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COOPERATION BETWEEN ZOOLOGICAL LABORATORIES AND THE GOVERNMENT BUREAUS

THE establishment of the Council of National Research and the utilization of a host of other scientific workers from universities and colleges in all sections of the country as parts of the war machinery of the government has for a considerable period and on a large scale brought the college scientists in close contact with the scientists of the governmental bureaus in Washington. This has, I believe, brought about a mutual feeling of friendship and cordial understanding far beyond anything hitherto existing.

Now that the extraordinarily varied scientific work being regularly conducted in Washington under governmental auspices has become more widely known to college workers, the way is open to make this information useful. For instance, would it not be practicable for the head of each college biological or zoological laboratory to make a point year by year to secure first-hand information as to the many lines of governmental work in progress in his branch of science, both as to research problems and as to the application of scientific knowledge to economic work? Probably no field of research offers the student a greater number of subjects of general value to the community.

Possibly the college zoological laboratories might obtain funds, perhaps as fellowships or in other form, with which the more promising students could be given opportunity to visit government laboratories in Washington and elsewhere and become acquainted with government workers in the lines in which they are interested. In this way they could get definite information as to methods of research, the practical handling of various problems and the technique of the leading government

workers, which could not fail to be most helpful in their subsequent studies.

Men of ability could often find opportunity to take up cooperative work in connection with government investigations and eventually many of them would unquestionably join the army of scientific men in the government service, which is helping build up modern agriculture and other forms of food production and conservation, the public health and other beneficial activities.

The extent and variety of the zoological problems being handled by the government bureaus are well illustrated in the activities of the Bureau of Fisheries of the Department of Commerce and in the Bureaus of Animal Industry, Entomology and Biological Survey of the Department of Agriculture, represented here to-day.

The close relationship often existing between technical scientific investigations and the practical application of the knowledge thus obtained is well illustrated by the development of the Bureau of Biological Survey. In its early history the small organization which has since become the present bureau, while taking up certain problems concerning the economic relations of birds, devoted much the larger part of its attention to essentially technical field and laboratory investigations of our native birds and mammals. As the investigations advanced new vistas were opened and numerous practical problems demanded attention. As a natural evolution the technical work became the foundation of the practical work directly for the public benefit.

The facts developed from exact study of the food of birds through microscopic examination of their stomach contents, with field observations on their numbers and distribution, so conclusively demonstrated the value of birds as insect destroyers that public opinion has caused the passage of state laws for their protection throughout the country. The latest result has been a treaty between the United States and Great Britain for the protection of migratory birds in this country and Canada.

The investigators of the food habits of birds must have, in addition to a knowledge of birds, a good working knowledge of insects and of plants. Studies of the food habits of birds are constantly in progress and there is always room for additional investigators in this field.

As the result of the field investigations of the distribution and habits of birds and mammals large series of specimens have been collected and early in the work the fact developed that there existed a surprising lack of technical knowledge concerning our bird and mammal life. In consequence, a number of investigators have been engaged for years in the study of these and other recent collections, and numerous monographs of groups of mammals and shorter papers on birds have been published. These studies have resulted in the discovery of new genera and hundreds of previously unknown species, especially of mammals. The field is still a promising one, particularly as concerns the anatomy, osteology and embryology, and the life histories of most of the species.

The Biological Survey is charged with the administration of the federal laws for the protection of birds, which entails investigations, both technical and non-technical, in order to supply information covering a wide range. Among other tasks it is our duty to determine which species are beneficial and which harmful, and to discover methods for the control of the harmful species.

In addition it is necessary to have definite information concerning foreign birds and mammals, since the law requires that control shall be exercised over the importation of birds and mammals of injurious habits in order to prevent their becoming established here. For example, the colonization of the mongoose in this country would be a calamity of far-reaching effect. At the same time the importation of certain harmless and useful species is encouraged.

With the increased occupation and great extension of farming and stockgrowing throughout the country it has developed that certain native mammals which exist in enormous numbers have become excessively destructive to the crop and meat output. Predatory ani-

mals, such as wolves, coyotes and others, have been killing more than $20,000,000 worth of live stock yearly on the western ranges, while swarming millions of rodents, such as prairie-dogs, ground squirrels, jack rabbits, field mice and others, were destroying farm crops, orchards and forage to the approximate value of $300,000,000 yearly. Through investigations of representatives of the Biological Survey, effective methods have been developed for the destruction of these pests on a large scale. These pests occupy such an enormous area, however, that the cost of handling the problem is a large one. Improvements in this work are still possible and investigations are being continued to devise still more economical and effective methods.

Recently other investigations have been begun to determine with scientific accuracy, through fenced plots of land in the west, the definite amount of injury done to forage production by the principal different kinds of rodents. There is much room for cooperation here and the results will be of the utmost practical value.

