalamus, medulla oblongata, and spinal cord.

In keeping with the spread of the virus by neuronal pathways, the white matter also presents lesions. This may range from slight vacuolization of the myelin sheaths to complete demyelinization, depending upon the duration of the disease. These areas will show infiltrations by large mononuclear cells filled with fat containing vacuoles.

In addition to the diffuse cellular infiltration into the nervous tissue, there also are sharply delimited accumulations of glial cells (Babès' rabies nodule). At one time, these were considered pathognomonic for rabies; but since they may occur in other conditions, such as typhus and encephalitides, no special importance can be attributed to their presence.

The neocortex usually shows very little damage except mild neuron degeneration.

The Negri body is the pathognomonic inclusion body for rabies, and a positive diagnosis can be made upon the demonstration of its presence. The bodies may be found in almost any portion of the central nervous system and also in the peripheral ganglia. However, they are most numerous and most consistently found in the hippocampus in the large ganglial cells adjacent to the fimbria, and in the Purkinje cells of the cerebellum. The cerebral cortex also contains Negri bodies in a fair percentage of cases.



Negri bodies are generally most numerous and most consistently found in the hippocampus shown here bulging from the floor of the lateral ventricle.

The sizes of the Negri bodies show remarkable variation ranging from 2 to 30 microns in diameter. They vary in shape from round to oval. When located in the dendritic processes, they may be distorted by the limits of the cell into triangular or flattened forms. Negri bodies occur only in an intracytoplasmic position.

The Negri body possesses definite tinctorial affinities. The ground substance or matrix shows an affinity for acid dyes. Embedded within this matrix are one or more basophilic bodies, the so-called "inner granules." There are also the "mulberry" forms, which consist of a cluster of refractile acidophilic granules in which are located the characteristic inner granules. Inner granules may be lacking in very small inclusions, and therefore these have no diagnostic significance.

The dorsal root and cranial nerve ganglia show the ballooning type of neuron degeneration, neuronophagia, and perivascular lymphocytic infiltration seen in the central nervous tissue. The presence of these changes in the ganglion nodosum of the vagus nerve is always suspicious of rabies, but cannot be considered as a final diagnostic criterion due to the rare occurrence of changes in this ganglion in other diseases.

When virus is present in the submaxillary salivary glands, these structures show degeneration of the acinar cells and infiltration by mononuclear cells. Other glands with similar structure, such as the pancreas and lachrymal glands, also may present these changes.

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Rabies in Animals Other Than Dogs

RAYMOND FAGAN, Scientist (Veterinarian)*

Since a large percentage of the people in the world are urban dwellers, they have the notion that their pet animals are the sole sources of danger from rabies. That other animals are involved is attested to by the following chart which lists the source of exposure and the mortality rates of more than a million and a quarter people throughout the world who have taken antirabies treatment.

MORTALITY AMONG PERSONS GIVEN ANTIRABIC TREATMENT BY SPECIES OF BITING ANIMAL, 1927-44.

(Health Organization League of Nations)

Biting Animal	No. Persons Treated	Percent of All Treatments	Deaths from Rabies	Percent Mortality
Wolf	1,827	0.2	159	8.70
Jackal	34,846	1.8	514	1.48
Dog	1,100,249	81.2	3,270	0.30
Cat	64,911	5.0	23	0.04
Solipeds	10,240	1.0	2	0.02
Humans	11,134	1.1	1	0.01
Ruminants	23,386	2.0	1	0.004
Others	19,573	2.0	15	0.08
Species not stated	24,592	5.7	30	0.12
Total	1,290,758	100.0	4,015	0.31

In different parts of the world, different wild animals have been and still are responsible for the maintenance of rabies. The fox appears to be the principal wild animal vector of rabies in western Europe. Seven major outbreaks in this animal have been described between 1803 and 1925. In eastern Europe, the wolf appears to be important in perpetuating rabies in wildlife.

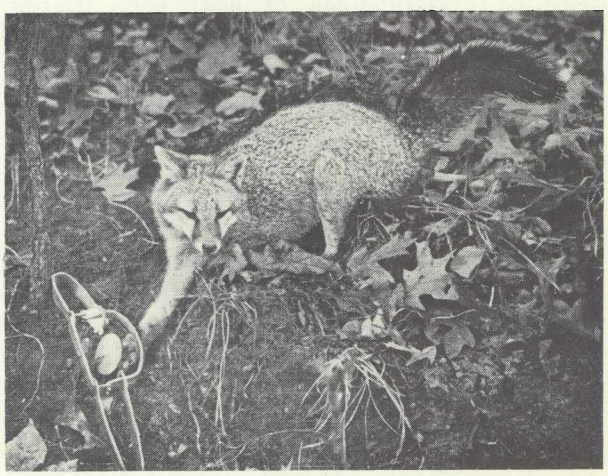
The jackal is the principal wild host and vector in India. Although this country has a great population of mongooses, and rabies in the mongoose has been described, it is not an important host of rabies in that area.

The situation in South Africa is in contrast with what has been described for India. In Transvaal, Orange Free State, and Cape Province, the yellow mongoose is the principal host and vector of rabies. Rabies also is found in other small, veld carnivora of the same family *(Viverridae)*.

In the United States, epizootics in skunks have been responsible for at least fifty cases of human rabies. A nickname for skunks in the West is "phobey" cat because of the animal's role in causing hydrophobia. In Kansas, in 1873, about forty people, primarily men who camped out on the plains, died of rabies caused by skunk bites. In Arizona, in 1907, rabid skunks were said to have caused the death of 10 people.

California, Oregon, and Nevada had a huge outbreak of rabies in wild animals in 1915 and 1916. The coyote was the principal vector in this case. To illustrate how a vigorous campaign of wildlife decimation will stop an epidemic of rabies and eventually eradicate it, Nevada's experience is worth citing. By 1931, that State had rid itself of rabies, but only after 89,000 coyotes, bobcats, and mountain lions were destroyed as well as several thousand smaller mammals.

Fox rabies has been on the increase in the United States since 1940. Especially involved have been the Southeastern States. However, New York State has a remarkable feature: dog rabies



Organized trapping programs have successfully controlled outbreaks of fox rabies in many parts of the country.

