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PRESENT AND POST-WAR HEALTH PROBLEMS IN CONNECTION WITH PARASITIC DISEASES[1]

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As a nation without imperialistic aims and with few colonial possessions, we have viewed with considerable nonchalance the tropical disease problems of other countries. Now that we are engaged in an all-out war on many fronts, we are frantically endeavoring to absorb and put into practice knowledge of these exotic diseases. For the moment, most of these problems are military problems, but sooner or later they are apt to become public health problems of direct concern to our civilian population.

Our past military campaigns in tropical areas have been confined to small-scale operations in Cuba, Puerto Rico, the Philippines and briefly in Central America. Now our troops are serving by the thousands in such hotbeds of exotic disease as Africa, India, China and the South Pacific. While every effort is being made by our military authorities to practice effective preventive medicine in these areas, it is inevitable that some of our troops will contract one or more tropical diseases and will return to the United States as infected individuals. Already the homeward trek of these men has begun. The return of military personnel from all these areas will probably constitute a cumulative introduction of tropical disease equaled or exceeded only by such introduction during the slave-trading days. It is well, therefore, to consider some of the possibilities which confront us and to ponder the relationship of these possibilities to civilian health.

Some of the diseases of greatest importance from a military standpoint and possibly from a subsequent civilian standpoint are those caused by protozoan and

[1] Presented before the Section on Epidemiology, War-time Conference, American Public Health Association, New York, October 12, 1943.

helminth parasites as well as others which are transmitted by various species of insects and other intermediate hosts.

Many of these parasitic diseases are characterized by a relatively long incubation period, by pronounced chronicity, by lack of permanent immunity and by difficulties in diagnosis; there are no successful means of immunizing an individual against them, and for many of them we have no satisfactory treatment. These facts all add to the probability that the parasitic diseases will be the ones most likely to be brought back by returning troops and the ones which may well prove to be of considerable concern from a public health standpoint.

PROTOZOAL DISEASES

Malaria. This disease has always been the scourge of armies operating in tropical or sub-tropical countries and we can only expect that the present conflict will offer no exception to this rule. In our brief military excursion in the Spanish-American War, over half of our troops contracted malaria. In World War I our malaria problem was confined to the southern camps and extra-cantonment areas. For the most part our troops were engaged in temperate or cold climates where malaria was not endemic. But now the sons of the veterans of that war are in combat in some of the most highly malarious areas on the globe. Under these circumstances, we may expect a considerable morbidity rate from this disease.

Many infected individuals will return as carriers of the disease and many will go back to their homes in parts of the country which have long been free of the infection. A proper concentration of carriers in areas where there is a suitable concentration of vectors will lead to the establishment of new endemic centers of malaria. Furthermore, there is the probability of the introduction of new strains as well as new species in areas in which all the several species do not at present exist. We already have isolated examples of the potentialities of such occurrences even with the introduction of a limited number of carriers. For instance, Craig[2] has reported the incident of the National Guard company from Connecticut, the members of which contracted *Plasmodium falciparum* infection in southern camps during the Spanish-American War and introduced this species in their home community on their return from the service, a community in which only *P. vivax* had previously been known.

Matheson[3] has cited the Aurora, Ohio, outbreak of 1934 to show the explosive effect of the introduction of a single case in a community, in which a suitable mosquito host was available.

During and following World War I, malaria reappeared in England after a lapse of sixty years. The outbreaks resulted from the introduction of the disease by returning soldiers, mostly by those who had served in the Macedonian campaign.

We may anticipate as a post-war development the probable occurrence of numerous instances of the above-mentioned sort. In the present endemic areas, we may expect introduction of new strains to which even already infected individuals may have little or no resistance. In the many parts of the United States in which anopheline vectors are found outside of the infected zones, it is probable that we shall see localized outbreaks over a period of years.

The situation calls for farsighted planning to meet the eventualities which we are bound to have to face. It is a question whether as a public health measure we should not now be placing even more emphasis on control of anopheline mosquitoes in endemic zones and extending this control work into areas which have long been free of the disease. Also, in some of these latter areas we must know more about the distribution and ecology of vectors.

