DISCUSSION

KENNETH S. DAVIS, M.D. (St. Vincent's Hospital, Los Angeles).—Careful consideration of Mr. Pugh's paper brings out the fact that everyone doing x-ray therapy, whether a radiologist or otherwise, should utilize the services of an x-ray physicist to properly calibrate the machine that is being used for therapy. The physicist should be expected to accurately measure the output of the x-ray machine in r units, so that the dosage reported will be in such terms as can be understood by anyone doing x-ray therapy. The physician doing such therapy should bear in mind that the *allowable* dosage of x-rays depends on a number of factors:

1. The kilovoltage used.
2. The kind and the amount of the filter.
3. The size of the treated area.
4. The distance from the target of the tube to the skin of the patient.

He should also realize that there is a variability in the output of an x-ray machine from day to day, and that changes of any part of the apparatus, especially the x-ray tube, will influence the output of x-rays by a matter of as much as 5 to 10 per cent, all other factors remaining the same. For these reasons the periodic calibration of the x-ray therapy machine is essential.

At this point the duties of the physicist cease and those of the physician begin, for the physician must translate this physical knowledge into terms of biologic reaction; *i. e.*, the response of the tumor cells, and the *normal tissue cells surrounding them,* to a given dosage of x-rays correctly measured in terms of r units. Each case presents itself as an individual problem to the x-ray therapist, both as to the methods of therapy employed and the biologic response. The location of the tumor, the type of tumor cell, and many other facts will influence the treatment technique used.

Mr. Pugh states that dosages should be measured and reported in air without taking into consideration the back-scatter. I disagree with him on this point, as I find so much variability in the intensity of the radiation in the differently sized portals that it would seem wise to make this a matter of record. The back-scatter in our laboratory is determined by the use of the victoreen ionization chamber half-buried in a paraffin block, each size of the portals used in our work being calibrated once a month.

However, the r per minute in air is also recorded on our treatment chart for purposes of comparison with the records in other x-ray therapy laboratories.

JOHN D. LAWSON, M.D. (1306 California State Life Building, Sacramento).—Certainly, the association of the physical and biological facts pertaining to radiotherapy is essential.

Until the relatively recent perfection of physical mensuration of radiation energies, and the adaption of an international unit of measurement, dosage was discussed in indefinite terms of "erythema doses." The variation of an erythema dose between two radiologists might be 50 to 75 per cent. Hence, each radiotherapist was a law unto himself, and comparative studies could not be made.

The point made by the writer, that "there should be no confusion between the biological result and physical measurement," should be stressed. Certainly, the same dosage (in roentgens) of heavily filtered radiation will manifest itself differently from an unfiltered application.

So, too, the various factors of kilovoltage, rate of administration, location of portal, size of portal, and many other factors require the knowledge of biological application on the part of the radiotherapist.

The assistance of the physicist has been great to the radiologist, but his purely physical measurement cannot in any way displace the detailed biological knowledge of the physician who has learned from observation and study the application of these measurements in the treatment of pathological conditions.

GEORGE STEVENSON SHARP, M. D. (605 Professional Building, Pasadena).—This excellent paper by Mr. Pugh should be studied by every physician who employs radiation in any of its various forms. The basic factors of x-ray and radium therapy have been clearly defined, and a detailed check of the factors, recorded habitually, will promote more scientific treatment.

Knowledge, experience and judgment of radium and x-ray therapy are assumed qualities of a therapist in this specialty. Knowledge of dosages is essential, but the radiologist must know his equipment as any artist must know his instrument. Complete information must be available on the output of his machine. He may obtain this instantly by one of the various dosimeters, or by consulting a physicist at least every two months in order that mechanical or equipment variables may be known.

Knowledge of the r-unit output of a machine is essential for the present-day procedures in radiation. By the multiple divided dosage technique and multiple portals, one may now deliver to a deep-seated growth more radiation than the skin over it will tolerate. There is a fair margin of safety, but not sufficient to permit these heavy dosages without accurate data on the r-unit output and the type of radiation.

