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THE INTERDEPENDENCE OF TROPICAL MEDICINE AND GENERAL MEDICINE *

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INTRODUCTION

MR. PRESIDENT AND FELLOWS OF THE MASSACHUSETTS MEDICAL SOCIETY:

When you so kindly asked me to address you on this occasion I assumed that you would wish to hear about the subject which has absorbed most of my attention during the past seven years, namely, tropical medicine. Supposing that you might like to know something of the background of this address I venture to say that my first contact with the subject was made twenty years ago on a trip to the Far East. Later, in 1915, I saw much typhus fever, malaria, relapsing, fever, and papataci fever in Serbia.[1] In 1921 I joined the Department of Tropical Medicine at Harvard, started a Service for Tropical Diseases at the Boston City Hospital in the same year, and since then have devoted myself to tropical medicine. During this period a year was spent in the Amazon Basin,[2] and another in Equatorial Africa.[3] My work has been, chiefly, of a clinical nature.

DEFINITION

What is meant by "tropical diseases"? The answers will depend upon the approach to the question. A colleague, for example, asked whether I considered that all cases of rare and interesting disease should be regarded as "tropical." I replied that his interpretation suited me perfectly but that minds less liberal than his preferred

* The Annual Discourse delivered before the Massachusetts Medical Society, June 12, 1929. This article first appeared in the New England Journal of Medicine of June 13, 1929 and is here reprinted by courtesy of the Editor of that Journal.

[1] "Typhus Fever with Particular Reference to the Serbian Epidemic." By Strong, Shattuck, *et al.*—Harvard University Press, Cambridge, 1920.

[2] "Medical Report of the Hamilton Rice Seventh Expedition to the Amazon." By Strong, Shattuck, *et al.*—Harvard University Press, Cambridge, 1926.

[3] A Report of the work is being prepared for publication.

to give the term a more restricted meaning. When perusing the yearly index of the "Tropical Diseases Bulletin" (which is published by the Bureau of Hygiene and Tropical Diseases in London) the eye is arrested by such familiar names as amoebiasis, beri-beri, black-water fever, cholera, dysentery, plague and leprosy. Among them are other names which may appear new or strange, such as oroya fever, sodoku, or tsutsugamushi disease. It may be a surprise to find nearly two pages of references to rabies, and a few, respectively, to pneumonia, small-pox, tuberculosis, and typhus fever.

As interpreted by the "Bulletin" the term "tropical disease" is inclusive. It covers diseases of limited but not tropical distribution such as Rocky Mountain fever, as well as maladies like smallpox, typhus fever and rabies which modern hygiene knows how to banish and which, in consequence, are more likely to be found today in backward communities in the tropics than in highly civilized parts of the temperate zone. Rabies, however, is too common in Massachusetts to be regarded here as a "tropical disease."

Pneumonia and tuberculosis are not tropical diseases, but, they have far more serious consequences in the tropics than is often realized and they present special problems there which will be discussed later.

No one in Massachusetts should question the propriety of rating malaria as a tropical disease, for although it is common in subtropical latitudes and develops occasionally in the temperate zone, it is the greatest scourge of the tropics. For us here, hookworm falls into the list naturally enough, but in some of the Southern States both malaria and hookworm are commonly treated in the course of general practice. This means that the practitioner of our Southern States lives in an intermediate zone where knowledge of some of the tropical diseases is essential for him, but the practitioner of Massachusetts is not likely to see enough cases of any of the so-called tropical diseases to justify the expenditure of much of his time in keeping informed about them.

On the other hand, he who would qualify as an authority on tropical diseases must take a world-wide view of his subject and must have had clinical experience in various types of tropical environment. But he should not lose touch with general medicine, for many of the ordinary diseases of the temperate zone are common in the tropics as well.

The practitioner permanently settled in the tropics does not need to cover so wide a field, because there is no place in the world

where all tropical diseases exist. Before undertaking such work the prospective practitioner will do well, at least, to gain laboratory experience in the diagnosis of the important diseases likely to be encountered; and he may be able to save much time by learning the language of the country before going there.

