

a sterile formalism quite unrepresentative of nature's unconventional methods. That they have in this case fallen into this pit is due, I think, to the misleading influence of words. Starting with forms in which there are two distinct generations (as in the ferns), and applying very appropriately the terms *sexual generation* to the gametophyte and *non-sexual* to the sporophyte, they have kept these names for the morphologically equivalent stages in the evolution to the phanerogam, not noticing the gradual emptying of the names of their original physiological significance; until, finally, the names themselves have come to stand in their minds for the facts they state, and to be accepted as evidence, or even as final authority, upon the points at issue. The mischievous terms *sexual* and *non-sexual generations* have been and are the cause of the whole difficulty. Let us abandon them.

W. F. GANONG.

SMITH COLLEGE.

A TROPICAL MARINE LABORATORY FOR RESEARCH?

DESPITE the creditable activity which has developed in our country in biological research during the past few years, it must be confessed that it is difficult to explain the neglect upon the part of our naturalists to avail themselves of the opportunity to study the marine life of the tropical Atlantic, especially as one of the most, if not the most, favorable locality for the prosecution of such researches lies within our own territory at the Tortugas, Florida.

As Professor Davenport aptly states, we know more of the life of the Red Sea than we do of that of the Caribbean and Gulf of Mexico.

Our knowledge of the life of the tropical Atlantic is almost wholly dependent upon the results of brief and cursory expeditions, and the innumerable researches which re-

quire a permanent station for their successful prosecution have hardly been attempted. The mere systematic study and classification of forms in our tropical waters is glaringly incomplete, while we have almost failed to take advantage of the exceptional facilities which a tropical station offers for physiological and embryological studies, owing to the fact that the water in the tropics may be readily maintained at the same or at even a lower temperature than that of the ocean itself. In consequence of this and of the remarkable purity of the ocean water at the Tortugas and Bahamas, it is possible to rear larvæ or carry out physiological experiments with far better success than is attainable in our northern stations. If much has been accomplished in work upon the limited fauna of the southern New England or Carolina coasts, how much more might be expected from a study of the far richer fauna under the more favorable conditions attainable in the tropical Atlantic.

The cause of this neglect has been that none of our educational institutions has been able to afford to maintain a permanent laboratory in the tropics, and no co-operation has yet been, or is likely to be, effected which could bring such a laboratory into being.

The establishment of the Carnegie Institution has suddenly changed the aspect of the case, and as it appears to be the province of this institution to support important research work which none of our existing institutions has been able to afford, the prospect for the establishment of a permanent research laboratory in the tropical Atlantic appears for the first time possible.

As far as the writer is aware, no application for the establishment of such a laboratory has yet been addressed to the

Carnegie Institution. Were such an application to be made, it would appear that it should be national in character and that it should aim to secure a laboratory under conditions which will meet with the entire approbation of our leading naturalists, and which will be visited by an able and numerous clientage. The Carnegie Institution being national in scope, is the only one in the country which may hope to secure completely this combination of happy auspices, should it decide to establish such a laboratory.

In order to determine the sentiment of the country concerning the advisability of establishing such a laboratory, letters were sent to leading zoologists of the United States and Canada. Similar letters might also have been sent to the marine botanists, but it appeared probable that the general consensus of opinion concerning the proper situation and advisability of establishment of such a laboratory could be gleaned from the replies of the zoologists alone.

These letters read as follows:

An expression of opinion by leading biologists concerning the advisability or inadvisability of establishing a marine biological laboratory for research at the Tortugas, Florida, or at some other station in the American tropics, will be gratefully received by the undersigned. No definite steps leading to the establishment of such a station should be undertaken until the consensus of opinion and the desires of the leading workers in biology have been ascertained.

Do you approve or disapprove of the plan of establishing a laboratory for research in marine biology at the Tortugas?

If not, what alternative would you suggest?

If established would the station be of any practical service to you, to your colleagues, or to your students?

Criticisms as well as commendations of the plan are equally desired, and both will be published and discussed in a judicial manner in some leading journal of science.

As the replies may be numerous, it is desirable that each should be brief. Your letter may be addressed to the undersigned at the Museum of

the Brooklyn Institute of Arts and Sciences, Eastern Parkway, Brooklyn.

Replies were received from the following forty-three zoologists: M. A. Bigelow, Chapman, Conklin, Dall, Davenport, Dean, Dodge, Edwards, Evermann, Gill, Hargitt, Herrick, L. O. Howard, Jennings, H. P. Johnson, D. S. Jordan, V. L. Kellogg, Kingsley, Lillie, Lucas, MacBride, McMurrich, Metcalf, Mills, Minot, Montgomery, Morgan, Neal, Nutting, Ortmann, G. H. Parker, Rathbun, Ritter, Sedgwick, Springer, R. M. Strong, Treadwell, Verrill, H. B. Ward and four others whose names we are not at liberty to reveal.

