UTILITARIAN VALUES OF ZOOLOGICAL SCIENCE[1]

I HAVE been asked to contribute my bit to the symposium on the value and service of zoological science by discussing the utilitarian aspects of the subject. The first procedure is, naturally, to inquire into just what we mean by utilitarian. Utilitarian, that is, useful! Useful for what?

If we restrict the meaning of utility to service in filling our pockets or our stomachs, or in protecting ourselves and our possessions from various dangers, in other words, to economic phases of the subject—and I suspect that this is what I am intended to do—then I can not pass on to my more specific assignment without the parting protest that valuable as are the economic applications of zoology, I would rank them as far subordinate to the part that this science has played in widening the intellectual horizon of man and, notably, in helping to cast out from the human mind the twin devils of superstition and ignorance. The firm establishment of the theory of organic evolution is in itself perhaps the greatest event in the development of human knowledge. Not only has it clarified and made significant the uttermost limits of biological science, but its unifying principles have irradiated into all other sciences. Its spirit has pervaded and rationalized the whole realm of human thought.

Before passing to the economic aspects of the science I would also call attention to its unsurpassed value as a means of educational discipline. Somewhere in our educational scheme students should be taught to weigh evidence, in order that they may learn to deal adequately with facts and to evaluate the conclusions of others. This ability can be gained only by actual practise. And nowhere outside of zoology can we, with as little expenditure of effort, find better materials for training in the fundamental processes of observation, perception of relations and inference. Nowhere are there greater opportunities for developing that questioning, impartial, problem-solving attitude of mind which must obtain, if truth and sanity are to rule the world.

But coming now to the more conventional conception of utility as distinct from abstract truth, beauty or the refinements of existence, the science of zoology can boast a proud record of helpfulness in the practical affairs of life, and can point to a lusty brood of economic offspring.

During the past twenty-five or thirty years, in order to justify our existence, however, as professional zoologists we have had to call the roll of these so frequently, that most of you already know the list by heart and can not look forward to its rehersal anew with much but ennui. I shall endeavor, therefore, to make the story as mercifully short as possible.

1. *In Relation to Health and Disease.*—Perhaps it is in the realm of health and disease that some of the most obvious utilizations of zoological knowledge and zoological materials are evident to-day. While our first thought flashes bacteriology before us as the science *par excellence* in medical advancement, we must not forget that bacteriological progress has been and is inseparably linked with animal experimentation, that the great studies in immunity, or on the pharmacological action of drugs are essentially studies in animal life, and that more and more diseases are being shown to be of animal origin or conveyance.

Disease, plague and famine are all biological problems, and the great science of medicine itself is essentially a branch of applied biology. Medicine passed from the

[1] Symposium of the Zoological Society of America, Minneapolis, December 29, 1917.

realm of demonology, incantations, amulets and miasmas, hand in hand with advancing zoological knowledge. The members of the great sister societies meeting with us here to-day, ostensibly as allied medical devotees, are nothing in the world but camouflaged zoologists. For proof of my statement you need look only at the program of the so-called Anatomists. Have they not outdone the Zoologists themselves in presenting a purely zoological program? Moreover it is one which can not even be appreciated without considerable background of zoological knowledge. Contemplating the Zoologist's and the Anatomist's programs side by side, I am reminded of that foolish bit of verse attributed to Bill Nye,

> The Autumn leaves is fallin', is fallin' everywhere,
> Is fallin' through the atmosphere, and likewise through the air.

Can any one here, even with a Taschiro's biometer, detect a difference between the anatomical atmosphere of the one program and the zoological air of the other?

Next glance at the program of the Physiologists or of any of the other affiliated societies and does not a somewhat similar condition exist? In all of these are we not merely looking through different windows at the common science of zoology? Is not an acquaintance with the fundamental principles of the latter the most logical and direct approach to any one of them?

The study of zoology not only gives the beginning medical student practical skill in preparing for the study of the human body, but it also supplies him with a fund of conceptions and develops an attitude of mind that should be of great service to him in all his future work. Acquaintance with a wide variety of animals has invariably proved a boon to physiologists, and knowledge of the life of any form throws reflected light upon human life.

If more specific reference is required to show the relation of zoological science to sanitation and medicine, then let me call attention to the fact that some of our most dread diseases are of animal origin. At once comes to mind such scourges as syphilis, sleeping sickness, malaria, various amebic diseases, hookworm infection, elephantiasis and other filarian diseases, spotted fever, relapsing fever and many other fevers. And where the malady itself is not directly attributable to an invading animal parasite, it is in many cases conveyed by animal carriers. For instances of this we have only to think of bubonic plague, yellow fever or typhoid fever.