The principle of tumor dosage, and lethal or cancercidal dosages, have concentrated thought on the radiation one delivers to the tumor rather than to the skin. Radiation dosages are known for certain types of neoplasms, according to size, depth and degree of invasion, and a therapist is expected to deliver that required amount without permanent damage to the surrounding tissues or the patient. The dosage may be delivered in part by x-radiation and the remainder by intracavitary or interstitial radium, but the summation of radiation by all procedures should be equivalent to the calculated or required amount for that particular growth.

Dosages for such growth destruction cannot always be given, and for such patients the treatment should be considered palliative and primarily symptomatic. Much relief of pain and obstructive symptoms in various parts of the body may be obtained by less severe and palliative measures without untoward radiation effects in the incurable cancer patient.

I agree with Mr. Pugh that the mechanics of roentgen radiation is essentially a branch of the science of physics, but the application to medical therapy is a specialty of medicine and the physician must have this data constantly available to obtain the maximum beneficial effect of irradiation procedures.

HUMAN RABIES IN CALIFORNIA*

WITH DISCUSSION OF DIFFERENTIAL MICROSCOPICAL ANATOMICAL DIAGNOSIS

By J. C. GEIGER, M.D.
AND
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San Francisco

DISCUSSION *by J. L. Pomeroy, M. D., Los Angeles; W. M. Dickie, M. D., San Francisco; Hyman I. Vener, M. D., Los Angeles.*

RABIES is a serious and expensive preventable disease, since the financial losses in cattle and sheep represent a not inconsiderable figure. When rabies appears in a new territory, a few scattered cases are usually followed by a sudden sharp increase in incidence of the disorder. Reaching the maximum rather quickly, the epidemic presents almost an equally sudden decreased incidence. The actual spread through the territory may be slow and steady, and is probably dependent on the number of infected dogs traveling out of the affected areas. In fact, the spread could be anticipated and prevented in contiguous neighborhoods, but the well-known and effective measures of control are gener-

* Symposium on Rabies, Pasteur Society of Central California, March 3, 1938.

ally used in an ineffective and half-hearted manner. Generally, a further handicap presents itself in those unthinking persons who desire to protect the dog and other animals against an alleged transgressor of their animal personal rights. Moreover, opinions are still openly expressed that the disease, rabies, does not exist except in the imagination of some public health officer.

ADVENT OF RABIES IN CALIFORNIA IN 1898

The disease is unique in its specific characteristics: the long incubation period, the short infectivity period with fatal termination, the usual mode of transmission—by bites—and a peculiar tendency to spend itself and become endemic. The type of spread of the disease may be noted as it occurred in California. This state remained uninvaded until 1898. Several years ago, Geiger[1-3] described the outbreak then occurring in California, reporting, in all, 1,897 positive examinations and thirty-six human cases. Evidently, the spread of rabies was continuous and rapid throughout the state. Obviously, the control of rabies in California is by no means a minor public health problem. All the human deaths might have been prevented if proper control measures were established for the animal reservoir, the dog. The presence in any community of this comparatively easily eradicated disease indicates that the community is not doing all that should be done to control the menace of rabies.

REPORT OF CASE

A typical case of human rabies is given below.

D. M., a child, age six, died of rabies on August 16. On July 17, this patient was bitten by a dog proved rabid by microscopical examination. She was badly bitten on both hands, the right hand showing a tear an inch long underneath the thumb, two punctures in the palm of the hand, and two deep punctures on other fingers. There were three punctures on the back of the hand. On the back of the left hand there was a deep cut one-half inch long, an inch tear was on the back of the middle finger, and a similar sized tear on the palm of the hand. There were a number of punctures on the back of the hand, and there was a deep tear on the inside of the ring finger. All the wounds were cauterized with carbolic acid, but over two hours after the biting. Administration of the Pasteur treatment was begun on July 19.