*Veterinary Public Health Services, CDC, attached to Harvard School of Public Health, Boston, Mass.

has been controlled effectively while fox rabies is still rampant.

In those areas where wildlife rabies exists, there is also a correspondingly great loss from cattle rabies. New York State is such an example.

In South and Central America, an epidemiologic analysis of deaths of cattle dying with a paralytic disease led to the discovery of the most unusual case of wildlife rabies yet discovered. Vampire bats were found to be transmitting rabies to cattle and humans. In studying this disease in bats, it was found that some of these animals could transmit the virus by biting and yet not show symptoms of rabies themselves. Because the most complete study of rabies in vampire bats was done on the West Indian island of Trinidad, the disease has been named "Trinidad rabies" and the little mammal has been called euphemistically the "Trinidad bat."

As far as control of rabies is concerned, there are two distinct cycles: (1) the natural disease as it occurs in wild animals, and (2) the urban type which is maintained in the domestic dog. For each type, the methods for control and eradication are known and there is no reason to assume a defeatist attitude toward the eradication of rabies just because it has found its way into wildlife. There are areas in which wildlife rabies has been eradicated, notably States of the Rocky Mountain region of the United States, and in England and Scandinavia, where rabies has been eradicated even though it had invaded wildlife.

The Comparative Regional Prevalence of Dog Rabies in the United States, 1949

ROBERT F. LEWIS, J. A. Sanitarian (R)*
ERNEST S. TIERKEL, Veterinarian **

This is a preliminary review of the study of rabies in recent years in the United States. Acknowledgment is made to the State health departments which have cooperated in this review by preparing special tabulations of reported animal rabies data by county, month, and type of animal for 1949. The Public Health Service Regional Offices have facilitated the project by collecting and forwarding data as it was available.

The reporting of rabies in animals varies not only with prevalence of the disease from area to area, but also with the effort applied in discovering it. The present portion of the study has been limited to the disease in dogs, since it is probable that the close association of dogs to humans leads to less variation in reporting than for wild animals.

This close association indicates, further, that in the absence of a better measure, it is possible to devise a crude index for the comparison of the prevalence of the disease from one area to another in the United States. Presentation of the distribution of rabies in terms of reported cases per State does not provide an adequate basis for the epidemiological analysis of the disease.

Such an approach falsely stresses the political boundary of a State as the limitation of the infection in that area and does not include a measure of such important related factors as human and animal population concentrations in the region under consideration.

In an attempt to avoid these shortcomings, use has been made of an index given by the number of reported dog cases divided by the human population, by county. Such a ratio, in a given area, is a rough measure of the probability of human

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exposure. In this evaluation, however, the index is used for comparison between rural areas and between urban areas with respect to the prevalence in the dog population. It will be noted that the rabies picture in the counties of the index map (figure 1) differs considerably from that of the incidence map (figure 2).

The assumption is made that the ratio of dogs to humans varies little from one area to another in the region with which the study primarily is concerned. It is characteristic of the index to magnify the rabies situation where the ratio of dogs to humans is comparatively higher and to diminish the situation where the ratio is comparatively lower. Thus there is some magnification of the rural and diminution of the urban, with quite obvious effects at the extremes of human population densities. Consequently, in making comparisons, attention should be given to relative human population densities.

In 1949 there existed several apparently separated areas of enzootic-epizootic dog rabies (figure 3). The largest of these has its center along the Ohio River in the Kentucky-Indiana-Ohio sector. It extends north to Lake Michigan, east into West Virginia and Virginia, and south including Tennessee, northern Alabama, and northern Georgia.

At the periphery of this general region lie other areas of relatively high endemicity when measured by the described index. The largest and most outlying of these is that in south and east Texas, Oklahoma, and western Arkansas.

A second peripheral area lies in South Carolina, central North Carolina, and southern Virginia. A third is in central and south Georgia, with some evidence of involvement in eastern Alabama. Another somewhat more vague area extends through south and east Louisiana, western Mississippi, and eastern Arkansas.

Other lesser areas are in evidence. One is in Iowa. Another extends through central New York, northeastern Pennsylvania, and northern New Jersey. It may be that one exists in Michigan and another in eastern Virginia.

There are local situations where one or two counties are high in index rank but are isolated by distance or natural barriers from the primary and secondary centers mentioned above.

With regard to the scale being used in applying the index, it should be understood that the breakdown as noted in figure 1 and as modified in figure 3 was devised to cover the range of possible values with arbitrarily chosen values of demarkation between levels.

Certain criteria may be put forward for the purpose of interpreting the index levels. The principal epidemiological factors of dog rabies are size of the dog population in a given area, the amount of contact between dogs, the immunity level within the population, the presence of rabies in cohabitative animal populations, and the importation of rabid animals.

To interpret an index of zero as indicating that the disease is not enzootic in the dog population of that area, one should presuppose reporting to be incomplete and judge on the basis of the length of time that the county has been free of dog rabies, the distance from the area perimeter (e.g. county line) to the nearest reported case, and the presence or absence of rabies in cohabitative animals.

The interpretation of indices other than zero depends on variations of the same factors. The presence and intensity of rabies in adjoining counties, the level of rabies in cohabitative animals, the concentration of the dog population, and the results of epidemiological investigation of previous cases of dog rabies will help in making the decision of whether an enzootic situation exists in the local dog population.