The Forest Service finds it impossible in many places to accomplish successful reforesting by seeding until the native mice, and sometimes chipmunks and other rodents in the vicinity, are destroyed. This leads directly to the fact, which has become recognized only recently among a few investigators, that mice and other small rodents, common nearly everywhere and which swarm in surprising abundance over vast areas exercise a great and at times perhaps controlling influence on the character of the vegetation prevailing, including forest production. Dr. MacDougal, of the Carnegie Desert Laboratory, at Tucson, Ariz., informs me that he finds the small desert rodents have a decided effect on the character of the desert vegetation through their destruction of seeds and of the sprouting plants. The exact facts in regard to this relationship between rodents and the native vegetation are not definitely known in the case of a single one among the hundreds of species of these small animals.

The study of our bird and mammal life and its relation to its environment, its distribution and other factors in the life history of the species are in part the object of the biological surveys of the states which the Biological Survey is conducting as rapidly as its means will permit. These investigations include both the field study of the birds and mammals and the technical investigations relating to their taxonomic characters in the laboratory. To enter into investigations such as those mentioned above requires a technical knowledge of the species of birds and mammals.

The house rat causes losses approximating $200,000,000 yearly in the United States. One of the greatest needs in controlling these pests is an effective poison which they will take freely. The investigator who discovers this will do a great service not only to this country but to the world. Little exact knowledge is available as to the relation of rats to the spread of diseases of man other than bubonic plague.

It is also desirable and important to learn whether other native rodents than the California ground squirrel are susceptible to the plague and can transmit it. The ground squirrel named is known to be a plague carrier. In important practical questions, such as that of determining the disease-carrying rodents, a technical knowledge of the various species and their distribution becomes of prime importance.

Many of the government bureaus, including the Biological Survey in the Department of Agriculture, are now cooperating with agricultural colleges and certain activities in universities. Yet the great majority of people out of Washington do not generally appreciate the real extent and variety of investigational activity in the capital, not even men engaged in related lines of work. The spirit of cooperation, however, is growing. An instance of this is the awakening interest of state institutions in the investigation of the relation of rodents to the production of forage plants, crops and other vegetation. A representative of the Agricultural College of Arizona is actively cooperating with the Biological Survey in a project of that character begun last

year in southern Arizona. The Agricultural College of the University of California has worked out a plan for cooperation with this bureau in the study of the relations of rodents to forage production in that state. The Museum of Vertebrate Zoology of the University of California is continually cooperating with the Biological Survey in its technical research relating to birds and mammals. Other universities have been cooperating along certain lines, as in the case of the Universities of Michigan, Wisconsin and Stanford with the Bureau of Fisheries. In some institutions of learning work is being conducted along lines parallel to that of the Bureau of Biological Survey, but without any definite cooperation and in some cases apparently without any definite effort to keep informed as to current work being done in Washington.

The biological surveys of the states covering field studies of the species of birds and mammals and the most characteristic vegetation and their distribution in relation to temperature or life zones, which this bureau has been conducting for many years, have in some instances, as in the case of Oregon and Washington, had local cooperation from state institutions. The bureau will be glad to see much more of this active cooperation developed in the future. Then, whenever a state survey is being conducted, students of the local colleges may have an opportunity for doing field work in the study of birds, mammals and the distribution of plants, thus gaining an insight into the relationships which exist in nature and obtaining a practical knowledge of field methods which have resulted from years of experience. The Biological Survey welcomes cooperation and will be glad to make itself helpful to students and laboratory workers who desire information or suggestions which may be useful in developing their studies.

In the practical handling of economic zoological problems it is interesting to note the close dependence of one specialist on another. The Biological Survey is continually forced to seek aid of the specialists in the Bureau of Entomology, in the Bureau of Animal Husbandry, in the Bureau of Plant Industry, and even in the Bureau of Chemistry. This being the case, it is evident that the college student of narrow viewpoint will be at a disadvantage when getting into professional scientific work.

The foregoing facts touching the work of the Biological Survey are illustrative of the many opportunities for useful research open to the student of birds and mammals. These opportunities form only an exceedingly small fraction of the vast field covered by economic zoology and the necessary attendant technical studies.

In its relations to the public welfare economic zoology is of the most vital and far-reaching importance. Animal life, from its lowliest organisms, among which lurk some of our deadliest foes as well as beneficent friends, to the highest vertebrates, touches and affects our lives and welfare in innumerable ways. It must be studied in all its phases as never before to guard against previously unsuspected or little-known diseases of man and domestic animals, as well as to develop the wealth and ever-increasing variety of products from which we obtain food, medicines, clothing, dyes, ornaments and an endless number of other useful articles. No man can now be considered well informed who has not a general knowledge of economic zoology in its more direct relationships to human life. The scientific investigator finds in the subject the charm of endless variety and of service to mankind.

E. W. Nelson

THE HISTORY OF POISON GASES

The introduction of poison gases by the Germans at Ypres in April, 1915, marked a new era in modern warfare. The popular opinion is that this form of warfare was original with the Germans. Such, however, is not the case. Quoting from an article in the *Candid Quarterly Review*, (4–561), "All they can claim is the inhuman adoption of devices invented in England, and by England rejected as too horrible to be entertained even for use against an enemy." But the use of