THE TREE OF TROPICAL MEDICINE

The tree of tropical medicine draws essential nutriment from the roots which vitalize medicine in general but, thus far, it has drawn from these roots in different proportions and has developed a greater number of main branches. The large branches of general medicine are physiology, chemistry, pathology and bacteriology. Tropical medicine has another main branch; namely, biology represented by helminthology, protozoology, and entomology, all of which are of lesser importance to general medicine. In consequence of this fact, a school or department devoted to tropical medicine should be prepared to teach these biological subjects and should, at least, have the cooperation of teachers of the main branches which are alike in the two trees. If given the biological nutriment which it requires, the tree of tropical medicine should flourish best in the soil of a well-rounded medical center. Good development of the tree presupposes, of course, adaptable organization and a generous spirit of cooperation between departments.

Given these requisites, many investigations in the field of tropical medicine can be prosecuted more advantageously in the temperate zone than would be possible where the climate is less favorable to sustained work. For a like reason, institutions of learning in the tropics cannot be expected to compete successfully in all things with their sisters who are more fortunately situated geographically. Northern institutions, whether in Hamburg, London, Liverpool or Boston, may be excellent bases from which to send to the tropics expeditions of selected personnel equipped for specific purposes. It seems to me that the institutions within the tropics should have a different aim, namely to provide clinical instruction, to study carefully the group of diseases at hand and to solve such medical problems as can best be studied in a tropical environment. Also, there should be contact and cooperation between the institutions within the tropics and those in the temperate zone.

THE EVOLUTION OF TROPICAL MEDICINE

Before attempting to forecast the future development of the tree

of tropical medicine let us consider briefly the stages through which it has passed since the seed was planted by Bilharz in 1853, when he attributed to the hookworm the prevailing anemia of Egypt. In 1880 Laveran discovered the protozoon parasite of malaria. Fifteen years later (in 1895) Ross, working with the malaria of birds, demonstrated its transmission by the mosquito and, in 1901, Reed and his associates proved that yellow fever was similarly transmitted. The discoveries of Ross and of Reed were foreshadowed by Theobald Smith's elucidation of the nature of "Texas fever" in cattle, and by his classical experiments which proved beyond doubt that this disease was transmitted by a species of tick.

Thus it is apparent that helminthology, protozoology, and entomology were hand maidens of tropical medicine from the first and that diseases of cattle and of birds became beacons to light the way. Subsequent discoveries served but to confirm the importance of biological investigations and to emphasize the close analogy between the parasitic diseases of animals and those of man.

Meanwhile, pathology helped at every step and bacteriology played its essential part which was exemplified by Hansen's discovery of the lepra bacillus in 1874, Koch's finding of the cholera vibrio in 1883, Kitasato and Yersin's demonstration of the plague bacillus in 1894, and Castellani's discovery in 1905 of the Spironema of yaws. But plague is transmitted by the rat flea and is, primarily. a disease of rats so that entomology and animal medicine again took a share of the honors.

Chemistry gave us control of scurvy and of beri-beri and became pre-eminent in therapeutics. By providing remedies such as the alkaloids of cinchona, and of ipecac, purified and improved antimonials, arsphenamines, tryparsamide, and valuable vermifuges for hookworm, it raised the treatment of many tropical diseases to a high plane.

Speaking broadly, many of the foundation stones of tropical medicine, like those of general medicine, have been shaped by men who were primarily clinicians but, in recent years, the foundation of the subject has been vastly strengthened and the structure greatly extended by the laboratory specialist.

Dependence is placed more and more upon him for the solution of intricate problems requiring time-consuming investigations which the calling of the clinician debars him from undertaking. On the other hand, the task of the clinician as correlator and interpreter in terms of diagnosis and of therapy becomes ever more difficult and

exacting. As the basic sciences aid and complement each other, so the laboratory and the clinic march together.

Most of the pioneers of the past worked with scanty equipment, often provided by themselves and, generally, they worked alone. Those of the present are vastly better equipped, and they are developing team work. Although some individuals may still do their best work in isolation, interdependence is desirable and is increasing.