All expressed the hope that a well-supported marine laboratory for research might be established in the tropical Atlantic.

Twenty zoologists expressed the opinion that the Tortugas, Florida, would be the best situation for such a laboratory. Among these at least twelve have been upon one or more expeditions to various parts of the American tropical Atlantic.

Sixteen zoologists expressed the hope that a station might be established somewhere in the tropical Atlantic, but were non-committal concerning the best locality. Only three of these sixteen are known to have been upon any expedition to the American tropics.

Seven favored localities other than the Tortugas. Four of these preferred the Antilles,* two the Gulf coast of the United States, and one the Bermudas. All of these seven have been upon expeditions to the tropical Atlantic.

Recapitulating, we see, that of the twenty-two who have been upon expeditions to the tropical Atlantic, twelve favor the Tortugas, three are non-committal, four prefer the Antilles, and one the Bermudas. It is apparent that among those who can speak from personal experience

* Jamaica was specified by two.

the majority favor the Tortugas as a fit locality for the establishment of the laboratory.

Concerning the use which would be made of a tropical laboratory, twenty-two stated that they would expect to visit it and carry on research work under its auspices, sixteen either failed to answer the question or were non-committal, while five stated that the laboratory would be of no personal use to them.

It would appear that, in order to insure the constant use of such a laboratory, it would be necessary to assure the proper publication of all creditable researches and to defray at least a portion of the traveling expenses of students. The latter provision would probably be essential for the first few years of the existence of the station, but would become less imperative later.

We here reproduce a few of the letters which were received and which throw light upon the situation from various points of view:

"From an ornithologist's point of view the Tortugas afford exceptional opportunities for the study of bird migration and of the life history and social relationships of colonial nesting birds. Having no resident land birds, and evidently lying in a highway of migration between western Cuba or southern Yucatan and Florida, the host of migrating birds which visit the Tortugas in the spring and fall write their records on a clean page. That is, the movements of migratory birds are not confused with those of resident species or of merely local wanderers, as is apt to be the case on the mainland. This would be especially true in studying the southward migration of birds which, in the Tortugas, would probably begin late in July. I say probably, simply because we as yet know little or nothing about the early stages of the migratory movements from the United States. At this time, too, an observer in the Tortugas would be admirably situated to secure much interesting data as to whether old or young birds lead the migration of their species. Comparison of his observations with those already recorded from the Florida mainland would also show how

much of the Tortugas migration was directed to or from Florida and how much of it might be termed pelagic. In short, many of the phenomena of bird migration would be observed under far less complex conditions than occur on the mainland.

"The colonies of terns which annually visit the Tortugas to nest would afford a most interesting subject for continuous study by a student who at the same time could be engaged in laboratory research along other lines. The remarkable tameness of these birds permits of that close study of the individual without which the study of the species is always more or less lacking in definiteness, and I know of no more promising subject for ornithological investigation in the field than the life-history of the noddy tern and its social relationships to birds of its own species as well as to those with which it is associated."

FRANK M. CHAPMAN.

"I am heartily in favor of the plan of establishing a research laboratory at the Tortugas, for the following reasons:

"1. The fauna of the coast of the Gulf States is less well known than that of the Red Sea, and is the least known of our coast line, although it is probably the richest. This is partly due to the fact that students of zoology are usually free only during the summer, when the Gulf coast is supposed to be too hot. Your plan will attract occasional winter workers and others in the spring and autumn.

"2. The isolation of the Tortugas is their safety. Parasitic diseases are to be feared only in a larger community.

"If established, I should be tempted to visit the laboratory; I have no doubt Chicago University would be represented by workers there nearly every year."

CHARLES B. DAVENPORT.

"I am very glad, indeed, to send you an expression of my opinion regarding the fitness of the Dry Tortugas as a point for the establishment of a zoological station. For I have collected myself in Florida waters, and I know at first hand what valuable material is to be secured there for research. As far as I can understand the problem of faunal distribution, water currents, and the like, I am decidedly of the opinion that there is no better general locality for a zoological station than the one which you are interested in. The only objection to it, as far as I can see, is the matter of ferriage to and from the mainland, but I think this is counterbalanced by the ad-

vantages derived from the offshore currents. My belief is strong that we have reached the point in our zoological studies when it is necessary to provide investigators with working facilities at a number of conspicuous faunal points along our coasts, and I think that there could be no better move in this direction than by the establishment of a station in the locality you suggest."

BASHFORD DEAN.

"I highly approve of the plan of establishing a laboratory in this or a similar locality, as part of a general plan of a series of stations on the Atlantic coast in the centers of the successive Atlantic faunæ.

