

of the station's program of work by individual or organized farmers, or it may be the indirect and insidious influence of the ability to cite definite financial benefits to the state or nation from the result of each completed project of station work, as a matter of pride in achievement or as an influence in securing future moral and financial support for the station's program.

Whatever the character of the pressure may be, it will be most unfortunate for the ultimate success of agricultural research in America if this pressure is allowed to influence the methods by which the station research is conducted. I believe it to be a cardinal principle of station research that the investigations shall be pursued according to the very best possible methods of scientific inquiry by a staff of investigators who are as well trained in these methods as it is possible to obtain. It is, of course, fortunate for the man himself if he has had such practical experience in farm operations as will lead him to see the possible applications and ramifications of his problem and such a back-ground of experience is an undoubted aid in the selection and formulation of a project to be undertaken; but, on the other hand, it may be a real handicap if it so prejudices him against certain methods of study as to limit his working tools of investigation, or if it gives him such pronounced preconceptions as to the probable outcome of the investigation as to unconsciously warp his observations or conclusions. From the standpoint of the successful prosecution of station research an open and unbiased mind and the ability to use skillfully all the working tools which are afforded by a proper knowledge of fundamental sciences, are, in my judgment, better qualifications for station research than is any amount of practical farm experience.

I am not discussing preparation for extension or teaching of agriculture; but preparation for agricultural research. I do not wish to appear to belittle the value of practical farm experience to any worker in scientific agriculture. I know what its value has

been to me. Nor do I underestimate its value in contributing to the solution of many problems which come to the station to be answered. But there are hundreds, if not thousands, of farmers in every state who have a vastly better wealth of farm experience than bring to the solution of these problems than we could possibly get for our station men. They can, should, and do contribute the part to the improvement of agricultural practices which farm experience can teach. They can not contribute what scientific inquiry has to add to agricultural knowledge and it is this latter contribution which our stations should be organized to provide.

I have every confidence that the future has even greater opportunities and successes in store for the contributions of science to agriculture than the past has had, and I, therefore, close this paper with the utterance of my profound conviction that the present apparent slight reverse is but a temporary phase of the general problem of agricultural development in America, and that the outlook is for future opportunities which will challenge and stimulate our very best efforts to meet them.

R. W. THATCHER

NEW YORK AGRICULTURAL  
EXPERIMENT STATION,  
GENEVA

#### ZOOLOGICAL RESEARCH AS A CAREER

IN the present state of the subject a person looking forward to a career in zoology must, in most cases, expect to find it in academic life. Here there are increasing opportunities leading out into special lines such as anatomy, physiology, genetics, histology, embryology, cytology, entomology, paleontology and in occasional cases into systematic work upon limited groups, such as fishes, reptiles, birds, mammals, molluscs, etc. The increased entrance requirements of professional schools, demanding scientific training, has led to larger numbers of students in the elementary zoological courses, thus making more teaching positions in colleges; while improved methods of instruction in anatomy, physiology, histology, and embryology have

opened up positions in medical faculties for trained workers in these subjects.

The history of a professor of zoology at present would run some such course as this. While an undergraduate he might show a special interest and ability in the subject leading to an appointment as assistant of some kind in the laboratory. Upon graduation he might receive a scholarship in the graduate school and later a fellowship, these various appointments making him somewhat self-supporting. Having obtained his Ph.D. degree and developed a special interest in some phase of zoology he could expect to be appointed an assistant or instructor taking part in the laboratory instruction of the elementary courses. After a time he would be given charge of a class in the particular subject in which he had specialized and with it the rank of assistant professor. After a number of years he would attain the rank of associate professor or its equivalent. Finally after a period of about fifteen years he might be made a full professor. During the preliminary years of his career his salary might range from \$1,000 to \$3,500 per year, while as full professor his income would be from \$4,000 to \$6,000. Within recent years salaries have advanced and in a few places reach from \$8,000 to \$10,000. While from the financial standpoint not much can be said for such a prospect there are many additional compensations which are worthy of consideration. Chief among these is the opportunity for constant mental growth and development, and the contact with young and inquiring minds which keeps the mind active and adaptable. Constant association with the best products of human thought, and with pleasant and congenial fellow-workers, together with opportunities for travel and study in the summer vacation constitute arguments of great weight for any one whose tastes incline to a scholastic life.

