between them. Sections of the spikelets show that the floral organs are extensively occupied by the bacterial organism which may be found filling the spaces between them. The disease seems to be that of the upper portion of the plant and has not been found on the roots or lower internodes and sheaths. There is produced a premature drying and bleaching of all the parts of the plant covered by the bacterial ooze. When the bacterial slime hardens it may be separated from the plant surface in the form of thin, lemon-yellow flakes.

At room temperature (25° C. ±) the organism grows very slowly on nutrient neutral agar. Plates that were thickly sown did not begin to show growth until the eighth day, while very thinly sown plates produced no bacterial colonies. However, the organism grows promptly on cooked potato, producing a viscid, lemon-yellow growth at the end of about the sixth day, but growth is apparent by the end of the second day. Organisms taken from a two-day cooked potato culture and stained with carbol-fuchsin, are about twice as long as broad and occur singly or in pairs joined end to end. A white organism which grows readily in agar is frequently found associated with the yellow organism.

This disease of western wheat-grass has many characteristics in common with Ráthay's disease of orchard grass (*Dactylis glomerata*, L.) caused by *Aplanobacter ráthayi*, E. F. S., and described by Ráthay[1] and later by Smith.[2]

First: The characteristic viscid, lemon-yellow slime forming layers over the uppermost leaves, the upper internodes and the different parts of the inflorescence is common in both dieases.

Second: The injury to the plants is due to the bacterial growth which first develops conspicuously on the surface and only later penetrates into the interior.

Third: The bacterial organism in both diseases produces a characteristic lemon-yellow growth.

Fourth: The best growth is made upon cooked potato; growth on agar is very slow and unless the organism is thickly sown growth does not readily take place.

Fifth: A white organism which readily grows on agar is frequently associated with the yellow organism in both diseases.

An extended study of the disease and the causative organism is in progress and the results will be published later.

P. J. O'GARA

DEPARTMENT OF AGRICULTURAL INVESTIGATIONS,
AMERICAN SMELTING & REFINING COMPANY,
SALT LAKE CITY, UTAH,
July 13, 1915

1 Ráthay, Emerich, "Ueber eine Bakteriose von *Dactylis glomerata* L.," *Sitzber. der Wiener Akad.*, 1 Abth., Bd. CVIII., pp. 597–602, 1889.

2 Smith, Erwin F., "A New Type of Bacterial Disease," SCIENCE, N. S., Vol. XXXVIII., No. 991, Dec. 26, 1913. "Bacteria in Relation to Plant Diseases," Vol. III., August 4, 1914.

REPORT OF THE SAN FRANCISCO MEETINGS OF SECTION F OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE opening session was held on Monday morning, August second, in San Francisco, in joint meeting with all other sections to listen to addresses of welcome and the address of the president of the Pacific Coast Division of the American Association for the Advancement of Science, Dr. W. W. Campbell.

In the afternoon, the Section adjourned to the University of California, Berkeley, where, in conjunction with the American Society of Naturalists and the American Society of Zoologists, the following papers were read.

On Wednesday, August 4, the affiliated societies made an excursion to Stanford University, at Palo Alto, and in the afternoon held a joint session with the American Genetic Association and the Eugenics Research Association.

The program for the San Francisco meetings was arranged by the following committee:

COMMITTEE ON PROGRAM

Charles A. Kofoid, chairman, University of California; Barton W. Evermann, California Academy of Sciences, San Francisco; C. H. Gilbert, Stanford University; Joseph Grinnell, University of California; S. J. Holmes, University of California; Vernon L. Kellogg, Stanford University; William E. Ritter, University of California; Harry Beal Torrey, Reed College, Portland.

JOHN F. BOVARD,
Acting Secretary for Section F

PROGRAM

Monday, August 2

Afternoon Session, Demonstrations

In charge of W. P. Taylor, University of California

Pacific Coast Crabs, F. W. Weymouth, Stanford University.