"The station would certainly be of great practical service to many American zoologists, and I would hope to make some use of it personally. It appears to me that such a station should be open throughout the year; in this way it would best supplement the uses of the more northern stations, which are principally summer stations. At present there is no opportunity in this country for marine work in the late fall, the winter and the early spring, and I am very sure that in a short time, when the advantages of the location became known, the station would have numerous visitors during these portions of the year. So far as the fauna differs from that in the vicinity of more northern stations, the location would possess advantages for special workers at all seasons."

FRANK R. LILLIE.

"Your letter asking my opinion regarding the establishment of a marine biological laboratory for research at the Dry Tortugas has been received.

"In reply I will say that I am enthusiastically in favor of the plan. As you know, I have some personal knowledge of the Tortugas as a field for biological work, having spent some time there with a party from this university, and I have frequently expressed the opinion that it is the best place for a laboratory that I know of on the eastern coast of the United States. It has several advantages that seem to me to be unique, and no very serious disadvantage, now that the quarantine station has been removed.

"If such a station were established I am sure that it would be of practical advantage to me and to students from this university.

"Of course a good deal depends upon the plan that is adopted. I am not informed as to whether you have formulated any definite plan. If you have, I would be glad to know of it, and would like to have this university have some share in the

matter. Of course I can promise nothing officially, but it seems to me that the state universities of the west could be led to see the great service that such a station might be made to render them. The Tortugas are no farther than the New England coast, so far as western institutions are concerned, and the faunæ of the two are not comparable, so great is the advantage of the Tortugas over the North Atlantic coast.

"I would be glad to help in the furtherance of your plan in any way that I can. Please keep me advised as to progress."

C. C. NUTTING.

"Your inquiry regarding the advisability of the proposition depends upon the standpoint of the individual for its reply. The *practical* question is whether sufficient funds can be secured for the proper establishment of the laboratory, and this is a problem which will color a reply to the subsequent questions, for I do not believe that a poorly equipped or otherwise unsatisfactory laboratory would be of any very great advantage to the country at large, however much it might be useful for the few workers who under such conditions might spend a short time at it.

"I have prefaced my remarks by this statement for the reason that so many projects have been entered upon in this country without means for putting them into satisfactory operation, and with the result that they have been of comparatively limited value.

"Reverting now to the specific questions proposed, and replying to them simply from the scientific standpoint, and without regard to the practical questions of access as well as support as mentioned above, I may say as follows: The location appears to me as peculiarly fortunate for the investigation of marine biology and as offering better possibilities in prospect than any of which I know in this country. I can foresee that the station would be of much practical value to the country at large. Whether, considering the distance of Nebraska from the ocean and the expense incident to the trip, it would be possible for me individually or for my students to take advantage of the opportunities offered I can hardly say in advance. I know from the way in which your article was discussed in our zoological seminar that no project has appealed more strongly to its members than precisely this one. I feel as if it were time that we had a satisfactory subtropical laboratory, and I know of no place which would be superior to the location you suggest."

HENRY B. WARD.

"In general I think that the establishment of a tropical station is highly desirable, but I must confess that, so far as I am personally concerned, or so far as any of my students are concerned, it is not probable that we would be able to make any practical use of a station at the Tortugas. The one great objection to the Tortugas as the site for a station is its relative inaccessibility. One other objection has occurred to me, namely, that the fauna is exclusively marine, whereas by locating a station on some one of the larger islands—for example, Jamaica—it might be possible to have a considerable tropical land fauna as well as marine fauna. I have never visited the Tortugas and can not speak from experience as to whether the advantages there offered entirely overcome the objections I speak of. If so, the station ought to be located there irrespective of these objections. If, however, similar advantages can be found, say on the island of Jamaica, I should myself prefer to see such a station established at that point."

E. G. CONKLIN.

"The proposition to establish a marine laboratory on the Tortugas Islands certainly has much to commend it, and so far as the fauna of the Gulf Stream is concerned, probably, as you suggest, no better station in the West Indies could be chosen.

"The advantages of small islands in affording immunity from tropical diseases are no doubt considerable, yet it must be remembered that a greater land area and a more diversified coast add intensely to the interest of students who go to the tropics for zoological or botanical studies.

"I hope that the attempt to inaugurate a tropical marine laboratory will become a national one, and that before any site is definitely chosen a thorough zoological reconnaissance will be made of the larger islands, particularly of Porto Rico, on its southern shore. The future may see the establishment of a large central station with one or more subordinate ones. In any case you have advanced the idea by setting forth the strong claims of the Tortugas, and I hope that the zoologists of America will take up the question in earnest."

FRANCIS H. HERRICK.