THE BATTLE

The northern races, active in mind and limb, see in the tropics a challenge to their strength, rich economic prizes to win, humanitarian ends to serve, and seductive problems which pique their scientific curiosity. But the battle with tropical disease was joined long before the physician had invented his heavy artillery and, in consequence, defeats used to be as numerous as victories. Witness, for example, the ravages of disease among the Spanish conquistadors in the New World, the invasion of London by the plague, the loss to France of Haiti through the devastation by disease of Napoleon's army in the latter country, the epidemics of yellow fever formerly common along our own Atlantic seaboard, the failure of the French to build the Panama Canal, and the repeated disasters along the line of the Madeira-Marmore Railway which links the Amazon to Bolivia. It is said, and probably with essential truth, that every tie in this railway represents a corpse. These misfortunes were due to ignorance. Had modern medical artillery been available the invasions of disease would not have occurred and the battles with disease in the tropics could have been won with little loss of life.

PRACTICAL PROBLEMS

Was the power to prevent disease applied to the best advantage in the tropics soon after the necessary knowledge became available, and is it so applied today? Assuredly not? The means of preventing malaria was known for a long time before those in authority could be induced to make much use of it, and, even after Gorgas had shown the way, many refused to learn this lesson. How many people died prematurely at their posts in consequence of this neglect will never be known, but the number must be very large and the end is not yet. What has been said of malaria is true in lesser degree of dysentery and of some other tropical maladies, although the death toll of malaria in the aggregate still overshadows that of any other tropical disease.

The most important causes of the preventable loss of life which continue even now in the tropics are two; namely, persisting ignorance and economic considerations. For the persisting ignorance we physicians must shoulder a share of the blame because we ourselves are sometimes too slow to see the light. Similarly, the layman whether captain of industry or field lieutenant may be blind to his own interest because his mind has not been trained to evaluate medical data. But sometimes the organizer knows well what might be done to conserve health and yet objects that the cost is too high. When the president of a newly organized company gives one to understand that it is cheaper to "break" sub-ordinates than to prevent dysentery among them, the physician can reply that one, at least, of the most prosperous corporations doing business in the tropics considers that a well developed medical service is not only a necessity but that it increases dividends. I shall not discuss the moral side of this issue but will venture to remark that, when leaders of industry are faced with health problems, they should be very sure of their ground before deciding that neglect of employees is cheaper than reasonable expenditure for conservation of their health and of their lives. When health measures have been tried, found too costly in practice and abandoned on this account, one is at liberty to doubt whether the health measures were wisely planned and well conducted.

Sanitation of communities is apt to be more difficult in the tropics than in the temperate zone. Not only are most of the diseases of temperate climates found also in the tropics but there are other diseases to be combatted as well. Extreme ignorance about the causes of disease is more widespread, poverty and shiftlessness are much more common, admixture of races, unsanitary religious practices, superstition stronger than law, and primitive habitations may prevent additional obstacles. For example, it is no easy matter to deal with plague where there are acres of huts built only of palm leaves and bamboo poles. Moreover, a tropical climate seldom breeds energetic individuals, and heat, as a rule, damps the ardor of the alien, even though he may successfully evade disease.

The cost of sanitation must be cut according to the cloth. This is particularly true of primitive communities where there is little taxable property. Local industry, agriculture, or natural resources developing under the stimulus of adequate capital may supply the "sinews of war" to the government, or some large corporation may be obliged, in its own interest, to assume financial responsibility for community sanitation. Fortunately, there is also a "Fairy God-

mother'' disguised as the International Health Board which often lends a helping hand.

For the development of resources three things are necessary: capital, enterprising management, and labor. Capital is available in ever-increasing quantities; enterprising management develops with the demand; but the available supply of labor becomes, relatively, less and less.

Clearly, then, health measures for the native population of the tropics are of importance to the foreign investor as well as to the governments which are directly responsible for the welfare of the people of the tropics. This viewpoint is expressed by thinking persons in the Belgian Congo, and the Government there is making strenuous efforts to improve the health of its native tribes. Similarly, the economic future of Liberia and of Amazonia will be conditioned, to a great extent, by availability of labor. These instances are drawn from personal observation but, doubtless, the same situation exists in many other tropical countries. In India, on the other hand, there is likely to be a surplus of labor for a long time to come.

RESPIRATORY DISEASES

The question of labor shortage leads us to consider the significance in the tropics of pneumonia and of other respiratory diseases, including tuberculosis.

The medical reports published by the United Fruit Company, which employs large numbers of native laborers in the West Indies and in Central America, show a high incidence of respiratory diseases and a high mortality from pneumonia. This group of diseases is of importance also in India, in Liberia, in the Belgian Congo and, probably, among the native Indians in Northern Brazil.