Amoebiasis. Like malaria this disease is endemic in the United States, where about 10 per cent. of individuals examined in surveys have been found infected. Following the last war, there was some apprehension that soldiers returning from overseas might spread the disease widely over the country. In this connection Boeck and Stiles[4] made a total of 13,043 examinations of 8,029 individuals for intestinal parasites. These persons included overseas veterans, troops stationed in the United States, persons with no military service and persons whose service connection was unknown. The incidence of *Endamoeba histolytica* in overseas soldiers was no higher than that encountered in the other groups.

Kofoid, Kornhauser and Plate[5] found an incidence of *E. histolytica* of 10.8 per cent. in 1,200 overseas soldiers and an incidence of only 3 per cent. in 300 on home service. However, the incidence in the former group was not materially different from that encountered generally in surveys in this country.

As with malaria, however, we are faced with a situation somewhat different from the one that confronted us in the first World War. Some time ago, an eminent medical officer remarked that amoebic dysentery has never been a military problem except in the Philippines during the Spanish-American War and the In-

[2] Charles F. Craig, Publication No. 15, Am. Asn. Adv. Science, Washington. 1941, pp. 131–134.

[3] Robert Matheson, Publication No. 15, Am. Asn. Adv. Science, Washington. 1941, pp. 157–162.

[4] William C. Boeck and Ch. Wardell Stiles, *Hygienic Lab. Bull.* 133, Treasury Dept., Wash., 1923, 198 pp.

[5] Charles A. Kofoid, Sidney I. Kornhauser and J. T. Plate, *Jour. Am. Med. Asn.*, 72: 1721–1724, June 14, 1919.

surrection. This statement is of course true, but the fact must not be overlooked that the Philippine campaign is the only one of any consequence which we had fought in a tropical country. At the present time our troops are in combat in areas in which strains of *E. histolytica* are particularly virulent for those who have not been previously exposed to such strains. Experience in the British Army in North Africa indicates that about one eighth of the hospitalized dysentery cases were due to *E. histolytica*. On the other hand, amoebic dysentery is said[6] to be the prevailing form attacking British troops in India.

The protection of troops against the dysenteries is difficult under combat conditions but the water purification tablets now provided for sterilizing water in canteens are effective under most conditions for the destruction of cysts of *E. histolytica*. The hyperchlorite ampule is still used in the Army Lyster bag but effective cysticidal action is not obtained without, in effect, superchlorination and adequate exposure time. Portable sand filters such as used in advanced zones will probably remove most amoeba cysts from water provided such units are operated properly. Fly-borne dysentery is not uncommon in troops under certain conditions. Craig[7] has called attention to an epidemic of amoebic dysentery from this source in troops on the Mexican border in 1916, while the widespread outbreak of dysentery in combat divisions taking part in the Marne-Aisne offensive in 1918 was undoubtedly due mostly to the spread of infection by flies, as can be readily attested by the writer.

Consequently, even though the best sort of protection is provided, it is not always possible under combat conditions to make use of available facilities and the dysenteries must be reckoned with in any military campaign. In the case of amoebic dysentery, we may expect the return of a certain number of infected individuals at the end of this war. What effect these carriers will have on our civilian health is problematical, but it is reasonable to assume that their dispersal may well lead to a higher morbidity rate from amoebiasis, and that perhaps new and more virulent strains may be introduced.

Leishmaniasis. Visceral leishmaniasis or kala-azar occurs throughout the Mediterranean littoral, the Near East, India and China. In addition, it has been found in certain parts of South America. Cutaneous leishmaniasis or oriental sore has much the same distribution as kala-azar. Further, we have in parts of South America and in Mexico the mucocutaneous form known commonly as espundia.