"The plan to have a laboratory in the Caribbean region is excellent. It is something we have long needed. What you say concerning the favorable character of the Dry Tortugas would lead one to think this an exceptionally good location, but this is a point that requires very careful and thorough consideration. It would be well to look to the

fate of laboratories established on small islands and in other out-of-the-way places. We have the Anderson Laboratory on Penekese as a horrible example. A marine laboratory should be in touch with the rest of the world. Perhaps the Tortugas fulfill this condition; but the land fauna is to be considered. In a region like the Caribbean especially it is no less important than that of the sea. Insular forms are in constant danger of extinction; hence it is incumbent upon us of this generation to give them as much study as we can. It is doubtful whether the Tortugas or even the Bahamas offer so good a site as the Greater or even the Lesser Antilles, from this point of view."

HERBERT P. JOHNSON.

"Never having been there, I can not speak of the place as a desirable residence, nor of the facility for going and coming, which are of course very important considerations for students and scientific men, but my impression has been that it was rather expensive going there from the north, and not a very agreeable climate except perhaps in the coldest months. As for the marine fauna there, I can speak in the highest terms of its richness and variety, for I have studied the fauna of that region for many years. There can be no question as to the excellence of the place for obtaining abundant material of all kinds of marine life. Perhaps the very richness of the fauna would be embarrassing to many. My own preference would be Bermuda, probably because I have become familiar with that locality. The fauna there is less rich, of course, but the climate, especially in the spring and early summer months, is more favorable for work and study, being more temperate, and I suppose it is easier and considerably cheaper to go there. Perhaps the social conditions, also, are superior in Bermuda. There would be no lack of materials in either place, and a biological station in either place would be of great value to the progress of science."

A. E. VERRILL.

"I am in hearty sympathy with the attempt to establish a station in the Tortugas, although I think Jamaica would be a better place for a tropical station. One of the most important considerations is accessibility, and in this respect Jamaica has the advantage. Whatever place is selected, some way should be planned to reduce the traveling expenses to a minimum. This would be, I think, an important element in the success of a distant station."

T. H. MORGAN.

It appears to the writer that as the number of persons who will work at a research laboratory is relatively small, richness of fauna and healthfulness of location are probably of more importance than accessibility.

Ideal conditions for a laboratory can not be found in the tropical Atlantic.

The mainland Florida coast is infested with mosquitoes in summer, and its pelagic life is relatively poor. The climatic conditions and healthfulness of the Antilles are not of the best, while their marine fauna is probably inferior to that of the Bahamas or Tortugas. They possess, however, a restricted but interesting land fauna and flora.

The Bahamas lie upon the windward side of the Gulf Stream, and on this account their pelagic life is probably poorer than that of the Tortugas.

The Tortugas are relatively inaccessible, but here we find very pure ocean water, a relatively cool climate, a long period of remarkably calm weather during the late spring and summer, healthfulness due to isolation, and few mosquitoes. The last-named advantage will be appreciated by all who have attempted to live upon the Florida coast or the West Indies in summer.

Were a research laboratory to be established under the auspices of the Carnegie Institution, it might seem advantageous to found it in cooperation with such of our leading universities and colleges as are granting the doctorate for original research. As a tentative proposition, each college might contribute at least \$150 annually for each student which it might send to the laboratory, thereby gaining the privilege of nominating students, who, subject to the approval of the Carnegie Institution, should be given free use of all facilities of the laboratory for the purpose

of carrying out some definite research work. The traveling expenses of this student should be paid by the laboratory and his research should be published in a suitable manner with illustrations. The proper maintenance of such a laboratory would require an assured annual income of at least \$10,000. It would be better to abandon the project than to attempt to carry it out with inadequate equipment and income.

In conclusion, it should be stated that the sole aim of the present writer is to focus the interest of the country upon this project; he desires no official connection with the laboratory, but speaks merely as one of at least forty-three zoologists who are interested in the project. There would appear to be no better medium for a thorough consideration of the subject than the columns of SCIENCE, and it is hoped that sufficient interest will be awakened to evoke an active discussion of the project from all points of view.

The establishment of the Carnegie Institution has, in increasing the possibility for the development of research, placed a corresponding responsibility upon each and every man of science. No laboratory should be founded unless our biologists ardently desire its establishment, and stand ready to avail themselves of its advantages to the fullest extent.

A. G. MAYER.

MUSEUM OF THE BROOKLYN INSTITUTE OF
ARTS AND SCIENCES.

SCIENTIFIC BOOKS.

- I. *Experiments on the Effect of Freezing and other low Temperatures upon the Viability of the Bacillus of Typhoid Fever*, with considerations regarding ice as a vehicle of infectious disease.
- II. *Statistical Studies on the Seasonal Prevalence of Typhoid Fever in Various Countries and its Relation to Seasonal Tempera-*