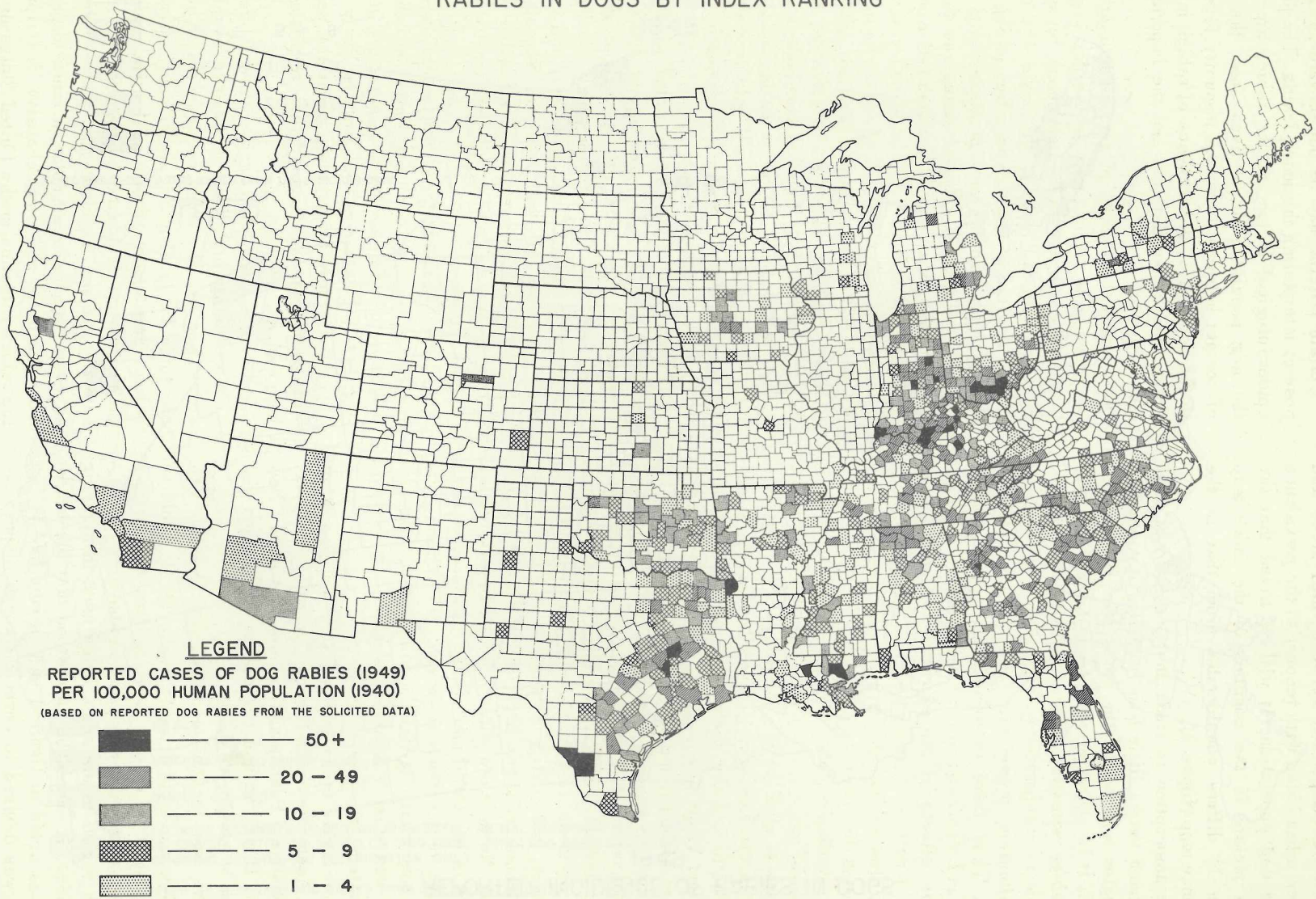
General similarities may be noted which are to be found in varying degree among these areas. First, and in agreement with the epizoology of dog rabies, it will be noted that sparsely settled areas (for example, ranch land, arid land, and depleted land) generally are not involved. Second, there seems to be evidence that the distribution of critical areas may be associated with waterways and drainage areas.

In order to explain the discrete-area phenomena evident in figure 3, much more must be done. It is desirable to know whether these areas are in reality one; if not, whether a given area is likely to disappear or merely to fluctuate about the perimeter with established permanent foci remaining over long periods.

It is not the purpose of this review to draw conclusions pertaining to the prevalence of rabies in specific areas. The study is presented as a possible guide for local and regional comparative evaluation. Subsequent reports will utilize available information on incidence of the disease in other animals, animal vaccinations, and human post-exposure vaccine treatments, in order to provide a more complete and comprehensive description of the rabies situation in the United States as it has developed in recent years.