Other than a few imported cases, leishmaniasis has not occurred in the United States. Even though the method of transmission of the visceral type of the disease has been definitely established by Swaminath, Shortt and Anderson,[8] as occurring through the bite of sandflies of the genus *Phlebotomus*, we have difficulty in appraising post-war significance of the disease as a public health problem in the United States. It is evident that protection against the vectors of the disease is often impracticable, if not impossible, and that with present diagnostic methods only the most obvious cases are detected. Consequently, we may surmise that infected individuals will return to this country and may serve as reservoirs of infection, possibly over a long period of time. Three species of *Phlebotomus* are described from the United States, and others are known. One species, *P. diabolicus*, which occurs in Texas, is said to be a vicious feeder on man. As a public health measure, it is believed that effort should be made to determine the distribution and ecology of domestic species of *Phlebotomus* and to ascertain the infectibility of *P. diabolicus*. However, it seems probable that this disease will not be one of those of greatest importance which may be introduced by military personnel.

Trypanosomiasis. The possibilities for the establishment of African sleeping sickness seem much more remote than those in the case of other tropical diseases. We do not have in this country species of *Glossina*, a fact which militates against the disease gaining a foothold in the continental United States. We do have other blood-sucking flies, including tabanids and *Stomoxys calcitrans;* the latter has been incriminated as one of the vectors of the disease. However, as African trypanosomiasis has exhibited no tendency to spread extensively in areas where species of *Glossina* do not abound, it would appear that the disease is unlikely to become established in areas where dependence on transmission is limited to other vectors.

The case for the establishment of Chagas' disease is perhaps of more concern. Naturally infected *Triatoma* have been found in various areas in the South, Southwest and California, and reservoir hosts of *Trypanosoma cruzi* are known from some of these areas. No human cases of the disease have been discovered to date in the United States. However, we are sending on various missions numerous individuals to endemic areas in Central and South America and furthermore are importing labor from south of the Rio Grande to work in regions where infected *Triatoma* have been located. It is hoped that fortuitous conditions will not bring about the introduction of human cases and the spread of the disease in this country.

[6] "Amoebic Dysentery as a Water-borne Disease." Editorial, *Indian Med. Gaz.*, 78, 2: 97, February, 1943.

[7] C. F. Craig, *Military Surg.*, 40: 286–302; 423–434, March–April, 1917.

[8] C. S. Swaminath, H. E. Shortt and L. A. P. Anderson, *Indian Jour. Med. Research*, 30, 3: 473–477, July, 1942.

NEMATODE PARASITES

Among the nematode parasites of man, we have endemic in this country the following species: *Ascaris lumbricoides, Necator americanus, Strongyloides stercoralis, Trichuris trichiura, Trichinella spiralis* and *Enterobius vermicularis.* While troops on foreign duty may be expected to acquire some of these parasites, the return of such infected individuals will make little difference in the status of these parasites here. On the other hand, some of our military operations are now being carried on in endemic areas of the Old World hookworm, *Ancylostoma duodenale,* and no doubt this infection will be brought back to this country. This species is somewhat more damaging than is *Necator americanus* and is more difficult to remove by anthelmintic treatment. However, the measures applicable to our present hookworm problem will be equally effective in controlling *A. duodenale.*

Filariasis. A nematode infection of more concern from a post-war standpoint is filariasis. This disease was once endemic in the region of Charleston, S. C., Guitéras[9] reporting the first case in 1886. Four years later De Saussure[10] recorded the finding of microfilariae in 22 cases of chyluria in persons born in Charleston. In 1915, Johnson[11] found 77, or 19.3 per cent., of 400 individuals representing routine admissions to Roper Hospital in Charleston to be infected with *Wuchereria bancrofti.* Francis[12] in 1919 examined 37 inmates of a home for the aged in Charleston and reported 13 positive for microfilariae. At the present time, Dr. Kenneth Lynch,[13] of the Medical College of the State of South Carolina, advises that this focus has practically died out.

It is difficult to fathom the circumstances which led to the establishment of filariasis at Charleston and not at other points in the Southern States, since the disease was no doubt introduced elsewhere by slaves from endemic areas in Africa. Perhaps an unusually large number of infected individuals was congregated at Charleston and conditions were extremely favorable for *Culex quinquefasciatus,* which Francis showed to be the intermediate host in that area.