So important has become the subject of animal parasites in relation to man and useful animals that not a few zoological departments in our larger universities have thriving courses in animal parasitology. These are elected not only by prospective medical students but by agricultural and veterinarian students and by practically all who expect to go into any branch of economic zoology. Even students of plant pathology are finding that they have to look beyond their rusts, smuts, molds and bacteria, and learn something of nematodes, soil protozoa and other animal forms.

2. *In Agriculture, Animal Husbandry and Related Interests.*—Possibly even more conspicuous than in medicine are the applications which have been made of zoological knowledge to the field of agriculture and related interests. When we realize that injurious insects alone cause an annual loss in the United States of well over a billion of dollars, and that with proper knowledge of insect life and intelligent application of this knowledge, probably at least half of the loss could be avoided, the importance of economic entomology is at once evident. And when we add to this the long list of disabilities and deaths of our common ani-

mals, poultry, fish and game due to infestation by animal parasites—protozoa, tapeworms, flukes, threadworms, various insect larvæ and what not—we can realize that to cope with these pests successfully requires no inconsiderable knowledge of zoological principles and zoological forms.

Where in science can one find more of thrilling interest than in our quest throughout the animal kingdom for friends which we may pit against our insect and other foes? This setting of one species to prey upon another, as of lady beetle on scale-insect, and the world-wide search for suitable predaceous forms which it involves, requires, of course, a thoroughgoing understanding of the life relations of animals in general.

The great field of economic zoology is demanding more and more workers, both in the service of the federal government and that of the various states. Now the call comes for a mammalogist or a practical ornithologist, next for some one to investigate an epidemic among fish, then a man to help fight horticultural or agricultural pests, or perhaps the demand is for a protector of forest trees, an inspector of nursery stock, a scientifically trained apiculturist to safeguard and foster the bee-keeping interests of the state, and so the list goes on.

Another phase of applied biology that is attracting much attention to-day is that of genetics as applied to our farm crops and farm animals. The very fact that departments of experimental breeding or genetics are being established in practically all of our agricultural colleges and experiment stations is sufficient commentary on the practical value of this kind of work.

3. *Conservation.*—The whole subject of conservation of natural resources is so prominently before us at present that it requires but passing mention here. The depletion of our lakes and streams, the destruction of our bird life, the extermination of our game, is a story well known to you all. It is obvious that, first of all, those who are to undertake the correction of these evils must be thoroughly informed. Intelligent management of the situation, suitable regulations and restorations require much knowledge of animal life in general, such as that possessed by well-trained economic zoologists. Lack of such knowledge is accountable for much of the inadequacy of the measures in vogue in many places to-day.

4. *Fisheries.*—Again, the practical bearing of zoological knowledge upon such industries as our fisheries is patent at first glance. When we consider that one season's catch of salmon will run more than 455,000,000 pounds, that the annual yield of whitefish is some 75,000,000 pounds, that the catch of herring will total above 3,000,000,000 individuals, and that the quantities of many other kinds of fish taken run into correspondingly large figures, it is evident that our fisheries are one of our most important sources of food. In dollars the aggregate must be an enormous sum. The Pacific coast catch of salmon alone may in a single season run over $25,000,000. The work being done by the United States Bureau of Fisheries with its thirty-six permanent hatcheries and nearly one hundred auxiliary stations, together with that of the various State Fish Commissions may legitimately be reckoned as economic zoology. There is increasing demand for adequately trained zoologists to enter this practical field. Since such work embraces not only fish, but includes the aiding and controlling of the industries which have to do with such forms as the oyster, the lobster, the shrimp, the crab, the clam, the fresh-water mussel, the sponge and other types, a good foundation of zoological knowledge is clearly nec-

essary for its successful prosecution. In spite of all efforts so far toward regulating seasons of operation and quantities of catch, and notwithstanding much aid by artificial propagation and the control of epidemic diseases, the supply in every field is diminishing. If we are to strike a balance short of extermination, it is evident that much important investigation remains yet to be done.

5. *As a Practical Foundation for Education and Philosophy.*—Animal behavior and comparative psychology constitute the most logical approach to the problems of human psychology. For complex as is the human mind, and artificial as is human society, it has at last been recognized that human processes, mental, neural or vegetative, are only special cases of the more generalized processes of lower animals. The fact is coming to be more and more appreciated that biological researches, biological methods and biological principles can be utilized to a much greater extent in solving the problems of psychology, child study, pedagogy, sociology, philosophy and ethics than they have been in the past. A thorough course in zoology, together with a good digest of the evidences and the factors of organic evolution, a review of our present knowledge of the principles of heredity, and an understanding of the recent work in animal behavior, would seem well nigh indispensable for balance and perspective in the fields of psychology, education and philosophy.