The added attraction of a career in a chair of science is that one deals with matters which are essentially of interest to our present civilization. The contributions made to human knowledge are now almost exclusively

in science. Other civilizations have equalled or excelled us in many lines of endeavor, but in coming to an understanding of the real nature of ourselves and of the universe in which we live, we stand apart. An opportunity to take part in enlarging the bounds of human knowledge and in gaining control over the conditions of human existence must appeal to the imagination of any young man, who really has ambition to leave the world better than he found it. The teacher has the additional satisfaction of contributing to the forces that will continue the attack upon Nature's secrets because his students live after him.

Added to the attractiveness attaching to any scientific position the zoologist finds a compelling interest and satisfaction in studying living things and in learning from them secrets which profoundly affect his own existence. It is only necessary here to recall that Darwin, in establishing the theory of evolution, supplied a philosophy which has dominated every phase of human affairs in the last half century. Every year sees additions to our knowledge of life and its processes which make for a better and fuller human existence. The subject of zoology is so young and fertile that any capable person may hope to make a worthy contribution to it. Because of this he may well forego opportunities more attractive in a worldly way.

But should there exist a taste for scientific pursuits and a disinclination for scholastic life there are many ways in which a scientific training can be utilized outside the school room. The national government maintains extensive laboratories among which are those dealing with the applications of zoological knowledge. At present these are largely concerned with parasitological questions, but in the study of these there open up fascinating life histories of animals, and their pursuit involves travel and investigation in many lands. To one interested in fishes and their ways the Bureau of Fisheries offers many opportunities, some of which lead to ocean voyages and experiences with the mysteries of the sea.

The most extensive demand that the government makes, however, is for entomologists. Large numbers of such specialists are engaged in the study of insect life in all its aspects. A part of this work is done in the laboratories of the Department of Agriculture, but in many cases the field studies constitute a large proportion. Some of the investigations are of the most fundamental scientific value and there are projects for the exhaustive studies of life histories, such as, for instance, that of the honey bee. In this case several men give all their time to investigating, with excellent equipment, the complicated social and biological life of the hive.

As biological science grows, places are made in government departments to take advantage of the latest developments. Within recent years the subject of genetics has undergone rapid development and some of the underlying laws of heredity have become known. To extend our knowledge of these and to make them applicable to animal breeding the Department of Agriculture has established special facilities for the study of genetics and has employed men to investigate breeding problems in the most comprehensive manner. Positions thus opened are very attractive to persons desiring to follow the career of an investigator unhampered by teaching responsibilities.

The states now are also setting up laboratories which require trained zoologists. These may be in their universities and colleges or may be connected with public health departments, biological surveys, entomological commissions, or museums. Among them they offer some variety of choice but, in general, are distinguished from teaching positions by greater contact with the general public and by a larger element of administrative or regulatory work.

Similarly, large cities have established departments of public health in which there is occasional demand for zoologists, principally in entomological or parasitological studies. In some cities also there are municipal museums and zoological gardens which require zoologists trained as collectors, field naturalists and systematists in different groups. Sometimes these positions are very attractive.

Finally there are research institutions on private foundations where opportunities for zoological investigators are of the highest character. The development of these has been due largely to the failure of universities to make adequate provision for research. The rapid growth of science and the expensive equipment required for investigational work, together with the necessity of providing plenty of unhampered time for the student of new problems, has made inevitable and necessary the establishment of research institutes. Since these are well-endowed they offer attractive openings for thoroughly trained zoologists.

C. E. McCLUNG

UNIVERSITY OF PENNSYLVANIA

## GEOLOGY AS A PROFESSION

### INTRODUCTION

"THE geological book—the greatest historical document of the ages . . .," these are the words of one worker after thirty active years of teaching and research. Are the attractions of geology really such that able young men of to-day may expect to be led to similar enthusiastic exclamation after their initiation into the science? To answer this question is the purpose of this paper.

### RELATION TO OTHER SCIENCES

The first point which should be understood is that a liking for chemistry, physics, biology, mathematics, astronomy, or economics, excludes no one from becoming a geologist. Geology is not truly an independent science; it is a combination of other sciences directed towards a specific field of study—the earth. One of the greatest deterrents to more rapid progress in geology is the lack of broad training in other sciences; a professor of geology in a well-known university recently remarked that he would rather teach a graduate student well-grounded in other sciences and knowing little geology, than one well trained in geology and knowing little of other sciences. The fact that geology is in many ways not one of the exact sciences by no means indicates that a foundation in these is