A number of biological factors undoubtedly govern the spread of filariasis in any given locality. These factors include a high rate of infection in the locality, the occurrence in the blood stream of the infected individuals of an optimum number of microfilariae, the presence of a suitable mosquito host in numbers sufficient to provide an optimum rate of infection in this host, the accessibility of infected individuals to such mosquitoes and conditions of temperature and humidity suitable for the development of the microfilariae in the mosquito host.

While nothing is known concerning the infectibility of mosquito hosts in this country, other than that of *Culex quinquefasciatus,* many other suitable vectors undoubtedly occur in the continental United States. If a sufficient number of infected returning troops should be concentrated in areas in which intermediate hosts are prevalent, it is conceivable that filariasis might become reestablished in this country.

The matter of preventing such a circumstance is a difficult one. The period between infection and the appearance of microfilariae in the peripheral circulation is so long that infected individuals might be distributed over the country before the presence of their infection could be established while they were still in military service. Further, not all persons with microfilariae actually develop clinical symptoms, although, conversely, some with marked symptomatology may never show microfilariae.

The problem arises as to what disposition should be made of returning troops infected with *W. bancrofti* or *W. malayi.* Since there is no specific treatment for filariasis, there is no known way of destroying microfilariae in the blood stream, and therefore no method of sterilizing carriers. Furthermore, it would not appear feasible to retain these men in military service under quarantine conditions, since their infection might persist for years. Under these circumstances, a certain number of carriers will no doubt be distributed over the country. The probable number of such carriers is unpredictable. For this and other reasons, it is impossible to hazard a guess as to the opportunities for the reestablishment of the disease here. However, the seriousness of the disease and the potentialities of the situation warrant alertness on the part of public health officials. While awaiting further developments, we can at least secure additional information concerning mosquito vectors in this country and continue the search for a drug which will kill adult worms or one which will destroy microfilariae and sterilize female worms so that individuals carrying such worms will no longer serve as reservoirs of infection. Work on both of these problems has been going on in our laboratory for some time.

Onchocerciasis. This very serious parasitic disease occurs in a broad belt through Central Africa and in the Western Hemisphere in the States of Oaxaca, Chiapas and Guerrero, Mexico, and in certain departments along the Pacific Coast in Guatemala. The known vectors in the latter areas include three species of blackflies of the genus *Simulium.* We have little

[9] John Guitéras, *Med. News,* 48, 15: 399–402, April 10, 1886.

[10] P. G. De Saussure, *Med. News,* 56, 26: 704–707, June 28, 1890.

[11] F. B. Johnson, *Southern Med. Jour.,* 8, 7: 630–634, July 1, 1915.

[12] Edward Francis, *Hygienic Lab. Bull.* 117, Treasury Dept., Wash., June, 1919, 36 pp.

[13] Kenneth Lynch, personal communication.

to fear from the importation of the disease from Africa, but the situation to the south of us is of more concern.

The projected route of the Pan American highway will take the road through the endemic areas in Mexico and Guatemala. While at the present time, there is some movement of infected individuals from one country to another, particularly the movement of laborers on the coffee fincas, the whole region is a fairly inaccessible one. With the advent of the highway, we may expect the opening up of these previously inaccessible endemic zones with consequent migration of non-infected individuals into the zones and the expanded movement of infected persons out of the zones. Although some of the vectors occur outside of the infected zones, knowledge of their distribution is still very meager; furthermore, information is lacking concerning the infectibility of other species of *Simulium*. The fact that the microfilariae of *Onchocerca volvulus* penetrate the structures of the eye and lead to profound visual disturbances with eventual blindness in many cases makes the disease one of great importance from a public health standpoint. Because of the potentialities of the present situation, the Pan American Sanitary Bureau, under the direction of Dr. Hugh S. Cumming, in cooperation with the Republics of Mexico and Guatemala, is undertaking a coordinated program of laboratory and field studies with the view of developing measures effective for the control of the disease.