FIGURE 1

RABIES IN DOGS BY INDEX RANKING



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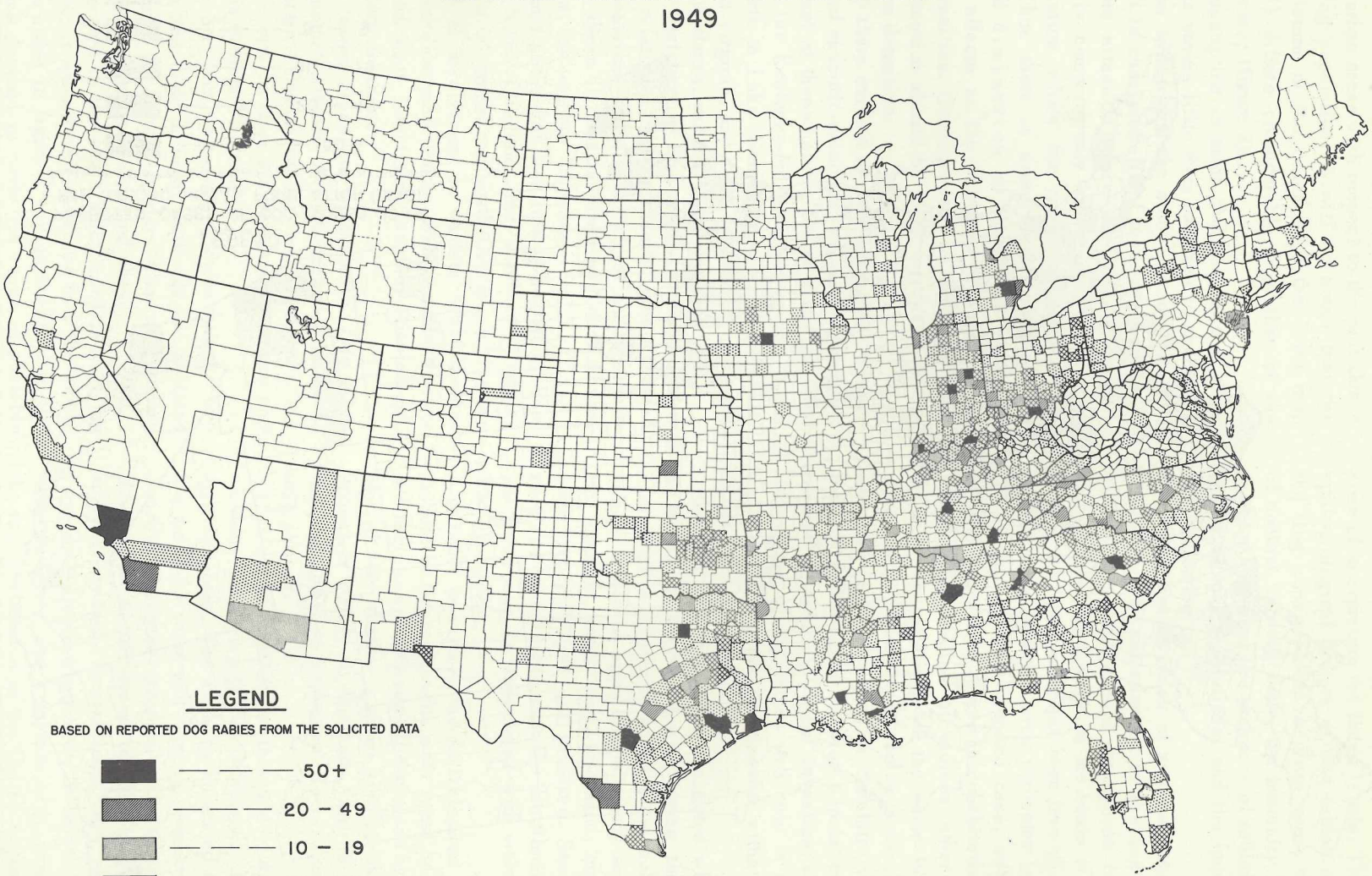
SEPTEMBER 1950

FIGURE 2

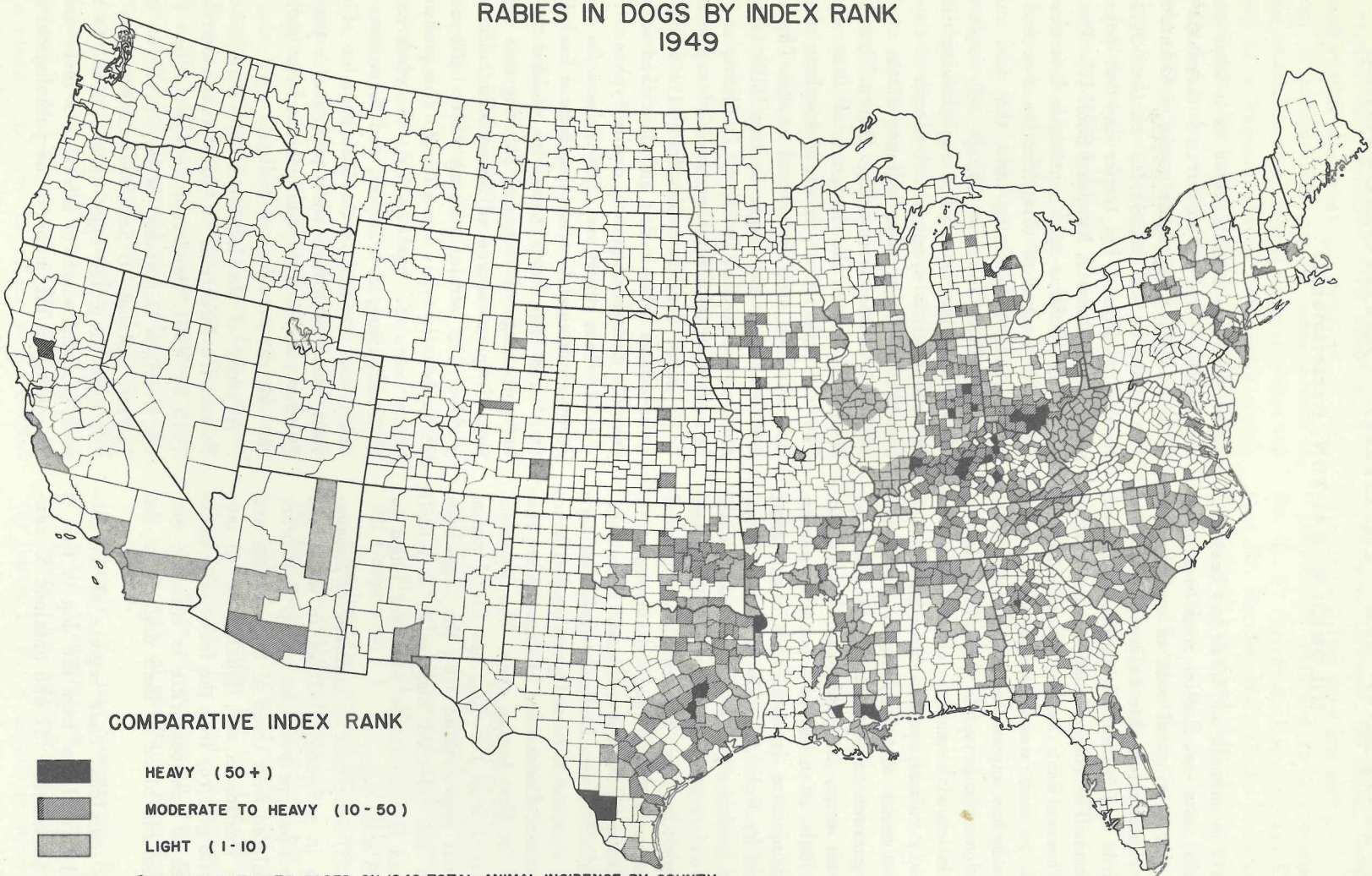
REPORTED INCIDENCE OF RABIES IN DOGS
1949



FEDERAL SECURITY AGENCY PUBLIC HEALTH SERVICE COMMUNICABLE DISEASE CENTER ATLANTA, GEORGIA SEPTEMBER 1950

FIGURE 3

RABIES IN DOGS BY INDEX RANK 1949



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A Review of Canine Salmonellosis

MILDRED M. GALTON, Bacteriologist*

Salmonellosis in animals and birds has been the subject of many studies. Earlier work was concerned with the etiological role of salmonellas in those infections which were believed to involve animals or birds and in identifying the source of human infections. The role of fowl, swine, cattle, rodents, and horses as a source of outbreaks of salmonellosis in man was established clearly. But only recently has any concerted attention been given to our domestic pets, the animals living in closest association with man.