Further examination of the reports of the Fruit Company for the years 1924 to 1926 (inclusive) shows that, among employees of the Company, the average yearly number of deaths during these three years was seventy-eight for malaria against 200.6 from pneumonia. In other words, there were more than 2.5 times as many deaths from pneumonia as from malaria among the employees.

When the average death-rate in the Fruit Company per 1,000 cases of malaria admitted to hospitals in the years 1915 to 1925 (inclusive) is compared with the rate for pneumonia during the same period, a still more remarkable contrast is revealed. The mortality rate for malaria in hospitals is only 11.76 per 1,000 against 400.6 per 1,000 for pneumonia. That is to say, that nearly ninety-nine

per cent of all the malaria cases sent to hospitals do recover, but that forty per cent of the pneumonias are fatal. Analysis of the figures shows immediately that it is the native laborers of African descent and not the white man who particularly needs protection from pneumonia in the West Indies and in Central America.

The Negro race in the United States is notoriously susceptible to tuberculosis, and, doubtless, comparative poverty and lack of hygiene are contributing factors.

In Liberia pulmonary tuberculosis is believed to be common at Monrovia; but, in the interior, where the native population has had little contact or communication, as yet, with the inhabitants of the coast, pulmonary tuberculosis is rare, if indeed it exists there at all.* In the Belgian Congo I was informed on good authority that tuberculosis is increasing among the Negroes, and that the extent of it in any locality is proportional to the frequency of contact with whites. In view of the primitive habits of the Negro in Africa and the hot, moist climate of Liberia and of the Congo Basin, it seems likely that tuberculosis in the future may become a scourge of major importance in these countries.

EFFECTS OF INCREASED COMMUNICATION

Numberless instances could be cited of the importation of disease from one country to another and the consequences have often been most serious. According to Surgeon General Stitt,[1] W. H. S. Jones, who has studied this question, attributes largely to malaria the collapse of the once magnificent civilization of Ancient Greece. It has been suggested, too, that at the time of the Spanish conquest, yellow fever may have been imported with slaves from Africa and that this disease might have been an essential factor in causing the complete downfall of the civilization of the native Maya race in Yucatán and Guatemala, where today their sculptured temples are crumbling in the forests.

Stitt is also of the opinion that aestivo-autumnal malaria, hookworm disease, filariasis, and various other maladies were brought to America from Africa with the slaves. Be that as it may, subtertian malaria and hookworm have had serious consequences in some of our Southern States, and an active focus of filariasis persists at Charleston, South Carolina.

Improved facilities for travel in Africa, with the mingling of

* Report of the Harvard African Expedition, now in process of preparation.
[1] U. S. Naval Med. Bull., Vol. XXVI, No. 4, p. 801, Oct., 1928.

tribes and races which results, favor the spread of tuberculosis as mentioned above, and quite recently yellow fever has been discovered along routes of travel in the interior of West Africa where this disease is not believed to have existed formerly. Moreover, the relapsing fever of the Eastern Congo, which is transmitted by a species of tick, is said to be spreading similarly into new regions, and the notorious epidemics of African trypanosomiasis which decimated the native population in parts of Central Africa some years ago have been attributed to the appearance of the disease in territory where it had not existed formerly. It is apparent, therefore, that health protection for the native in Africa is becoming more and more necessary, not only for his own sake but also for the future development of Africa.

It is obvious that communication between the tropics and temperate zones will increase inevitably and rapidly. Already, we all know persons who have visited the tropics on business or pleasure and who have returned in ill health. Individuals suffering from sprue or from other tropical diseases wander in increasing numbers about the country not knowing where to turn for proper treatment, even when they are able themselves to give the physician the correct, diagnosis. More physicians of special training are needed to take care of such cases.

In the tropics are still found great storehouses of raw materials which are vital to industry in the northern hemisphere, vast territories awaiting agricultural development, rich mineral deposits to be exploited, and large reserves of labor.

Enough, I think, has now been said to emphasize the urgency of some of the medical problems which must be faced in the tropics; the tremendous medical contribution toward economic conquest of the tropics has been pointed out, and the growth of knowledge in tropical medicine has been outlined. Let us glance then at some of the questions which may occupy the future student of tropical medicine, and let us inquire also whether there may not be new ways in which old problems might be approached with the prospect of profitable results.