Papers: Conservation

Barton W. Evermann, California Academy of Sciences, San Francisco, presiding

Opening Address, Charles A. Kofoid, University of California, acting vice-president, Section F, Zoology.

Conservation and Utilization of our Fur Seals (illustrated with lantern slides): George Archibald Clark, Stanford University.

The paper pointed out the importance of the herd which has yielded twenty-six millions in revenue to the treasury since transfer from Russia in 1867. The seal herd was shown to be reduced to-day to one tenth its original size, with corresponding decrease of revenue. Two pertinent features of the natural history of the seals were discussed; first, the polygamous habit, on which land sealing, the removing of the surplus males—as in case of domestic animals—was based and conducted without injury to herd; second, the distant feeding and migration habit, which take the animals constantly outside the ordinary territorial jurisdiction and down in the Pacific to the latitude of Southern California each winter. The decline of the herd was shown to be due to indiscriminate hunting in the open sea, involving the death of gravid and nursing females with their offspring. This form of hunting was stopped after thirty-two years by treaty with Great Britain, Russia and Japan, signed in 1911, in which the United States pledged a share of its land catch of males to Canada and Japan in return for abandonment by their citizens of pelagic hunting. Congress in 1912 in enacting law to give effect to this treaty suspended land sealing also, cutting off vital consideration and jeopardizing the treaty, also involving half-million dollar annual loss and future detriment to herd through overstock of males. A review of government management showed mistakes and apparent inability to deal effectively with problem; marked by inefficiency of transient politically appointed agents and failure to utilize scientific investigations when made at intervals. The need of systematic and persistent expert care and study was shown to be imperative. Management through Treasury Department first and later by Department of Commerce both marked by failure. Transfer urged to Department of Agriculture, which in its biological survey and division of animal industry has experts and facilities necessary to deal with herd, whose problems are analogous to those of sheep, cattle, etc.

Condition of the American Seal Herd in 1914 (motion pictures of the fur seal): W. H. Osgood, United States Biological Survey.

A census of the American herd of fur-seals on the Pribilof Islands in 1914 shows in round numbers 295,000 seals, of which 93,250 are breeding females. This is an increase from 268,000 in 1913 and 215,000 in 1912, or nearly forty per cent. in two years. Although there are other considerations, this increase is due mainly to the treaty of 1911 by which pelagic sealing was stopped. The total number of animals is not large as compared with upwards of 2,000,000 which the herd once contained, but actually it is by no means small and it is reasonable to hope that with proper management a nearly or quite complete regeneration of the herd may be effected.

A very large proportion of the increase consists of young male seals and these, if permitted to come to maturity, will soon produce a large overstock of males of breeding age. This increase and the impending surplus of male life are due principally to a limitation of land killing imposed by a law passed by the congress of the United States in 1912. It has been and may well be contended that this law should not have been enacted. Whether or not the law at the time it was passed had any features deserving support (and this is of no present importance) it is evident that the restrictions imposed by it are now both unnecessary and harmful. That it should be radically changed or entirely repealed is so plain as to be scarcely open to argument.

Motion pictures taken in 1914 illustrate the peculiarities of seals of different classes, their appearance and habits, and sufficiently demonstrate in an incontrovertible way that the seal herd is not, as many suppose, on the verge of extinction. They show also the methods of enumerating seals, of driving, branding, killing and of taking and preserving skins.

The Recent History and Present Status of some Game and Fur-bearing Mammals of California: Walter P. Taylor, curator of mammals, Museum of Vertebrate Zoology, University of California.

The present condition of the native animals of the world is such that the preservation of representative faunas is coming to be one of the important concerns both of zoologists and of governments in widely separated localities. California's list of mammals aggregates 369 species and subspecies, as compared with 80 for Kansas, 94 for Nebraska, 152 for Colorado and 182 for Texas. An examination of the recent history and present status of California's fur-bearing and game mammals, including the beaver, sea elephant, sea otter, deer, elk, mountain sheep, pronghorned antelope, black and grizzly bears, serves to justify according her a place among the important big game countries of the world. There has been a steady decrease in the original supply of wild life of the state dating from the beginning of the nineteenth century. It is coming to be realized that, particularly in a democracy, a special obligation to furnish leadership in movements for the perpetuation of the native fauna rests upon the professional zoologist.