So far as our information goes, the known vectors of onchocerciasis do not occur in this country. However, Dyar and Shannon[14] listed 27 species of simuliids from the United States, and it is possible that some of these species might be biologically adapted to serve as intermediate hosts of the parasite. While the disease is still far from our borders, it will pay public health officials to keep a weather eye on the situation to the south of us.

CESTODE PARASITES

We already have in this country several species of tapeworms, including *Taenia saginata, T. solium, Echinococcus granulosus* and *Hymenolepis nana* and *diminuta*. *T. solium* has been something of a problem to British forces in India. Military personnel will no doubt be exposed to *Echinococcus* infection in such heavily infected areas as Iceland, New Zealand, Australia and the Mediterranean littoral. Dogs employed by the armed forces in these areas may acquire the infection and measures should be taken to examine such animals and properly treat infected ones before they are brought back to the United States. However, under the improved sanitation in slaughtering establishments in this country, hydatid disease has shown a steady tendency to decline, and it is not expected that our military campaigns abroad will contribute to the spread of infection here.

TREMATODE PARASITES

Our troops have already been exposed and will be further exposed to various trematode infections endemic in various parts of the world. Among the most serious of these trematode diseases are paragonimiasis, clonorchiasis and schistosomiasis.

Paragonimiasis. The oriental lung fluke, *Paragonimus westermanii,* is not a stranger to the United States, since it has been reported from the pig, dog, mink, muskrat, wildcat, domestic cat and goat on this continent. Strong[15] has stated that at least one case of human infection has been reported in North America. Ameel[16] found the operculate snail, *Pomatiopsis lapidaria* Say, to be the first intermediate host of the fluke in this country, and crayfish of the genus *Cambarus* to be the second intermediate hosts.

Cases of paragonimiasis have already been reported as having occurred in troops in certain areas and it is possible that the infection will be acquired by additional individuals. However, the importation of the fluke would seem to constitute no additional public health hazard. The infection has shown no tendency to spread to man in the United States and is not likely to do so since our people do not customarily consume raw crayfish.

Clonorchiasis. Clonorchis sinensis is distributed in various parts of the Sino-Japanese area. It has been brought into the United States frequently by immigrants from the Orient. In accordance with the Immigration Act of 1917, the Surgeon General of the United States Public Health Service classified clonorchiasis as a dangerous contagious disease, making mandatory the exclusion from admission to the United States of persons carrying this parasite.

During the following years, intensive investigations were carried out in California by Wayson[17] to determine whether there was any possibility of the parasite becoming established in this country. These experiments were entirely negative in so far as infection of domestic species of snails was concerned. Furthermore, epidemiological investigations carried on during the same period failed to disclose any autochthonous cases of clonorchiasis in California. So far as is known, no such cases have turned up since that time,

[14] Harrison G. Dyar and Raymond C. Shannon, *Proc. U. S. Nat. Museum,* 69, Art. 10: 1–54, 1927.

[15] Richard P. Strong, "Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases," 1747 pp. Sixth edition. Philadelphia: The Blakiston Company. 1942.

[16] Donald J. Ameel, *Am. Jour. Hyg.,* 19, 2: 279–317, March, 1934.

[17] N. E. Wayson, *Pub. Health Rpts.,* 42, 51: 3129–3135, December 23, 1927.

although eggs of *Clonorchis* are found occasionally in Orientals around San Francisco and in other parts of the state. In view of the above-mentioned facts, it is hardly conceivable that *Clonorchis* would become established here through the return of infected troops from abroad.

Schistosomiasis. At the present time our military forces are distributed in many endemic areas of schistosomiasis, including those in which *Schistosoma mansoni* and *S. haematobium* are present. Eventually we shall probably be campaigning in areas in which *S. japonicum* is endemic.