On August 13, four days after the completion of the treatment, the mother telephoned that the child was not well. The mother said the child had come home from school the day before, complaining of pain in the left arm from the fingers to the elbow. The arm was not tender to touch. The scar on one of the fingers was red. The temperature was 99.7, pulse 124; knee-jerks could not be obtained. There was loss of appetite. She could drink water without difficulty, but wanted only a little at a time. She was restless the night before, and cried twice.

When seen on August 14 the temperature was 103, pulse 120. The child readily recognized attendants and seemed normal. The pupils reacted but were dilated, especially the left. When offered water she seemed averse to drinking it. On persistent urging she was able to drink some with a great deal of difficulty, complaining of pain when she tried to swallow.

On August 15 the patient was highly nervous in the morning, afternoon, and night. She was very talkative, looking into space, seeming to see something with a look of terror. She would throw her arms around her mother and cry very sharply, then sob, then quiet down for a few moments. She would call for water, and when offered it she would refuse to take it. There was no real convulsion. The fact that one merely spoke to her would cause a spasm of the face, head and arms, with a jerking of the head. These paroxysms would pass very shortly, and then she would appear rational.

On August 16 the child was in a coma and died about 11:30 p. m. No autopsy was held. From the symptoms of this case there is no doubt that the cause of death was rabies, and it again points out that complete immunity, even with the intensive Pasteur treatment, is not established fast enough in some cases.

HUMAN CASES OF RABIES IN CALIFORNIA

In accordance with the records of California State Department of Public Health since 1899 to 1937, there have been eighty-six cases of human rabies in California, the greatest number occurring in 1923, amounting to eleven cases. Of these cases, thirty had some form of the Pasteur treatment.

Sixty-four had been bitten by dogs; six had had contact with rabid dogs, but were not bitten; one was bitten by a rabid cat; two gave no history of having been bitten or having known contact; twelve gave no information as to the source of the infection; one was bitten by an animal, species not given.

INITIAL CAUTERIZATION WITH FUMING NITRIC ACID

Of the total eighty-six cases, only fourteen had the wound cauterized with fuming nitric acid, and of these fourteen only nine received the Pasteur treatment, the remaining five giving no history of treatment.

PASTEUR TREATMENT

Of the thirty cases receiving the Pasteur treatment, nine had the wound cauterized with nitric acid; seven had no cauterization of any kind; six had no history of cauterization being used; four had wounds treated with iodin; two had wound treated with carbolic acid; one had wound treated with argyrol, and one had wound treated with silver nitrate.

Seventy-six per cent of the cases had an incubation period of sixty days or less, and in no case was the incubation period less than ten days, and in only three cases did it extend longer than six months.

INCIDENCE OF RABIES IN SOUTHERN CALIFORNIA

Of the eighty-six cases of human rabies, fifty-four, or 64 per cent, occurred in Southern California. As far as San Francisco is concerned, the last human case of rabies occurred in 1913, and the last positive dog was found in 1929.

Since in human cases of rabies there may be need of microscopical confirmation other than the demonstration of Negri bodies, there are submitted certain differential anatomical possibilities that may confuse the investigator. This is particularly important if other diseases, such as acute anterior poliomyelitis or encephalitis, may be prevailing in the community.

PATHOLOGY

Turning now to the pathology of rabies, that scourge that has come down through the centuries, written about by Aristotle, Xenophon, Ovid, and Virgil, elaborately treated, so far as attempts to forestall the infection are concerned, by Celsus and Galen, what we might consider as of funda-