Although many animal species have been associated with outbreaks of salmonellosis, and there have been numerous reports of the isolation of *Salmonella* from dogs, in particular, this animal has received little attention as a possible source of *Salmonella* infection in man. This observation has been made by Wolff (1) also in a discussion of the public health significance of animal *Salmonella* infections. There have been very few reports incriminating the dog as the source of human outbreaks. Probably the earliest report is that of Casperson (2) who investigated six cases of paratyphoid B fever in Rakkestad, Norway. This outbreak was traced to a dog which had been ill with a diarrheal disease for 14 days before the occurrence of the first human case. The organism was not isolated from the dog, but blood serum from the animal agglutinated with the organisms isolated from the infected humans in a 1-1280 dilution. H and O agglutinins were not found in the blood of 23 other dogs.

Magnusson (3) described an outbreak of *Salmonella* infection in a Swedish village in which the source of infection appeared to be a dog. *S. abortus canis* was isolated from three of the patients and from the dog. Kauffmann and Henningsen (4) isolated *Salmonella glostrup* from the feces of patients in an outbreak of gastroenteritis in a family and from the feces and blood of their dog, ill at the same time.

Among the individual case reports of the isolation of salmonellas from the dog is that of Castelo and Salsamendi (5) who obtained *S. newington* from the heart's blood in a fatal case of septicemia. Barto (6) reported the death of an elkhound from a hemolytic strain of *S. enteritidis*. The isolation of *Salmonella cholerae-suis* var. *kunzendorf* from a fox terrier and her pups was reported by Stafseth, Neu, and Sholl (7). The pups died of *S. cholerae-suis* septicemia 2 weeks after birth. The source of this infection was traced to swine, on a neighboring farm, that had suffered from necrotic enteritis. Craige (8) isolated *S. anatum* from the feces of a dog showing diarrhea and encephalitic symptoms. A search of the literature revealed only one instance of the isolation of *S. pullorum* from a dog. Brown, Bruner, and Moran (9) report the isolation of this organism from the lungs, liver, heart, and spleen of a dog that had been sick for several weeks. The animal had been fed raw eggs. Dolman (10) identified cultures isolated by Dr. E. G. D. Murray at McGill University from a fatal outbreak of septicemia in dogs as *S. bredeney*. Manifold (11) isolated *S. typhi-murium* from a dog and described it as the possible causative agent of canine typhus.

In a recent report on 2,788 *Salmonella* cultures derived from animals other than man or fowl, Bruner and Moran (12) noted that swine yielded the highest percentage of cultures. The dog was the next most frequent source of *Salmonella* cultures and yielded 103 strains. Among these 103 strains, 26 *Salmonella* types were found. The predominant types were *S. typhi-murium*, *S. cholerae-suis*, *S. Oranienburg*, *S. Newport*, and *S. anatum*. This study was a record of the identification of organisms received from a wide area over a period of 16 years, and it is probable that a large portion of the cultures were from sick dogs.

A study of the incidence and significance of *Salmonella* infections in dogs was undertaken in 1948 by Wolff, Henderson, and McCallum (13) at the Michigan Department of Health. These investigators isolated 16 *Salmonella* types from 18 of 100 dogs. Rejected eggs were believed to be the most probable source of infection of these animals. According to the authors, the pathological signif-

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icance of these organisms has not been determined. Their clinical data indicated some association of *Salmonella* with distemper or enteritis or both, although a considerable number were normal at the time of examination. It was suggested that the dog may be a frequent host of *Salmonella* organisms and that this animal should be considered as a potential source of the infection in man.

In the Ohio State Veterinary Clinic, Kintner (14) examined fecal cultures from 71 dogs. He isolated *Salmonella* from 13, or 18 percent, of these animals. The incidence of *Salmonella* infection was much higher in dogs suffering from distemper than in other dogs examined. In only one instance was any clinical significance attached to the presence of *Salmonella*. The author concluded that *Salmonella* organisms are capable of causing serious illness in dogs; however, he was unable to cause any illness or produce a chronic carrier by feeding organisms to healthy mature dogs. *S. typhi-murium* given intravenously to two dogs produced severe symptoms, but both animals recovered without treatment. Van Dorssen (15) was able to infect 6-week-old puppies by feeding them *S. enteritidis*. According to Bruner and Moran (12), records of isolations show that outbreaks of salmonellosis are more common and result in a higher mortality in young animals than in adults.

Reitler and Menzel (16) described a peculiar disease of dogs living in groups in Palestine. The disease resembles distemper in some respects. It is accompanied by diarrhea and may assume an acute or chronic form. It appears to be associated with tick infestation. Blood cultures from two dogs revealed a *Salmonella* identified by Kauffmann as *S. bovis morbificans*. *S. enteritidis* was isolated from one tick obtained from an ill dog.

A recent study of the incidence of *Salmonella* infection in dogs, cats, and pigeons in London was made by Cruickshank and Smith (17). These investigators examined five hundred fecal specimens from dogs obtained from the pound and from the streets of London, five hundred fecal specimens from cats, and one hundred thirty-three from pigeons. The majority of animals cultured were considered clinically normal and believed to represent an average sample of the London population of their species. Salmonellas were isolated from 5, or 1 percent, of the dogs; 7, or 1.4 percent, of cats; and 3, or 2.25 percent, of the pigeons.

In a recent study on the effect of fly control on diarrheal diseases, Watt *et al.* (18) have isolated *Salmonella* from ill children and from their normal dogs. During this study, 11 new *Salmonella* types were isolated. Of these, seven were from animals including dogs and cats.

