The Ohio Naturalist,

PUBLISHED BY

The Biological Club of the Ohio State University.

Volume II, DECEMBER, 1901. No. 2.

TABLE OF CONTENTS.

MEETING OF THE BIOLOGICAL CLUB.

November 4th, 1901.

The Biological Club met in Orton Hall and was called to order by the president, Prof. Osborn. As it is customary to elect new officers at the November meeting each year, the Nominating Committee presented the following names: For president, Mr. Mills; for vice-president, Mr. Morse; for secretary, Mr. Tyler. Prof. Lazenby moved that the secretary be instructed to cast the unanimous ballot of the members present for the names proposed. Carried. Messrs. J. C. Bridwell, M. T. Cook and Harvey Brugger were elected members.

The retiring president, Prof. Osborn, presented a very interesting address, an abstract of which follows:

SCOPE OF MODERN BIOLOGY.

It has been the custom in this society, following a mandate of its constitution, for the president on retiring from the chair to give an address, and it is presumed that such an address will either bring to your attention the results of some special investigation, summarize the work in some field of research or outline the progress and problems with which biology has to do.

When a year ago you were so kind as to honor me with this office, two things I think came especially to my mind; one the

success of the club particularly in the new enterprise of publishing a journal; the other the duty, honor and privilege of preparing an address for this occasion. I presume you have all had the experience of contemplating some distance in the future a certain duty, debating the most suitable theme or method, and perhaps seen the time grow shorter and shorter with little real accomplishment. If I were to enumerate the various topics that have come to my mind as suitable for this occasion it would exhaust quite a part of our time; if I could reproduce the current of thought that has flowed from time to time along the pathways of such topics, I am sure you would experience a weariness that I should regret to occasion.

The parts of biology which we may make thoroughly our own are very few. It may be profitable, therefore, occasionally to take a general survey of the field to see what its sphere of influence may be, what phases of life are being advanced by its discoveries or by the distribution of knowledge which follows. It has seemed to me therefore that it would be appropriate this evening to attempt some such survey of biology, even though it be fragmentary and inadequate.

For convenience in arrangement we may group this survey along the lines of practical applications of service to mankind, such as occur in medicine, agriculture and kindred industries, domestic and social life, and those which have to do with the acquisition of knowledge and with education.

Applications of biology in medical science, in agriculture and in domestic life have in many cases assumed such intimate and essential character that we often look upon them as applied sciences more than in any other way.

While biology has been the foundation of all rational systems of medicine and the constant servant of this most beneficent of human professions, the forms of its uses and the wide reach of its service have so increased in recent years that we almost have excuse in feeling that it is a modern acquisition.

Could the ancient disciples of Esculapius, with their views of physiology and anatomy, have seen the present scope of these subjects and the marvelous results in cure and control of diseases by the discoveries and applications in bacteriology, I doubt if they would have recognized it as any part of their biology. Still harder would it have been to appreciate the relations of malarial parasite, mosquito and man whereby a serious disease in the latter is occasioned. Intimate relations of two kinds of life, as evidenced in the common parasites, must have been familiar from early times and their effects duly recognized, though their means of access and necessary life cycles were long misunderstood. But such relations as are found to exist in the production of malaria, Texas fever and yellow fever have been so recently discovered

that we count them among the triumphs of our modern science. Indeed the discovery of such a relationship may be considered as having been impossible until the methods of modern research and the basis of knowledge as to life conditions were acquired, and which made it possible to put the disjointed fragments together. With the fragments thus related the riddle seems so simple that we wonder it was not solved before, but we must remember that it is knowledge which makes knowledge possible.

These direct advantages in medical science are however but part of the great gift to modern methods of disease control, for the possibilities in the control of disease by sanitation, quarantine, vaccination, etc., and other methods are all based on biological data.

In speaking of these recent acquisitions I would not disparage those important, in fact essential subjects of longer growth. Modern medicine would be a fragile structure without its basis of comparative anatomy, physiology, materia medica and therapeutics, which have for long years furnished a basis for rational methods in surgery and medication.

With all this knowledge at hand it is grievous to observe how general the delusion that disease may be eradicated by some much emblazoned nostrum, that some vile 'Indian compound' will be thought to have more virtue than the most accurately proportioned prescription which represents the best that modern science can do in the adaptation of a particular remedy to a particular ailment. That the patent medicine business is a most gigantic fraud and curse will I believe be granted by every scientific man who has made himself acquainted with the subject. Its immense profits are attested by the square miles of advertisements that disgrace the modern newspaper and magazine Fortunes made from the fortunes spent in such advertising, along with the commissions to the lesser dealers, are drawn from a credulous people who not only receive no value in return, but in most cases doubtless are actually injured as a result.