mental importance in the pathology of the condition is the discovery by Negri of certain cell inclusions which have since borne his name. Of the various guesses as to what they might represent are the observations of Goodpasture, who considers them local degenerations of neurofibrils, particularly the eosinophilic portion of the inclusion, and that the central, more basophilic portion represents mitochondria. It has long since been demonstrated that the infection belongs in the filterable virus group; that the virus travels by way of the nerve and the affected part is the central nervous system, and there is localized, more particularly so far as the distribution of the Negri bodies is concerned, in the hippocampus, the cerebellum, the medulla, and the upper cord. Occasionally, Negri bodies may be found in the larger cells of the cortex. In regard to the Negri bodies, it has been discovered that they are quite irregular in size as they lie in the cytoplasm of the nerve cells in the street virus, whereas in the passage through animals forming the fixed virus they become smaller and more uniform in size. Associated with this acute infection one would expect and find inflammatory reactions. These consist of accumulations of lymphocytes in the Virchow-Robin spaces, especially through those portions of the brain showing the Negri bodies, forming the collars of cells so prominent not only in affections of the central nervous system due to filterable viruses, but also in many inflammatory conditions caused by well-known organisms. The affected cells sooner or later disintegrate, showing disturbances of the Nissl bodies, some evidence of neuronophagia, but little evidence of alteration in other types of glia. The pia arachnoid, likewise, shows lymphocytic infiltration, it being a question, as in many such conditions, how much of the exudate is due primarily to the effect of the virus on the pia directly and how much it represents an escape in the lymph stream from perivascular collars into the pia, but both methods seem to be functioning.

COMPARISON WITH OTHER DISEASES OF CENTRAL NERVOUS SYSTEM

For purposes of comparison, there might be reviewed other inflammatory conditions of the central nervous system due to specific filterable viruses, as well as making some reference to other forms of encephalitis.

Poliomyelitis.—In connection with poliomyelitis, when the virus reaches the central nervous system, in the great majority of cases the affection is primarily of the lumbar cord, although other portions of the cord may be affected, either primarily or as an extension. The alterations which occur are largely confined to the cells of the gray matter, particularly but not exclusively the anterior horn cells. In the early stages a few polynuclear leukocytes may occur, coincident with intense, rapid degeneration of the cells. This may be accompanied by a certain amount of hemorrhagic exudate; the condition is not due to thrombosis. About such areas of primary disintegration we again meet extensive perivascular infiltration with lymphocytes and a variable number of plasma cells. As degeneration occurs, there is a reaction on the part of the adjacent fibers as well as protoplasmic glia, and the end-result consists of a hole in the tissue, the wall of which is outlined by a layer of frayed-out gliosis. During the process of scarring a few compound granule cells derived from microglia are distinguishable. Associated with the inflammatory reaction there is extensive infiltration of the pia arachnoid, with lymphocytes and plasma cells; while at its greatest intensity near the site of greatest parenchymatous defect, it extends widely even over the cortex. Occasionally, of course, poliomyelitis more particularly affects the upper extremities or even the medullary nuclei with the same destructive activity. As a secondary result, following the destruction of the nerve cells, Wallerian degeneration occurs following the destruction of the axis cylinder; this, of course, leads to the paralyses, neuromuscular type, and to the secondary muscular atrophy and ultimate varying degrees of fibrosis.

Encephalitis.—Again, considering the various forms of encephalitis, in the epidemic type no specific cause has been demonstrated. Whatever be the clinical form, whether it be the lethargic or the more or less manic form, the histopathology and its distribution are essentially the same. Here the affection attacks the brain stem, spreading in either direction from the mid-brain. In the gross anatomy of the condition we have hyperemia, occasional petechial hemorrhages in the cord, brain stem or, in rare instances, widely spread through the substances of the hemispheres. Occasionally, in fact, massive hemorrhage occurs, simulating an apoplexy; but such hemorrhages occur in portions where apoplexy rarely occurs. The brain cells at the site of the more intense affection disintegrate, neuronophagia is observed, but the degree of cellular destruction is much less marked than in poliomyelitis. The inflammatory perivascular infiltration is essentially the same, except for the presence of a fair number of large undifferentiated mononuclear cells with clear cytoplasm, the origin of which is still in dispute. In contrast to poliomyelitis, a certain proportion of the cases of encephalitis go into a chronic stage, characterized by the individuals' going to sleep readily; or they develop a Parkinsonian tremor. This condition anatomically, although it is not explained, shows striking degenerative lesions in the black substance of Sommering, at times extending into the neostriatum and the globus pallidus. Even in these chronic stages of the disease several years after the acute episodes, various degrees of perivascular infiltration are still persistent. Some have interpreted this as being due to persistence of the infection, but it is also true that lymphocytes and plasma cells may persist for long periods at times after clinical recovery from poliomyelitis, and one doubts that the persistence of the cellular exudates bears any association to the virus concerned.