Information obtained in a communication from Dr. T. F. Judefind, Loma Linda, Calif., states that Dr. Meridan Ball of the University of California has examined 148 fecal specimens from dogs in the Los Angeles area, Honolulu, and Bermuda, and isolated four *Salmonella*.

Currently, studies of the incidence and significance of *Salmonella* infections in dogs are in progress in California by Judefind, and in Washington State by Gorham. In Thomas County, Ga., Watt and DeCapito are continuing their investigations on salmonellosis in man and animals.

In the Florida State laboratory, the study of salmonellosis in dogs was begun in April 1949. As of January 1950, approximately 2,500 fecal specimens from dogs had been examined. The percentage of positive animals ranged from zero in some kennels to 100 percent in others. The average has been between 15 and 20 percent. Thirty-one *Salmonella* types have been isolated. Detailed results of the study will be reported at the American Veterinary Medical Association meeting in Miami in August 1950.

As a part of a broad study of the epidemiology of salmonellosis supported through a grant from the Armed Services Epidemiological Board, our study is being continued and extended with a view to defining clearly the role of dogs in the occurrence of *Salmonella* infections in man.

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Rabies Incidence*

The following incidence of rabies occurred during the second quarter of 1950 (April-June):

Rabies in humans – Arkansas 1, Indiana 1, Tennessee 1

Rabies in animals – Alabama 117, Arizona 4, Arkansas 41, California 37, Colorado 32, Florida 5, Georgia 120, Illinois 35, Indiana 184, Iowa 140, Kansas 24, Kentucky 171, Louisiana 3, Michigan 62, Minnesota 1, New York 256, Ohio 89, Oklahoma 44, Pennsylvania 23, South Carolina 77, Tennessee 66, Texas 271, Virginia 47, West Virginia 83, Wisconsin 5 (total for animals : 1,937)

*Reported incidence of communicable diseases in the U.S., second quarter, 1950. Pub. Health Rep., (65)36: 1158-1166 (1950).

PICTORIAL REVIEW

The Laboratory Diagnosis of Rabies

PRODUCTION NO.: CDC 4-111, Released 1950

DATA: Motion Picture; Sound, Black & White; Time: 6 Minutes; Length: 200 Feet

GRAPHIC FORM: General photography and photomicrography.

PURPOSE

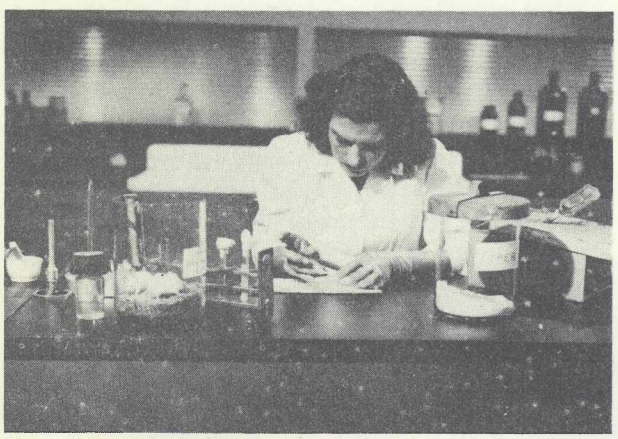
To aid in teaching the principles, procedures, and techniques necessary for the accurate laboratory diagnosis of rabies.

AUDIENCE

Laboratory technicians, State and local health department directors, public health officials, and medical and veterinary students.

CONTENT

Inasmuch as the presence of Negri bodies in the nerve cells of the suspicious animal is considered conclusive proof of rabies infection, the laboratory diagnosis of this infection consists of detecting these bodies.



The mouse inoculation test should always be carried out for Negri-negative and questionable brain specimens.

When the dog's head arrives at the laboratory, open the skull, remove the brain to a paper plate, and incinerate the rest of the head. With small, sterile scissors, cut through the cerebrum into the lateral ventricle to expose Ammon's horn because this glistening white tissue bulging from the ventricle floor is the surest location for Negri bodies. Remove to a wooden tongue depressor a thin cross section of Ammon's horn. Make several impressions on a single slide by applying the slide to the cut surface of the tissue. Immediately stain the impressions in Sellers' stain and rinse them under tap water. Dry the slide, locate well-distributed large cells in thin areas with the low power of the microscope, and then examine individual cells with the aid of the oil immersion lens.

The presence of Negri bodies indicates a positive diagnosis of rabies. These bodies characteristically contain dark staining basophilic granules. If Negri bodies are not readily apparent, search for them in sections of Ammon's horn, cerebral cortex, and cerebellum on each side of the brain. In case of doubt as to the presence of Negri bodies, inject intracerebrally into each of three mice (which have been anesthetized in a jar containing ether) 0.03 milliliter of a 10 percent brain suspension. Use a ¼-milliliter tuberculin syringe and a ¼-inch, 27-gage needle. After typical rabies symptoms have developed (rough hair, hump back, tremors, paralysis, prostration, and death), examine the brain of each mouse for Negri bodies, using the same procedures as those used with the dog's brain. Although rabies symptoms usually begin to appear from the fifth to eleventh day after inoculation, it is advisable to keep all test mice under observation for at least 21 days because in some cases the disease may take that long to develop.

COMMENTS

This information also is presented in filmstrip 5-105, "Laboratory Diagnosis of Rabies."

Striking Back Against Rabies

PRODUCTION NO.: CDC 4-087.0, Released 1950

DATA: Motion Picture; Sound, Black & White; Time: 12 Minutes; Length: 420 Feet

GRAPHIC FORM: General Photography.

PURPOSE

To emphasize the need for a Nation-wide rabies control program and to depict the various steps and procedures by which public health personnel, physicians, laboratory technicians, veterinarians, livestock disease control officials, and other citizens may cooperate on local, State, and national levels toward the initiation and execution of such a program.

AUDIENCE

Federal, State, and local public health personnel, livestock disease control officials, physicians, laboratory technicians, veterinarians, and public health, medical, and veterinary students.