While several alleged autochthonous cases of schistosomiasis have been reported from the continental United States, the authenticity of most of these cases is open to serious doubt, and it is believed that they are based on mistaken diagnoses. At least, no case was acquired from domestic snails. In considering the possibilities for introduction into the United States of the three species of human schistosomes, a number of factors must be evaluated. Assuming that active cases occur among returning troops and that all these cases are not diagnosed and treated to the final conclusion in that the individuals will no longer be passing eggs of the parasite, we must consider whether the miracidia escaping from these eggs might reach snails and whether such snails might act as suitable intermediate hosts for the parasites.

Eggs given off into sewage systems would probably hatch, if temperature requirements were adequate, but nothing is known concerning the fate of these schistosome miracidia in sewage. Ordinarily, the miracidia are capable of active movement in water for a period of 16 to 32 hours but die after that time if they have not succeeded in reaching a suitable snail host. If sewage has no deterrent effect on the miracidia, it is conceivable that they might reach the treatment plant. If they were not sedimented out, they might be given off with the effluent and reach susceptible snail hosts, provided such snail hosts were available. It is not believed that chlorination of the effluent as commonly practised would be inimical to the miracidia, although more information is needed on the effect of chlorine on miracidia and cercariae.

Dangers of transmission of schistosomes to suitable snail hosts would be much more acute in rural areas in which feces or urine might be deposited in freshwater streams, ponds or lakes. The range of the human schistosomes lies within tropical and subtropical belts in low-lying areas characterized by slow-moving streams amply provided with vegetation, canals, irrigation ditches, marshes, swamps, freshwater ponds and smaller basins of accumulated rain water, conditions which are favorable for the snail intermediate hosts. Since schistosome parasites do not develop in snails under conditions of low temperature, warm climates provide most favorable conditions. Furthermore, the optimum temperature for hatching of ova lies between 25° and 30° C. All these conditions are present in many of our southern states.

In the presence of suitable intermediate hosts, the personal habits of the population in any given locality govern to a large extent the spread of schistosomiasis. For instance, Bettencourt, Borges and de Seabra[18] reported that at Tavira, Portugal, one of the few endemic areas on the European continent, it is the custom of the women to wash clothes in small ponds in which they also commonly urinate, the temperature of the water being favorable for the development of the snail hosts and for the hatching of the ova. In Puerto Rico, *S. mansoni* is confined mostly to parts of the island where there are slow-moving streams clogged with vegetation or where irrigation plays an important part in sugar cane production. The streams and irrigation canals are used for bathing and laundering, while most of the water for household purposes is obtained from the same sources. In endemic areas of *S. japonicum* in China, promiscuous defecation in canals and rice fields and the use of night soil as fertilizer contribute in an overwhelming manner to the perpetuation of the disease.

In the southern United States, where conditions would be most favorable for the establishment of schistosomiasis, the habits of the people are not comparable to those in most areas in which the disease continues to be an important problem. Probably only in exceptionally localized areas would conditions be optimum and circumstances sufficiently propitious for the propagation of the parasite.

However, there are in the United States 10 genera and 9 subgenera of snails of the family Planorbidae, and 12 of these 19 genera and subgenera occur in the southern states.[19] Some of these forms are related to species which are known to be good intermediate hosts of *S. haematobium* and *S. mansoni.* Other than *Helisoma lentum* reported by Faust and Hoffman[20] to be refractory to infection with *S. mansoni,* no experimental work has been done to determine whether these species of snails are susceptible to infection with these trematodes. Until proved to the contrary, it must be assumed that some of them at least might serve as carriers. Opportunities for the establishment of *S.*

[18] A. Bettencourt, I. Borges and A. de Seabra, La température de l'eau et la bilharziose a Tavira (Portugal). *Comp. Rend. Soc. Biol.*, 86, 6: 330–331, Fév. 11, 1922.

[19] The writer is indebted to Dr. Paul Bartsch, curator of molluscs and Cenozoic invertebrates, U. S. National Museum, Washington, D. C., for information concerning members of the family Planorbidae in the United States.