Syphilis.—To make further comparison, reference is made to the protean manifestations of syphilitic infection of the central nervous system. This may give rise to basilar meningitis with more or less perivascular lymphocytic and plasma cell

infiltration about adjacent penetrating vessels. In syphilis the relative number of plasma cells is usually more marked. In the neighborhood of gummata similar alterations are seen, and in the diffuse meningo-encephalitis or general paralysis, again in the presence of the Treponema pallidum, there is a remarkably extensive similar perivascular infiltration, combined with destruction of nerve cells, overgrowth of the fibrous glia, especially in the frontal cortex, the marked overgrowth of microglia from which, among other things, the rod cells are formed, and the occurrence of pigments phagocytized by forms of microglial cells which give the iron reaction. At least, that was the picture of general paralysis before the introduction of malaria and heat treatments. The picture has changed of late years; following such treatments the number of lymphocytes and plasma cells in the perivascular spaces has markedly diminished. There is evidence, however, of cell destruction and gliosis which apparently is stayed at the time of the treatment; so that while there is a damaged brain left, the functional activities are such that the individual may be returned, more or less impaired, to the community. The important point which should be made in the differential diagnosis of these conditions is that there is nothing specific in the character of the inflammatory reaction, and it is necessary to take for examination a number of sections from different portions of the central nervous system and to critically enumerate the findings in representative areas before reaching a diagnosis.

Botulism.—Two affections giving profound disturbances in the functional activity of the central nervous system are those due to the toxin produced by the Clostridium botulinum and that of tetanus. The spores of the first, contained in contaminated food products inadequately sterilized and grown in a somewhat neutral medium, produce an intensely potent toxin which, when consumed, is readily absorbed in the gastro-intestinal tract, leads to more or less gastro-intestinal disturbance, followed by lethargy, profound exhaustion, and, finally, death. The central nervous system shows a condition in which it was formerly considered that certain hyaline thrombi occurring in the vessels were responsible. This appearance of thrombi is by no means specific, but may occur in a number of weak cachectic conditions where death comes on very gradually. There is no inflammatory reaction present and the toxin is considered as affecting more particularly the neuromuscular apparatus of the body.

Tetanus.—The bacillus of tetanus, likewise, as is well known, produces toxin, particularly when introduced in puncture wounds. This toxin is gradually absorbed, probably not passed by way of the nerve fibers, as was formerly supposed; but upon reaching the central nervous system it produces symptoms of marked excitement and other well-known phenomena. Here again the toxin is without effect in producing inflammatory reaction and, although various alterations have been described in the nerve cells, practically nothing that can be considered specific has been discovered.

IN CONCLUSION

Rabies has caused eighty-six deaths in humans in California over a period of years. Only thirty of these received the preventive Pasteur treatment. Likewise, only fourteen had the wounds due to biting of an animal cauterized with fuming nitric acid, a protective procedure regarded as mandatory. Discussion is offered as to the differential microscopic anatomical diagnosis of rabies and other diseases. Finally, health officials must assume the responsibility for the control of rabies in a community, using every measure available, and ignoring the unseemly and sometimes fanatical clamor certain to arise when such control measures are applied to the dog, and perhaps other animals.

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DISCUSSION

J. L. Pomeroy, M. D. (Los Angeles County Health Officer, Los Angeles).—The paper by Doctors Geiger and Rusk concerning rabies is most timely. Few persons indeed realize, as the authors state, that the control of rabies is not a minor public-health problem. On the contrary, it is really one of the most difficult problems in public health—not because of any inherent defect in the machinery of control, but largely because of the psychology of our people. In Southern California particularly, the dog lovers are literally blind to the facts concerning rabies. In fact, many of them can almost be termed "dog worshippers." Since, in more than any other disease, coöperation of the public is the essential keynote of success, the efforts of the health officer are constantly nullified by both open opposition as well as mere indifference. In spite of human sacrifice, and in spite of tremendous suffering among the dogs themselves, I regret to state that a considerable percentage of our population fight more vociferously and effectively for the dog and its assumed rights than they do for many of their own political rights. All of which creates a situation in which the health officer "takes it on the chin" persistently and constantly.