CONTENT

Newspaper headlines announce a rabies epidemic in a typical county, and report that the county health department has called in the State public health veterinarian and a Federal rabies control expert to set up emergency control measures. Radio news commentator broadcasts the proper precautionary procedures for anyone bitten by a stray and possibly rabid animal, as well as how to safeguard oneself until an emergency control program is put into effect. In consultation with the county public health officer and the State veterinarian, the Federal rabies control expert suggests: (1) issuing a quarantine order restricting the movement of all dogs in the county; (2) establishing emergency dog inoculation clinics located at strategic points; and (3) organizing all of the practicing veterinarians in the county for an emergency canine vaccination program. A local physician reports that he has three more persons suffering from dog bite. The doctors in conference advise him that the State will furnish vaccine but that rabies vaccination should be delayed until the dog is caught and examined for rabies, if the delay is not too long. The scene changes to a residential area where a rabid dog, the suspected animal, staggers across a lawn and falls helpless. Dog wardens arrive and, with long poles equipped with leather loops, load the dog into their wagon and take him to the local humane shelter for observation. The dog dies and its head is sent to the health department laboratory. The brain is removed and under the microscope Negri bodies are revealed in the brain cells, especially in those of Ammon's horn. Therefore, the diagnosis for rabies is positive, and the local physician proceeds to inject with vaccine every day for 14 days all those who were bitten by the rabid dog. In the meantime, the emergency program to control the epidemic has operated efficiently and 80 percent of all dogs in the county are immunized in 1 week. As soon as the county epidemic is under control, the State public health veterinarian and the Federal rabies control expert outline procedures by which rabies may be controlled throughout the State and Nation.

COMMENTS

Another motion picture in the rabies series is 4-111, "The Laboratory Diagnosis of Rabies." Filmstrips are 5-093, "The Fight Against Rabies," and 5-105, "The Laboratory Diagnosis of Rabies."

Newspapers and radio stations are always willing to cooperate in organizing community interest for the execution of local rabies control programs.

Peace or Pestilence

THEODOR ROSEBURY
McGraw-Hill Book Co.
New York, N. Y., 1949, 218 pages.

The author has prepared 14 chapters on the dilemma implied in the title of this book. Chapter 1 outlines the development of the Camp Detrick Center for research on biological ("germ") warfare. Chapter 2 emphasizes that the book is based wholly on material already published in lay and professional publications and describes the sources. The author makes it clear that he does not betray any military "secrets." Chapter 3 is a discussion, for lay readers, of micro-organisms; host-parasite relationships; disease; vectors; and immunity: active and passive, natural and artificial. Chapter 4 shows, with such examples as brucellosis, tularemia, dengue, yellow fever, and botulinal toxin, that disease may be spread by artifice (such as sprays and dusts) much more effectively and efficiently than by nature.

Chapter 5 mentions certain diseases applicable in biological warfare and discusses advantages and limitations of some of them. For example, many pathogenic organisms are very specific in the host they can infect; some highly infectious agents are very fragile; some merely disable their victims, while others attack only a small percentage of the population; others might be effective but are averted easily by vaccination. Among the infectious agents mentioned are tularemia ("rabbit fever"), which disables but rarely kills; hoof-and-mouth disease and hog cholera which destroy cattle; Newcastle disease which destroys poultry; "blast" disease and "brown spot" of rice and "late blight" of potatoes and tomatoes; anthrax; 2, 4-D and other synthetic, inanimate plant-growth regulators. The military value of the panic, fear, and horror resulting from the production of only a few cases of such a highly fatal and dreaded disease as melioidosis is pointed out. A peculiarity of biological warfare is that, unlike explosives, it destroys life but not property (except, of course, livestock and crops).

Chapter 6 deals with the important properties of biological warfare agents. Criteria of a good biological warfare agent are: (1) high infectivity– i.e., very little required to start infection; (2) casualty effectiveness – i.e., must do real damage when it infects; (3) availability; (4) resistance– i.e., must survive under conditions of preparation, storage, shipping, and application (exposure to air, sunlight, and other elements); (5) means of transmission — these are largely covered under 4; (6) epidemicity – i.e., capability of spread after application; (7) specific immunity; (8) therapy – i.e., the possibility of preventing or curing the disease must be slight; (9) detection – i.e., the agent should not be detected readily until its purpose is effected; (10) retroactivity – i.e., it must not be too dangerous to be handled and must not remain to make the terrain uninhabitable by the user or be communicated to the user by the infected enemy.

Chapter 7 deals with the dreadful potential potency of botulinal toxin and infectious agents such as streptococci, only a few gammas of which produce disease. The possibilities, as described, are terrifying indeed as illustrated by the quart of psittacosis virus which could kill about 3 times the total population of the earth!

Chapter 8 points out that, unlike atomic bombs, hydrogen bombs, or even those obsolete children's toys– the 2-ton "block busters"– agents for biological warfare could be produced easily and cheaply with very simple equipment and materials, and under safe conditions involving air incinerators and filters, sewage sterilizers, and similar

devices.

Chapter 9 discusses the offensive use of biological agents. Their major value is for large-scale use in distant places. However, they have a definite value if cleverly used in acts of sabotage such as atomizing an infectious fluid in the intake of an air-circulating system of a large building; "nearly all the resources of BW (biological warfare) would find a place intended to destroy animal or plant life or make it unfit for human use or to kill or incapacitate human beings or to demoralize them." While the effectiveness of various possible modes of use remains to be seen, "We need not entertain serious doubts . . . . . that the bottleneck problem of BW — the large-scale dissemination of airborne agents — is not beyond the ken of human genius."

Chapter 10 deals with means of defense against bacterial warfare. The author takes a dim view of defensive measures, among which he lists: (1) identification of the agent; (2) quarantine and isolation of the infected; (3) masks and protective clothing; (4) use of immunizing and therapeutic agents; (5) use of ultraviolet irradiation, bactericidal vapors, air filters, oil as a dust-control measure, and other methods. The impracticality of using these without knowing when an attack impends, what the agent will be, or how it may be transmitted (air, water, food, insects), becomes evident after a little thought.