That no student of biology can be deluded by such preposterous claims as characterize these compounds, in fact by any system of cure not based on sound biological principles, seems only a logical result of his training. I do not recall ever seeing the name of a biologist among the host of those who sing the praises of some of these rotten compounds. Mayors, congressmen, professors, clergymen and other presumably educated parties appear along with the host of those who fill this guilty list, a list that should be branded as a roll of dishonor. I believe that educated men owe some measure of effort toward the abatement of this plague. Naturally the medical profession is thought to be the rightful source for action, but among the uninformed any effort there is attributed to selfish motive. Certainly some

measure of reform in this direction would be a service to mankind, and while no sensational crusade may be necessary, each one who knows enough of the laws of life to appreciate the monstrous folly of this business has it in his power to discourage it within the sphere of his individual influence at least. Newspapers are mostly choked off by the immense revenue derived from advertising, in fact I have known some which depended upon this as their main source of support, and have heard the candid statement that they could not have existed without it. All the more honor therefore to the few, and there are a few, which absolutely refuse to allow such advertisements in their columns.

That the modern physician must have a thorough knowledge of biology has become more and more apparent. He has to deal with life, and life thus far at least cannot be rendered into mere mechanical, physical or chemical factors. The activites of the human machine have much that must be studied from the basis of organic nature. If we do not know all the factors or forces of life we do know that there is a complex or combination of forces radically different from any single force of inorganic nature. Chemical affinity, physical attraction and repulsion, mechanical forces may furnish many aids, but the study of life activities must go still further. To do this we must recognize the laws of organic life, the forces of growth and nutrition, of reproduction, of evolution, in fact a host of forces which have no counterpart in the inorganic world.

Modern agriculture and horticulture are so dependent on the principles of biology that to dissociate them does violence to thought. Indeed this relation has existed through all recorded history, but in no period has the utility of biologic laws been so intimately blended with all the processes of cultivation.

The determination of the zones of greatest productivity for different crops, their soil requirements, the introduction and acclimatization of species belonging to other faunal or floral regions, the essentials of animal and plant nutrition, the control of disease or abatement of noxious forms of plant or animal, all these and more are embraced in the service of biologic science to agriculture in its various forms and thus to human interests.

Among special cases cited, but which cannot be printed here in detail, were various plant diseases, and particularly various insect pests, and the discoveries which have brought them more or less under control.

Aside from the sources of food supply, which come under the general term of agriculture, we derive many articles of diet from sources dependent on animal or plant life. The various fishery industries and oyster culture which have been so wonderfully promoted by biological investigations are excellent examples of the service of science to mankind. Game laws for the protec-

tion of certain forms of life of utility to man and the possible sources of food from various animals or plants not yet utilized may be mentioned here. Clothing comes in for its share, as in the methods for protection of silkworms, the saving of fur seals and other fur-bearing animals from extinction, and the use of various fibre plants. The successful growth of sponges, of pearls and many other articles of domestic comfort or ornament are connected in one way or another with biological problems, and their fullest development dependent on rational measures possible when the biological conditions are known.

In another way these questions enter into our social and commercial life. The rights of property in the migrant or semi-migrant forms of life have biologic as well as legal basis and some quite peculiar legal decisions would doubtless have been very different had the biology been appreciated. The classification of turtles as 'vermin' since they are neither fish nor fowl may be given as a case in point. Equally absurd and sometimes more disastrous are some of the rulings by customs officers whose knowledge of biology was doubtless derived from a greek lexicon or some equally good authority. Such quarantine restrictions as have been imposed upon certain products by some governments show total lack of knowledge as to the possible conditions of injurious transportation or else the misapplication of them to serve some special end.

The exclusion of American pork and American fruits from certain countries, the controversy over the fur seals in Alaska, the inconsistent laws of states or nations regarding game, are some of the instances where it is evident that the law-making power and the agents of diplomacy need to be re-enforced with definite biological knowledge.

But there is another phase quite distinct from the purely utilitarian. Biological science opens up to us the facts of life and solves some of the questions of the greatest interest to mankind. What is life? What its origin? What are the factors that have controlled its development and the wonderful complexities which we observe in its distribution and adaptations? Are the forces that operate in the living organism merely physical, mechanical and chemical or are there activities inherent in life itself or that operate only in the presence of the life containing complex? Certainly, in no other branch of science are there problems more inviting. In no other has present knowledge given greater inspiration or greater intellectual service to mankind.