[20] Ernest Carroll Faust and William A. Hoffman, *Puerto Rico Jour. Pub. Health and Trop. Med.*, 10, 1, 1–97, September, 1934.

mansoni would appear to be far better than those in the case of *S. haematobium,* since the former has become established and has flourished in parts of the New World, whereas the latter, though probably repeatedly introduced in the same areas by the same means, has never been able to maintain itself. Further, planorbid snails in the continental United States are more closely related to those species carrying *S. mansoni* than they are to those carrying *S. haematobium.* In the case of *S. japonicum,* members of the genus *Tironius* in Utah and California might serve as intermediate hosts, although these forms differ somewhat in their biological requirements as compared to known carriers of this species.

To summarize the case for the schistosomes, we may conclude that there is a possibility of their establishment in the continental United States and that this possibility is more pronounced in the case of *S. mansoni.* This conclusion presupposes the occurrence of fortuitous circumstances involving large numbers of returning troops infected with the parasites, the concentration of considerable numbers of infected individuals into given areas, particularly rural areas in the southern states, where conditions would be most favorable for the propagation of the parasites, and the presence of suitable intermediate snail hosts.

Military authorities have already agreed to take such steps as are practical to limit the return of carrier cases to their home communities. In view of the lack of information on small hosts, the National Institute of Health is carrying on experiments to determine whether domestic species of planorbid snails can be infected with the various species of schistosomes. If such species are found, the situation would warrant extensive studies on the ecology and distribution of the incriminated forms.

THE INTRODUCTION OF DISEASE VECTORS

The catastrophic consequences of the introduction of *Anopheles gambiae* into northeastern Brazil are too well known to need reiteration. This circumstance, however, has served to emphasize to a marked degree the potential hazards with which the United States is faced in view of our accelerated world-wide air travel. The establishment of more efficient vectors of malaria in our present extensive endemic areas would be followed by disastrous effects on the welfare and economy of the South and might hinder tremendously our war effort. The introduction of exotic diseases by returning troops will render us even more vulnerable to any vectors which might be able to gain a foothold here. Needless to say, the United States Public Health Service is alert to all the potential possibilities in the situation and in cooperation with our military services is exerting every effort to guard our shores against the introduction of disease transmitting species.

One can not leave this general subject without calling attention to the need for training in tropical medicine on the part of public health workers and practising physicians. Our armed forces have done excellent work in better implementing service physicians through the inauguration of basic courses in tropical diseases. After the war is over many of these men will no doubt return to practise with an adequate background in this field and will be capable of diagnosing and treating cases of exotic disease which will come to them.

Likewise, a commendable effort has been made in providing more and better instruction in tropical medicine in our medical schools. Little has been done, however, in furthering knowledge of tropical diseases among physicians remaining in civil life and among public health workers who may be called upon to assume responsibility for the control of any such diseases which may be introduced as a result of our participation in the war. This latter problem would seem to lie within the sphere of influence of this association and might well serve as a subject for further discussion, planning and accomplishment.

OBITUARY

EDWARD BENNETT MATHEWS

DR. EDWARD BENNETT MATHEWS, emeritus professor of mineralogy and petrography at the Johns Hopkins University, died on February 4, 1944.

Dr. Mathews was born in Portland, Maine, on August 16, 1869. He received the bachelor's degree at Colby College in 1891, and was awarded the honorary degree of doctor of science in 1928 as one of its most distinguished alumni. The fact that his family was engaged in slate quarrying in Maine doubtless influenced his choice of a geological career, and led him to study mineralogy and petrography under George Huntington Williams at the Johns Hopkins University. He was awarded the degree of doctor of philosophy in 1894 and was immediately appointed instructor in mineralogy and petrography upon the untimely death of his eminent teacher. As field assistant in the U. S. Geological Survey from 1891 to 1894, he had served invaluable apprenticeships under another great teacher, C. R. Van Hise, in the Marquette district in Michigan, and under the renowned Whitman Cross and R. A. F. Penrose, Jr., in the Pike's Peak region in Colorado. Before beginning his teaching career, he also spent some time in Germany in the laboratory of another