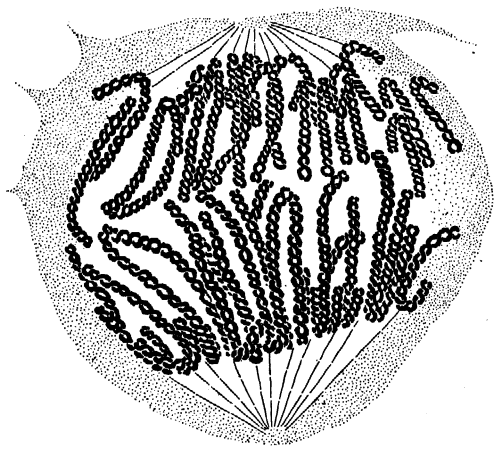

FIG. 2. The first division in the fertilized egg of *Erythronium americanum*. This figure shows that the chromosomes in the fertilized egg have identically similar structure to those appearing in the stages of fertilization.

union at meiosis, which is the essence of chiasmatype hypothesis.

It follows from the various considerations put forward in the preceding paragraphs that the older view —that fertilization takes place at the time of the union of the gametes—accords with the facts. It further follows that all unions of chromosomes are end to end and that parallel or so-called parasynaptic unions do not occur. It may further be remarked that once a chromosome, always a chromosome and that although chromatids can and normally do give rise to chromosomes, the process is an irreversible one since chromosomes do not degrade to chromatids as is assumed in connection with the chiasmatype hypothesis. Moreover, although chromosomes may divide either transversely or longitudinally, they unite only end to end.

The conclusion is reached that the hypothesis of chiasmatypy has no sound basis in fact. Further, since this is the case, the possibility of true sexual union (chiasmatypy) normally taking place long after the junction of the gametes, sperm and egg, is finally excluded, as similarly without basis in fact.

TROPICAL DISEASES AND GEOPATHOLOGY

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IT was a foregone conclusion that, in the great war which has just been brought to a successful end, our Army would suffer from tropical diseases and would have dire need of doctors with sound knowledge of tropical medicine. It is to be hoped that the experience will be thoroughly described, but such an end will not be easily or soon attained. In the early days of military operations in the Pacific, a great dearth of officers with adequate knowledge and understanding of tropical medicine made itself felt. As time went on, men with sound experience in basic pathology and medicine became competent to solve the problems that were presented. For malaria, the transition from May to October, 1943, contained a turning point. In May, all was uncertainty, lack of confidence and confusion. By October, skill, understanding and orderliness were widespread. In the interval, doubt existed that we could fight in New Guinea, although military necessity made it imperative to do so.

When it became possible to mobilize effectively skilled personnel available to put to work on tropical disease problems, the Army found that it had at its disposal a moderate number of experts in preventive medicine, a very limited number of experts in laboratory diagnosis and hardly any in the clinical field. It was necessary to use a large proportion of available experienced personnel as instructors in "hurry-up" courses which had to be organized to meet the emergency. This experience brings into sharp focus the fact that American medical schools, in spite of exceptional instances to the contrary, on the whole have neglected the so-called tropical diseases, especially their clinical aspects. We have not solved some of the important problems which this group of diseases presents in the United States, notably not in the case of malaria. Although we can be justly proud of our sanitary achievements in Puerto Rico, Panama and the Philippines, our close association with those tropical regions has had relatively little influence upon American medicine.

As for the future, it should not be supposed that our present security from potential world threats in the form of exotic diseases will always be maintained with ease. Preventive medicine has not yet abolished any disease. The price of health security is eternal vigilance. In this connection, we should take note that whatever course American political relations may take with the other American republics and the Far East, our commercial and cultural relations with the peoples of those parts will constantly increase in volume and in intimacy. The health problems of our neighbors to the South and West across the Pacific are bound to be matters of great concern to us.