The present outbreak of rabies in Los Angeles County has cost the County Health Department, during the calendar year 1937, nearly $60,000 and two human deaths. Here 789 persons received the Pasteur treatment; 2,204 had their wounds cauterized with fuming nitric acid; and 9,990 dogs' heads were submitted to the laboratory for examination. During the calendar year of 1937 there were 773 positive cases of rabies among dogs, which was the highest of any year in the history of the Department.

Following the action of the State Department of Public Health in invoking the Rabies Prevention Act, we have recently been served with a restraining order, the effect of which is to paralyze the enforcement of the law. This restraining order was based on an act which is not in force in Los Angeles County and has, in my opinion, no relation whatever to the Rabies Prevention Act. At the present writing it has not yet been decided, but it is quite evident that we are fighting not only the disease "rabies," but an emotional condition in the minds of some of our citizens which has demoralized law enforcement. The same forces are behind the new proposed Humane Pound Law which, of course, is aimed at the scientific use of animals in medical research. It is necessary that the population really want public health and preventive medicine before any health officer can give to that public the benefits of scientific knowledge. It would appear most emphatically that a considerable percentage of the people want freedom of dogs and rabies rather than the freedom from rabies and restriction of dogs. Meanwhile what becomes of the desires of the people who are entitled to protection of their children and

themselves from this serious infectious disease? Only time will answer this question.

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W. M. DICKIE, M. D. (Director of State Department of Public Health, San Francisco).—As Doctors Geiger and Rusk have stated in this paper, "rabies is a serious and expensive preventable disease." Since 1910, 15,226 cases of rabies in animals have been recorded with the State Department of Public Health, and approximately 95 per cent of these cases have been in dogs. The infection has been recorded also in cats, cows, coyotes, foxes, goats, hogs, horses, monkeys, mules, rabbits, raccoons, rats, sheep, skunks, and squirrels. During this same period rabies infection has been reported from fifty-three of the fifty-eight counties, and it is interesting to note that the following counties have reported cases for twenty or more years out of the twenty-eight years represented by our records:

Madera, Sacramento, Stanislaus	20 years
Alameda, Kern, Kings, San Joaquin	21 years
Riverside	22 years
Tulare	23 years
Los Angeles	24 years
San Bernardino	25 years
Fresno	26 years

We believe, therefore, that while the dog is the chief disseminator of the disease and the source of the majority of the cases in humans, the actual reservoir of infection is in the wild animals, such as coyotes and skunks in the foothill counties.

With reference to rabies in humans, Doctors Geiger and Rusk have presented the data recorded by our department prior to 1938. So far this year three human cases have occurred. Two of the patients were bitten by stray dogs, and the third was infected while treating a sick cow. This third patient put his hand down the cow's throat, attempting to grab the tongue, and the back of his hand was scratched by her teeth. The abrasions were not cauterized, but antirabic treatment was instituted within forty-eight hours. However, symptoms developed twelve days after exposure. This case was of the paralytic type, and the attending physicians were unable to differentiate between rabies and poliomyelitis until the report of rabies was received from the pathologist.

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HYMAN I. VENER, M. D. (Los Angeles City Health Department, Los Angeles).—Rabies at the present time is the most serious problem confronting the Departments of Public Health in Los Angeles County. By its insidious spread, the disease has reached such alarming proportions that it was necessary for the California State Board of Health to declare a quarantine. Unfortunately, at the present writing (May 6, 1938), a temporary restraining order is in effect, thereby further complicating the picture.* Such an order permits licensed dogs to wander about the streets unrestrained. Since rabies is no respecter of a dog license, the situation in Los Angeles City and County has indeed become alarming. Doctor Geiger is to be congratulated on the lack of the disease in animals and man in San Francisco. I should like to inquire what measures were instituted?