6. *Eugenics.*—Still another field which is of the greatest importance to human welfare, that of eugenics, is fundamentally linked with a knowledge of zoological principles. Practical eugenics, a subject upon which the very perpetuation of our national life depends, consists of the attempt to better the human race innately by an intelligent attitude toward marriage. And the keynote to the intelligence demanded in this connection is knowledge of the laws of heredity.

Since it is with the lower forms of life that we must do our experimenting to establish and test out these laws, and since a comprehension of all that is implied in heredity and its converse, variation, necessitates an understanding of fundamental principles that can be attained only through acquaintance with a considerable range of animal life, a preliminary training in general zoology becomes the soundest method of approach to this important field. A knowledge of different modes of life and development, and an understanding of the causes for the decay and extinction of races of animals, sheds direct light upon the present and the future of the human race, and should be the possession of every one who would see eugenics in its true relations.

7. *Public Support of Economic Measures.*—Lastly, I would urge, from the purely utilitarian standpoint if you please, the necessity of some knowledge of animal life and animal forms, and of their relation to human life and problems, on the part of the general public. The maintenance of regulations for sanitation, for the conservation of natural resources and for similar undertakings, must be in large part a matter of intelligent cooperation of the public. This means that the public must be made to see the purpose of our endeavors and to understand the facts and principles upon which such cooperation is based. Before the average citizen will respect and promote our general economic regulations he must understand why restrictions on hunting and fishing are desirable, why pollution of water supplies is dangerous, why food-inspection, health-inspection, vaccination and quarantine are necessary, why he should approve of federal or state appro-

priations for the establishment of experiment stations, laboratories and the prosecution of many forms of scientific investigation, and nowhere can he get this information so effectively as through biological studies. The scientific ideas and ideals upon which such measures are based if once drilled into the student by concrete example and experiment will inevitably affect his conduct through all his future life. Public encouragement, or at least public tolerance, must exist before we can travel far in the application of biological principles to the welfare of the community or of the nation.

M. F. GUYER

UNIVERSITY OF WISCONSIN

SCIENTIFIC EVENTS

THE LAKE LABORATORY OF THE OHIO STATE UNIVERSITY

FOR the session of 1918 the Lake Laboratory will be located at Put-in-Bay, which is a beautiful harbor on South Bass Island in Lake Erie. This island lies about five miles off the south shore of Lake Erie and twenty miles north of Sandusky, Ohio. It is only a few hours by lake steamer from Cleveland, Toledo and Detroit. South Bass Island is one of the group of three Bass Islands, the others being Middle Bass and North Bass. Nearby are Green Island, Rattlesnake Island and several other smaller islands. This situation offers an excellent location for a Great Lakes biological station. Lake Erie is probably the richest in flora and fauna of any of the Great Lakes. The islands offer a varied environment of rocky shore, sandy beach and woodland. On the mainland, within easy reach, are extensive sand dunes, large marshes, woodlands and streams.

The laboratory will have quarters in the building of the fish hatchery operated by the state of Ohio. The second floor of this building furnishes ample room for lecture and table space. On the ground floor there are large aquaria and several tiers of hatching jars supplied with running water. The laboratory owns a small gasoline launch and rowboats. In addition to this the boats and field equipment of the Fish Hatchery will be available. There is a large boat which will enable workers to visit any part of Lake Erie.

If the change for this year from the former location at Cedar Point to Put-in-Bay proves to be advantageous it is hoped that eventually close relationships can be established with the fish cultural activities in Ohio. The state authorities are giving their hearty cooperation. The staff for the coming session will comprise Dr. F. H. Krecker, Ohio State University, Acting Director, who will give a course in ecology of aquatic animals; Dr. S. R. Williams, of Miami University, who will offer a course in the morphology of fresh-water invertebrates; Professor M. E. Stickney, of Denison University, who will have charge of the work in botany, and Professor Z. P. Metcalf, of North Carolina Agricultural College, who will give a course in entomology. Professor Herbert Osborn, research professor of Ohio State University, and Dr. R. C. Osburn, head of department zoology and entomology at Ohio State University, will be in attendance for parts of the session.

While the courses mentioned above are given for the benefit of those who may need them, the research activities of the laboratory are to be emphasized. Persons who may desire to engage in independent investigation of biological problems will be cordially welcomed. No fees will be charged such individuals unless for special equipment or materials supplied.

Comfortable living accommodations will be afforded in a furnished cottage adjoining the Fish Hatchery. Board will be given at cost.

The acting director, Dr. F. H. Krecker, will be glad to give any information desired. He should be addressed until June 15 at Ohio State University, Columbus, Ohio, after that time at Put-in-Bay, Ohio.

ANTI-TYPHOID INOCULATION

DR. W. W. KEEN has addressed the following letter to the Secretary of War:

In a four-page pamphlet entitled "Why Is My Soldier Sick," issued by the National Anti-vivisec-