From the scientific point of view, it is notable that our knowledge of the immunology, the pathologic

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physiology, the course and the correlation of the course with the pathology of most tropical diseases is superficial and fragmentary. So is our knowledge of methods of diagnosis and treatment. Modern methods of study have hardly touched these problems, especially those that require clinical investigation. To some extent, these great lacunae exist in our knowledge because of failure to bring together the qualified personnel, the necessary facilities and the living material to be studied. The deficiencies are due in large part, however, to lack of stimulation and interest to attack such problems.

Experience shows that such problems can be attacked in many ways. One method is through the establishment of tropical institutes devoted specifically to this set of problems. Such institutes, however, have small influence on general medical education and are apt to work in fields remote from practical medicine. For these reasons alone, it is desirable that some of our medical schools (but by no means all) should take up the problems of tropical diseases without separating them unduly from general pathology, immunology and clinical medicine. The study of these diseases will profit enormously from intimate intermingling with studies of other diseases in the realm of internal medicine. At the same time, some at least of our medical students will acquire an adequate basic knowledge of tropical diseases. Intending specialists can continue to work in medical schools which devote serious attention to this field or betake themselves to special institutes.

The existence of "tropical diseases" as a group rests on the historical basis that modern medicine developed in Western Europe and North America. In regions where these diseases occur naturally, it is absurd to set them apart from general medicine. Yet this is often done. Tropical diseases are the stock in trade of India and China, for example. Moreover, there are in fact few truly tropical diseases. The classification of potentially worldwide diseases, such as cholera and plague, as "tropical" is dangerous, since it may result in widespread ignorance of their nature and general lack of skill in their control. Among the diseases commonly labelled "tropical" is malaria. As a result American medical students know little about this important American disease. Malaria owes its slender claim to the designation "tropical" mainly to social and economic conditions. The relapsing fevers are tropical only in small part. Even in the case of kala-azar, it is notable that Peiping, China, in latitude 42° North, is one of its great centers. Beriberi is often classed as a tropical disease, presumably because it has been extensively studied in the Netherlands East Indies and elsewhere in the Far East. Yet no fundamental linkage has been demonstrated between beriberi and the tropics. Surely no American physician should think of undulant fever as tropical. As for dysentery, when one considers its history in the United States, the ignorance of temporary Army medical officers in World War II concerning both amebic and bacillary forms is shocking.

When, as the result of social amelioration and preventive measures, certain diseases become rare in Western Europe or North America, there is a tendency to call them "tropical," even though there is no basis whatever for such a designation. The case of malaria has already been mentioned. In this instance, the designation "tropical" in America carries the false implication that we have banished the disease. A glaring example of this process was found in a standard English text-book of general medicine whose author classed epidemic typhus with tropical diseases (shades of Pringle, Hewitt, Bretonneau and Gerhard have mercy on him!). The worst ravages of typhus have never been anywhere near the tropics. It behooves all physicians, wherever they are, to consider the occurrence of one or more forms of the rickettsial diseases to be well within the possible bounds of their experience.

The confusion of thought on these matters is associated with vague notions as to what constitutes the "tropics." For example, although often loosely associated with the tropics (at least in this connection), China is tropical or even subtropical only in relatively small part and Japan proper to a still less extent.

The term "tropical medicine" is convenient and serves certain purposes, but as generally used it does not correspond to a field of medicine that rests on any serious etiologic, pathologic or clinical principle. It has only a feeble and inaccurate geographic significance, meaning at best diseases not now common in either Western Europe or North America (and often failing to stay within this definition).

In spite of all this, there are fundamental concepts and problems which are adumbrated in tropical medicine. These are the peculiarities of disease in relation to topography, climate and the distribution of pathogenic and disease-transmitting organisms. Such subjects are part of pathology and also part of that aspect of biology known as ecology. Inter-related in many ways are the effects of social conditions as they occur in various regions, of regional food habits and food supplies, and perhaps of hereditary racial traits. The peculiarities of tropical diseases and the subject of tropical medicine are fragmentary portions of this great field, the significance of which far transcends that of any selected group of specific diseases.

Unfamiliar terms are always objectionable. Nevertheless, a new and important field calls for a dis-

tinctive and adequate name. Perhaps the term "geopathology" is the best that can be found to designate the subjects under discussion.