UNSOLVED PROBLEMS

The effects of tropical sunlight upon man have been studied to some extent but much more knowledge of them is needed. Is the sun of India and of Africa, for example, really more dangerous to man than that of South America or of the Philippine Islands, or is the supposed greater danger of the former merely a superstition?

How much of the headache and exhaustion following prolonged exposure to intense sunlight is caused by deleterious rays which might penetrate headgear or clothing, and how much is due to overheating of the head or of the body? A good deal of important new information upon the effects of heat and humidity upon the human body is now being gained by the industrial hygienists,[1] and in this field the Department of Industrial Hygiene of Harvard has made important contributions.

The control of amoebic dysentery will not have a satisfactory basis until we can distinguish with greater certainty the pathogenic from the non-pathogenic amoebae, and until we have learned whether or not there are free-living amoebae which are, or which may, become pathogenic.

The broad field of immunity in relation to tropical diseases has hardly been touched. What, for example, is the cause of the immunity of species, of races, and of individuals to infestation by a given parasite? These questions relate to insects, to animals, and to man himself.

Comparative studies of basal metabolism in different races of man have been made under the auspices of the Carnegie Foundation. The results differ sufficiently to indicate that the subject requires further study and that important information may be obtained thereby.

The Rockefeller Foundation is working at problems related to the control of hookworn disease, of malaria, and of yellow fever.

Moreover, little has been done, as yet, to control filariasis, and we have no hopeful treatment for this malady. The therapeusis of leprosy, too, in spite of important gains, leaves much to be desired; and black-water fever is dreaded nearly as much as formerly. These are but a few of the important problems which present themselves.

Although the older methods of investigation have been by no means exhausted, the time is ripe, I believe, for an attack upon tropical diseases by employing tactics which have been relatively little used on this front. I refer to the newer methods of the biochemist, the immunologist, and the physiologist, and to the study of disordered function, when not easily explainable by the pathologist. The physicist, also, might perhaps contribute more information than heretofore about light, and possibly about other kinds of emanations as well.

Further investigation may not only revolutionize present con-

[1] Jour. of Indust. Hyge., Vol. 10, No. 10, Dec., 1928.

ceptions of many of the tropical diseases, but the information gained may have vast importance in relation to the habitability of the tropics for northern races. Broader knowledge might greatly facilitate the commercial development of tropical resources, the economic value of which is already enormous. The value of these resources increases fast but who can estimate their ultimate significance? Striking figures showing a rapid increase in our commerce with the tropics can be found in Siegfrieds' book, "America Comes of Age."

MEDICAL OPPORTUNITIES

Those interested financially in obtaining raw materials from the tropics or in promoting development of tropical resources are playing a game in which the stakes are of great economic value. They can afford to pay well for that which is likely to promote the success of their enterprises. Not only should they look with favor upon research which is designed to throw new light upon control or treatment of diseases of the tropics, but they should also subscribe liberally.

Unfortunately, the economic interests, which have profited tremendously in the past by knowledge already gained, which now so profit and which will so profit in the future seldom feel impelled to give generously to medical research in tropical disease. The debt will not be acknowledged and the support will not be secured until we physicians succeed in convincing the business men who are interested in tropical development that it is their duty to support research in tropical medicine, and that the finding of such research may be greatly to their advantage in the future. Meanwhile, in a country which is prospering as no country has ever prospered before, we find that the physician who might devote himself to this important field of study is likely to turn aside from it because of the uncertainty of obtaining the requisite financial aid.

Opportunity for work in tropical disease is provided for selected men by the Army, the Navy, and the Public Health Service. Private practice in our tropical dependencies supports a few more physicians, small salaries and hospital facilities are offered by some American companies which are large employers of labor in the tropics, the International Health Board has a Staff devoted to work in the tropics, and the medical schools in America are beginning to encourage specialists in biology and to provide half-heartedly for more or less instruction in tropical medicine. Few medical schools will do more until the demand for such instruction increases, but, obviously, the

demand will increase, and it is likely to increase rapidly. Some of the larger medical schools should be prepared to meet this demand and they should, even now, be training men for the work, else, they will be caught napping. The movement should be led by the few schools which are best situated and best equipped to undertake this kind of work.