Chapters 11, 12, 13, and 14 deal with questions of international control of bacterial warfare ("neither side ever met the other halfway"), the establishment of a permanent peace, the ethics of bacterial warfare as compared with other armaments, and a review of some of the useful and valuable discoveries which have accrued and may stem yet from the research underlying the development of bacterial warfare. Questions which remain unanswered are: (a) Except for special applications of sabotage, what will be the methods of large-scale application in the field? and (b) Will they prove effective?

In summary, the ideas conveyed are: (1) judged by laboratory experiments, infectious agents as military weapons are entirely feasible; (2) defense against them is difficult; (3) regardless of attempts at international control and ethical considerations they will be used in the next war; and (4) peace is the only possible alternative to pestilence. To quote the author: "I believe that both the Russian people and their leaders want a durable peace, if only because they, too, must realize what a World War III would cost them. I think it likely that, if they were given half a chance, they would help find and willingly accept reasonable means toward peace." "Given only a sound belief in our own true strength, we could afford to be generous in our approach to other nations, including Russia. If we could approach the international conference table with the respect for others that would grow out of true faith in ourselves we might find a solution to the problem of peace that all of us could accept."

The author, who must be accorded the status of an expert in the field, has been associated closely with the whole problem since its inception, and was deeply involved in the research at Camp Detrick. He evidently has thought much of the larger aspects, as well as minutely on the technical problems and the humanitarian and ethical considerations involved, and has arrived at the dilemma which is the title of his book. Is there a third course?

The book concludes with a list of source references and an index. The foreword is a quotation from a statement by Trygve Lie, July 5, 1948.

Martin Frobisher, Jr., Bacteriologist

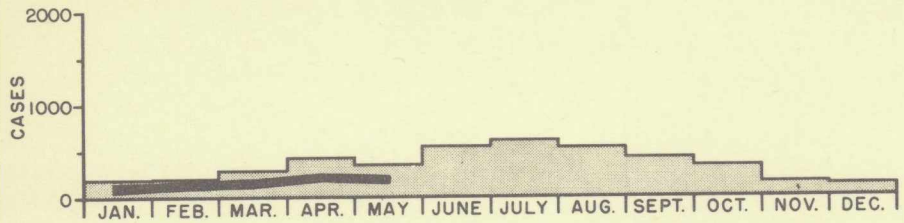
U. S. GOVERNMENT PRINTING OFFICE : O—1950

MORBIDITY TOTALS FOR THE UNITED STATES *
MALARIA, POLIOMYELITIS, TYPHUS

1949 - COMPLETE 1950 - AS REPORTED

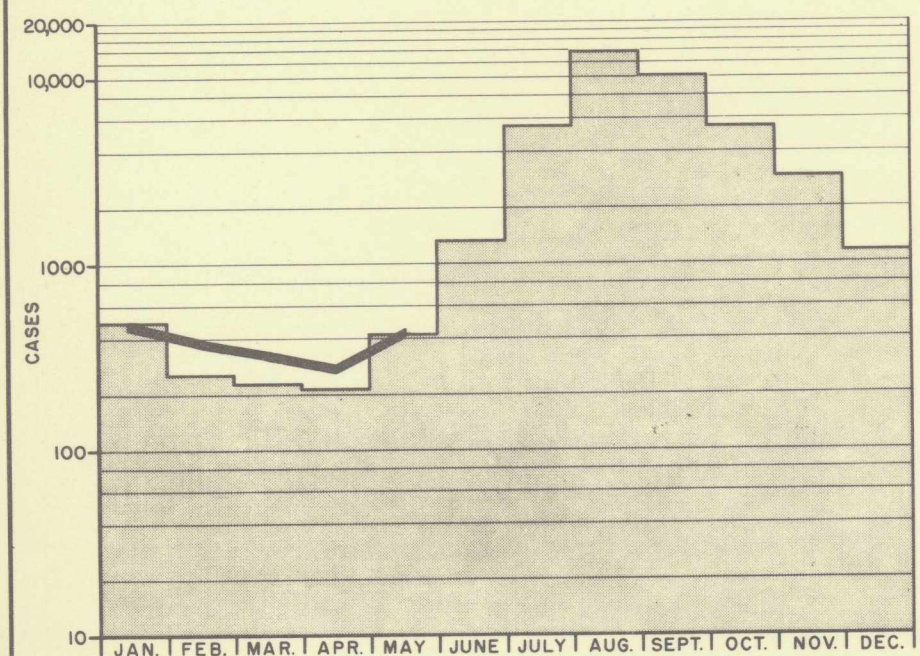
TOTAL INCIDENCE THROUGH MAY 1950 806

MALARIA
(TENTATIVE DATA)



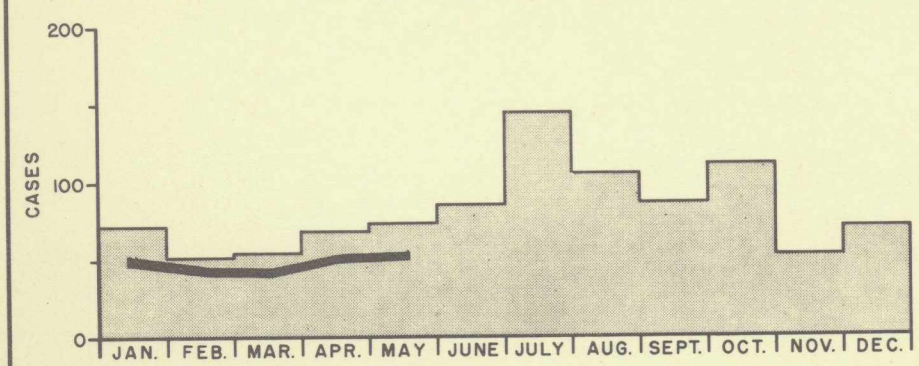
TOTAL INCIDENCE THROUGH MAY 1950 1,908

POLIOMYELITIS



TOTAL INCIDENCE THROUGH MAY 1950 237

TYPHUS



FSA-PHS-CDC ATLANTA, GA.

* SOURCE OF DATA: NATIONAL OFFICE OF VITAL STATISTICS