The field for acquisition of knowledge widens with each new discovery. We no sooner gain foothold in some hitherto unexplored realm than we become conscious that beyond this lie still

other realms, knowledge of which has been dependent on knowledge of the routes by which they may be reached.

Thus structure must be known to understand function, and function known enables us to interpret structure. Evolution could not be demonstrated until after there had been gathered the necessary materials to show relations of different organisms, past and present. But, evolution known, and vast arrays of structure become intelligible. Without the knowledge of organic distribution no laws of distribution could be framed, but without the explanation of distribution afforded by evolution the facts are an unmeaning puzzle. So, too, without an effort at systematic arrangement of plant and animal forms no fundamental law of relationship could have been discovered, but given a law of relationship and systematic biology assumes a totally different aspect. Recognition of the multitudinous forms of nature are but one step then in the presentation of the vast concourse in their proper relations.

No doubt biologists will persist till every form of life has been adequately described and some means of designating it adopted. So much may be expected from the enthusiasm of the systematist. Some centuries of effort must, of course, be expected to elapse before the task is done. But it is evident that the modern biology is much less concerned in the mere recognition of these innumerable forms of life, these remotest expressions of the force of evolution, than in the gaining of some adequate conception of their relations, the forces of adaptation that have fitted them for their particular niche in the realm of nature, their relation to the other organisms with which they are associated and which constitute for them a source of support or a menace to existence. That is, modern biology concerns itself not only with the elements of structure in the organism, with the means it has of performing its varied functions with the aggregate of individuals which constitute its species, but goes on to its relations to all the influences and forces which have made it what it is and which sustain its specific existence. Less than this is too narrow a view of the province of biology. Here is unlimited scope for the student who pursues knowledge for love of knowledge.

As an inspiration to the general student the field of biology has always held an important place, and in these modern times its fascination is as potent as ever. Men have attacked the problems of life from many different viewpoints with greatly different aim and great difference in preparation and method in their work. Some of these have sought merely for inspiration for literary effort, but so far as their records have been exact and truthful they are contributions to science, when mixed with "vain imaginings" they become literature and not science, although their right to rank here may depend on literary merit. Every grada-

tion from pure fiction to pure science may be found and every grade of literary merit as well. White and Goldsmith, Wood and Figuier, Kipling and Seton-Thompson, with many others that could be cited, illustrate this wide divergence among writers who have written to the entertainment and the greater or less profit of their readers. The value of such works as these is rather hard to estimate, especially from the scientific standpoint and particularly when one is under the hallucination of a beautiful piece of literary creation. They furnish entertainment and cultivate imagination, some of them stimulate observation and awaken an interest in nature, but unfortunately many of them contain so much that is inexact or erroneous that they may sadly encumber the minds of their readers.

But I would like to call attention here to what appears to me a fundamental condition of scientific work and thereby a necessary result of scientific training. Science is naught if not exact. Accurate observation, accurate record, accurate deduction from data, all of which may be reduced to simple, plain honesty. Anything else is error, not science. It is not that "honesty is the best policy," but that in science honesty is the only possible policy. Hence, scientific training should give to every student this one at least of the cardinal virtues, and we may claim with justice this advantage as one of the results to be derived from pursuing scientific studies. In fact the relation of science and biological science, no less than any other, to general schemes of education, has been one of its most important contributions to humanity.

Biology has influenced modern education both in the matter taught and the method of its presentation. It has gone farther and farther into the mysteries of nature and opened up wider fields of knowledge. It has insisted that the student should be trained not only in the facts and the accurate interpretation of facts, but in the methods by which facts may be obtained, thus providing for the continuous growth of the substance from which its principles may be verified and definite conclusions reached.

In recent years there has been a wide demand for the more general distribution of knowledge of nature, and "nature study" has had a prominent place in the discussions of educators. I must confess to some fear for the outcome of well meant efforts to crowd such studies into the hands of unprepared teachers, though surely no one could wish more heartily for a wider extension of such work well done. It is encouraging to note steady progress in this line and we should be content not to push ahead faster than conditions will warrant.