At present, the opportunity for American physicians to make good use of special training in tropical medicine is restricted by the small size of our tropical dependencies [1] as compared with those of Great Britain, by the almost complete medical sterility of our Foreign Missions, and by the lack of vision of most of those in control of our commercial interests in the tropics.

The small purchasing power of the dollar in the United States handicaps the American who might wish to compete in a British dependency, and many tropical countries by their registration laws virtually debar the alien from private practice within their borders.

What, then, might induce the young American to seek a career in tropical medicine? Assuredly the inducement must be strong which will lead him to abandon home and friends to embark upon so uncertain a career. Several motives, probably, will influence the decision. Preeminent among the motives may be the desire to dedicate one's life to the care of sick and the prevention of disease where the need for medical help is very great; or the young man may be enthusiastic at the prospect of working in relatively untilled fields presenting problems which are endlessly varied and peculiarly fascinating. There might, also, be a romantic longing to breathe the perfumes of flowers, to admire the "blazing tropic night", or to enjoy the luxury of sleeping in a hammock. The feet may itch for travel and the eyes demand strange sights or the young man may be blessed, or cursed, with the spirit of adventure.

At this point a word may be said of the spirit of adventure. It is sometimes decried as if it were selfish or even disreputable and sometimes extolled as if it were heroic. Many Englishmen believe that they owe the existence of the Empire to their adventurers, and the English have erected a statue in London to the memory of their hero of Antarctic fame, Captain Scott, even though his object failed. We in America admire our early pioneers. We are proud that an American first reached the North Pole, and many of us are thrilled by the expedition in which Commander Byrd is now engaged. Cer-

[1] The laws regulating medical registration and practice in our dependencies are given in full in the Directory of the American Medical Association.

tainly there is something inspiring in adventure, something which man craves instinctively, and which benefits even the individual who does not participate. Surely, too, the successes of adventurous persons have contributed much to the heritage of all dominant races.

Among the great pioneers of the tropics are the Spanish Captains, the Conquistadors, and the Jesuits who led the way in the New World. In more recent times individual explorers blazed the trails of Africa. Among many other names which come to mind are those of Du Chaillu, the naturalist; of Livingstone the missionary physician; of Stanley the journalists; of Cecil Rhodes; and of Dr. Jameson of South African fame. Tropical medicine, also, has had its pioneers. A few of them have already been mentioned in connection with the development of medical knowledge in this field.

Particularly in Cuba, Porto Rico, Panama, Hawaii, and in the Philippines, American physicians have been leaders. Some of the physicians who achieved most for humanity sacrificed their lives in the course of their work or died later leaving their families in actual want,—a fact greatly to be regretted. Our Government should provide liberally for the families of such men. In so doing it would, at least, acknowledge a debt which can never be paid.

Tropical Medicine is an adventurous field not only because of the greater menace to health common to most parts of the tropics but also because some of the tropical diseases are especially dangerous to life. Witness the deaths of a number of investigators of typhus fever and the loss to Serbia of two-thirds of her medical profession during the typhus epidemic in 1915.

Quite recently the world has been shocked by the deaths from yellow fever in rapid succession of Dr. Adrian Stokes, of Dr. Hideyo Noguchi, of Dr. William A. Young, and of Dr. A. Maurice Wakeman in Africa. Incidentally, it may be stated that one of our own men has demonstrated a method of preserving the virus of yellow fever, which method has enabled him to bring the virus from Africa and to continue his work at home.

If our young physician will avoid the pitfall of personal publicity, and if he intends to strive earnestly to relieve suffering or to contribute to human knowledge, may not a desire for adventure find an honorable place beside the other motives which combine to lead him to the tropics? Let him seek the answer, and let him decide.

When contemplating a career in tropical medicine one should realize that much must be sacrificed, that the fancied charm of life in the tropics may prove to be an illusion, and that he who intends

to reside for long periods in the tropics will need not only a good constitution but great strength of character as well, lest he partake too freely of the Lotus.

But the tropics, unquestionably, have an elusive charm. It is much like the "lure of the East", yet different. It is like the call of the sea, yet different again. I will close now with a few lines by Longfellow which indicate what I mean:

"Wouldst thou,"—so the helmsman answered,
"Learn the secret of the sea?
Only those who brave its dangers
Comprehend its mystery!"