I have witnessed four cases of human rabies during the past six months. To those who doubt such a clinical entity, I only wish they could see the pitiful sufferings of the victims and the helplessness of medical science. Nature, by its merciful messenger, Death, finally terminates the patient's agony. Once such a picture is witnessed the most cynical critic will pause to reflect the shortcomings of our efforts to deal with the problem of rabies.

Cases of human rabies unquestionably do occur without a definite history of a bite. This can often be explained by the victim having an abrasion which at the time may appear to be insignificant. Nevertheless, the victim has been in intimate contact with the rabid animal, and the virus in the saliva has been inoculated through the broken integument. It must be reiterated that cases of human rabies do occasionally occur, despite first-aid treatment with fuming nitric acid and the subsequent Pasteur treatment. We must be certain that the vaccine used is of sufficient potency to stimulate antibody formation, but an occasional individual will be found who is resistant to this type of stimulus.

Perhaps, following the experimental work of Webster of the Rockefeller Institute for Medical Research with mice, a new and improved vaccine may be prepared which may have many advantages over preparations now available. Possibly, too, in the future, rabies vaccine will be rated according to standards set up by the mouse inoculation tests.

The Pasteur Institute of Paris in 1918 reported the treatment of 1,803 cases, of which three died with rabies, a fatality rate of 0.16 per cent. From 1886-1918, a period of thirty-three years, the Institute treated 39,880 persons, with a total of 140 deaths, a fatality rate of 0.37 per cent.

In contrast, the generally accepted rate among exposed and untreated cases is 15 per cent. Postvaccinal paralysis following the administration of the Pasteur treatment is a minor factor. McKendrick, in the "League of Nations Quarterly," cited the record from the Pasteur Institute: paralysis developing in only nineteen instances in a treated group of 69,541 persons, a rate of 0.027 per cent.

The comparative microscopic pathology is most excellent. However, I feel that animal inoculation should be done as a confirmatory procedure in all cases of human rabies, and when the diagnosis in animals is in doubt. Webster reports the diagnosis by inoculating the suspected material into mice.

I believe that there are, undoubtedly, many abortive cases and apparent healthy carriers among dogs. Consequently, canine rabies is more widespread than we have thought heretofore. As a result, the most practical and simplest suggestion would be the elimination of the stray dog and the confining of the licensed animal. As long as this problem is made a political football, and pressure exerted on the various political factions, by minority groups, then the final word in the control of the disease will not have been said.

* Editor's Note.—The temporary restraining order issued by Superior Judge Emmet H. Wilson of Los Angeles was vacated subsequently. His opinion and decree were printed in the June issue of CALIFORNIA AND WESTERN MEDICINE, on page 478.

THE TREATMENT OF SYPHILIS*

FOREWORD.—The control of syphilis is intimately associated with the treatment of the disease. So effective are antisyphilitic drugs now available that infectiousness can be controlled within a few weeks after treatment is started. If it were possible to bring every infectious case of syphilis under treatment and continue such treatment along modern outlines of therapy, the problem of syphilis control would be practically solved.

From a public health standpoint there are two objectives in the treatment of syphilis. The first is to control the infectiousness of the patient and thereby prevent spread of the infection. The earlier in the course of the disease new cases can be found and brought under treatment the fewer will be the new infections.

The second objective in treatment is the prevention of the development of the late complications in the individual. The chief costs of syphilis arise as a result of the late manifestations of the disease. Most of the pain, suffering, and loss of life occur late in the disease. Any plan of therapy is inadequate if it does not aim at prevention of these late manifestations.

As a result of extensive studies in America and elsewhere, it is now possible to prescribe with some degree of definiteness the minimum requirements

* This is a reprint of Special Bulletin No. 62, issued by the California Department of Public Health. Reprint copies of this bulletin on "The Treatment of Syphilis" may be obtained by physicians upon request. Addresses of State Public Health Board offices appear in each issue, on advertising page 6.