Our science is an evergrowing one, and I wish to mention briefly some of the conditions of biological research and the conditions essential to its successful prosecution. The time has

passed when it is possible for the isolated individual to accomplish much of anything of value in the growth of science. Such instances as the cobbler naturalist can not well be repeated under present conditions, and biological workers must expect that some part at least of their time is spent where libraries, museums and scientific workers are to be found. I recall meeting some years ago in an obscure little village, with a young man who was following a trade, but whose ardent love for nature had brought him to take up the study of a certain group of insects, and in this group he had conceived the idea of preparing a work covering the geographical distribution for the world. With scarcely the beginning of a library, with no access to general collections, apparently with no conception of the stupendous nature of the task he was so ambitiously undertaking, there was perhaps little danger of his discovering the hopelessness of his case. He doubtless gained much pleasure and individual profit in the quest, but for the progress of science, how futile such attempts. Isolated work is often necessary, often the only way in which certain data can be secured, but if isolation be permanent, if it means to be cut off from the records of what has already been done in one's line of study, progress is painfully slow and results of little value. Access then to the world's storehouses of knowledge, to libraries and museums where one may determine the conditions of progress on any given problem is an imperative condition to satisfactory research.

Another condition almost as imperative is time for extended and consecutive work. There are comparatively few places where, after passing the stages of preparation, one may have the opportunity to give uninterrupted time to pure research, but fortunately such opportunities are increasing.

Another factor is necessary equipment, a condition varying indefinitely with the problem undertaken. Studies of some of the simpler processes of life may be successfully carried on with barely any apparatus whatever, while others require the most costly and complex of machinery. Deep sea investigations, for example, are possible only with a suitable vessel and elaborate apparatus for dredging and other operations, and such expeditions as that of the Challenger, the Blake, the Albatross and others involve such vast outlays that only the liberality of nations or of the very wealthy render them possible.

However, the modest student without a dollar to invest in these expensive undertakings may have the opportunity to work as diligently and effectively as any. So, too, the costly equipments of marine stations, of universities, of national and state museums are open to every earnest worker.

Still another condition related to the best effort in research is a satisfactory outlet for publication. Probably no investigator

enters on an elaborate extended research without the expectation that such results as he may obtain, especially such as are novel and important to the growth of science, shall at some time be given a public hearing and a permanent record in the annals of science. However much this ambition may be overworked and abused, it must be considered the logical and legitimate outcome of research, valuable as an incentive to work, essential to the progress of science.

The output of scientific laboratories is always pressing hard upon the organs of publication, and though we have numerous periodicals open to all, many society proceedings and transactions devoted to their membership, university bulletins intended primarily for the staff and students of each institution, still adequate publication facilities are often wanting. Especially is this true regarding the suitable illustration of papers which depend largely on plates or drawings for the elucidation of the text. Our own modest effort in THE NATURALIST is an attempt to meet one phase of this demand, but you all appreciate, I think, that it is insufficient for the needs of our own institution. Some of the more extended papers resulting from the work of either students or faculty must suffer oblivion, delay or inadequate presentation. Evidently a publication fund is one of our pressing needs.

Opportunities for research have been much increased within recent years, and now it is possible for one to look forward with some assurance to a career in research pure and simple if that is his desire. As many of those present doubtless anticipate such career, it may not be amiss to mention some of the opportunities that now present. Positions in connection with universities and colleges now as for a long time past offer some of the most available openings. Fellowships, and positions as assistants with comparatively light duties with expectation that the holder will devote himself to investigation that will advance his branch of science are offered in many places and their value is shown by the numerous candidates for each position. Many government positions in Department of Agriculture, Geological Survey and Fish Commission demand a high degree of training and offer exceptional opportunities for research.

The first few years following graduation are golden days of opportunity in the way of research. For the majority, perhaps, these are the days when the greatest amount of original study may be possible and under conditions favoring the greatest productivity. As time passes and duties and responsibilities increase the opportunity for uninterrupted work grows less and less. Of course original work should follow necessary preparation but can not be postponed indefinitely, in hopes of a more favorable season, if the individual hopes to accomplish anything of value in his chosen science. Too early publication however is

to be discouraged. Most good things will keep for a time at least, and the opportunity to test and verify investigations before publishing is desirable. It is unwise to attempt to harvest a crop of glory, in scientific fields at least, before the seed has had time to germinate. The extremes of too hasty publication and indefinite delay are both to be avoided.

But this disjointed address must be brought to a close, I have indulged in a medley rather than pursuing a connected theme, but it has been in my mind to show how the influence of modern biology has been felt in every phase of human life and modified every phase of human thought. It touches history and illumines it as a record of human activities, the modifications and adaptations of the most dominant organism of earth. It touches language and infuses it with life as the highest evolution of all means of communication among animals. It enters the sphere of human relations and we see society, government, law, as the most complex expression of forces operative all along the line of organic life.

We may gain inspiration in our work from the thought that our field of labor gives opportunity for the highest service in the advancement of human interests and the intellectual uplift of the race.

The club extended Prof. Osborn a vote of thanks for his valuable address.

F. J. TYLER, *Secretary.*