Brief reflection shows that geopathology, as here defined, is a subject of great practical and scientific importance. Studies in this field should be concerned not only with specific diseases (and *a fortiori* not only with specific parasites), but with regional peculiarities of all diseases. The peculiarities in certain areas of pneumococcus pneumonia, tuberculosis and rheumatic fever, though yet poorly known, are striking and suggestive. Moreover, the field is not limited to communicable diseases, but extends in all directions. For example, glimmerings exist of regional peculiarities in diabetes, bladder stones, hypertensive disease and cancer. In spite of the importance of studies in this field, both for the advancement of knowledge and for the prevention, control and treatment of disease, geopathology is in its infancy. There is no even moderately comprehensive treatise of existing knowledge of the subject. Presumably, such a work today is hardly worth the effort, in view of our fragmentary information and understanding. Adequate study and discussion of diseases in many important parts of the world have not yet been accomplished.

In the years to come, Americans will be looking especially in two directions, to the South and to the Far East. We will quickly build up and long maintain intimate relations with the peoples of those regions. Their health problems, which are vastly different from those we now have, will become in a measure our problems. American medicine should lead in the elucidation and solution of the problems of geopathology. It should do so without delay and with enthusiasm.

OBITUARY

HENRY BALDWIN WARD

THE sudden and unexpected death of Henry Baldwin Ward on November 30, 1945, brought to a close a truly remarkable career. Few scientific men have ever enjoyed a life of such intense and long-continued activity, which was kept up almost to the day of his death. In fact, one of his former students visiting him in his office at the end of October of this year found him busy breaking in a new secretary, while in the midst of finishing up an article that was due to go to the printers in a few days. His broad interests and unusual ability made it possible for him to take part in a wide variety of activities. He took pride in lecturing to freshman zoology classes. He trained a large group of graduate students. He carried the heavy administration duties of a large university department while taking part in general university and community life. He contributed important researches in parasitology and a variety of other zoological subjects and wrote numerous popular articles. He also found time to take a leading part in the development of scientific organizations, including the American Microscopical Society, the Society of Sigma Xi and the American Association for the Advancement of Science. He was also interested in a variety of national projects including wild-life conservation and stream pollution.

Henry Baldwin Ward was born in Troy, N. Y., on March 4, 1865. He received the A.B. degree at Williams College in 1885 and was employed as a teacher of science in the high school in Troy from 1885 to 1888. This was followed by one of the most fruitful periods of his life when from 1888 to 1890 he studied at the Universities at Göttingen, Freiburg and Leipzig and spent his summers at the marine biological stations at Naples, Heligoland and Ville-Franche-sur-Mer. At Leipzig he worked in the zoological laboratory of Rudolph Leuckart, who was then at the height of his career. It was here that he realized the possibilities of the field of parasitology, and determined to establish a graduate laboratory in this subject in the United States.

After returning to the United States in 1890 Dr. Ward undertook graduate studies under Professor E. L. Mark at Harvard, and completed his thesis for the Ph.D. in 1892. His first university position was that of instructor in zoology in the University of Michigan from 1892 to 1893. Soon after this he undertook biological studies for the Michigan Fish Commission on the Great Lakes, and for a number of years worked on a biological survey of the Great Lakes for the U. S. Fish Commission. Early in these investigations he started his collection of parasitic worms, which continued to grow throughout his whole life.

In 1893 Dr. Ward was called to the University of Nebraska as associate professor of zoology. He was promoted to professor in 1899 and became head of the department of zoology in 1906. At Nebraska he became interested in premedical and medical education, and served as the dean of the medical school from 1899 to 1909. Soon after his arrival in Lincoln he met Harriet Blair, who was teaching in the music school of the university. They were married on September 11, 1894, and celebrated their golden wedding anniversary in 1944. Mrs. Ward and their two daughters, Cecelia and Charlotte, survive him. At Nebraska he found the opportunity to train a small number of graduate students in parasitology and to