The Administration of Fish and Game Laws: ERNEST SCHAEFFLE, executive officer of the California Fish and Game Commission.

Mr. Schaeffle declared that in California the administration of the fish and game laws during the last twenty years has been made easier through the support of public opinion and the fact that to the violation of the laws is attached a good deal of the same obloquy that attends the commission of larcenies and other unpopular misdemeanors. He denied the claim that California could have on sale the same quantity of game as Great Britain if the British system were followed and that the British system is better for both game and man. Moreover, he pointed out that the limiting of shooting to the aristocracy, even if it is a protection of a sort to the game, is un-American and besides that undesirable.

"In this country we feel that it is not only right but wise that man's instinct for sport be kept alive; would not certain European nations be better off in this crisis if their common people —boys and men—had been permitted to hunt, fish, learn to camp out—and to handle arms? We think so—and further, we think that a state or country where the average man knows how to shoot is safer, in times of peace and war, than those countries which are obliged to depend upon conscript armies of men whose experience with firearms is limited practically to the dismounting, assembling and polishing of their weapons."

One reason why fish and game laws are more cheerfully obeyed now, Mr. Schaeffle said, is that the laws that are framed now are based on knowledge and common sense and sensibly administered.

The Need of Scientific Research in Salmon Conservation: JOHN PEARL BABCOCK, commissioner of fisheries, Victoria, B. C.

It has been supposed that the key to fish conservation is found in artificial propagation, whereby the percentage of egg fertilization is increased, but this has not been proven. Examination of large runs after planting do not show evidence of man's assistance. Feeding in later stages is not well understood and has not been successful. Propagation concerns but a fraction of the fish's life history and even this portion has not been thoroughly investigated. Too much money has been expended on propagatory work and too little on the necessary scientific investigation which should precede such work. [Read by Barton W. Evermann.]

The Crab Problem of the Pacific Coast: F. W. WEYMOUTH, Stanford University.

Cancer magister, the edible crab of the Pacific coast, is found from Unalaska to Lower California in shallow water. It frequents sandy bottoms, feeding chiefly on small fish and crustaceans. The females lay in the fall from three quarters to one and a half million eggs, which are carried attached to the abdominal legs until they hatch three or four months later. The larvæ are free swimming for about four months, but on molting to the adult form in the summer, seek the bottom and take on essentially the habits of the adult.

The principal fisheries are at San Francisco and Eureka in California, Dungeness, Anacortes and Neah Bay in Washington and Boundary Bay and Prince Rupert in British Columbia. Fishing is carried on in shallow sheltered bays by traps similar to lobster pots, and on exposed bars or limited coves by means of hoop nets.

The edible crab was once extremely abundant through most of its range, but has been markedly reduced in such old and heavily fished localities as San Francisco, in spite of protective legislation. We see in the lobster fishery that neither abundance nor wide distribution has prevented depletion under persistent fishing, and that to-day the lobster is hardly holding his own though protected by stringent laws and aided by artificial hatching. It is much easier to conserve an existing fishery than to replace an exhausted one. We should, therefore, anticipate the future heavy fishing in still unexploited regions with laws designed

not for to-day, but for the conditions we soon must face. The following regulations, at present in force to varying extents in different districts, are recommended for the entire coast:

1. A size limit of 6½ and preferably 7 inches, to be strictly enforced.
2. Complete protection of the females.
3. A closed season of three or more months covering the season, varying with the locality, during which soft crabs are taken.

Conservation of the California Elk: Barton W. Evermann (read by title).

Tuesday, August 3

Morning Session, Demonstration

In charge of J. Frank Daniel, University of California

Improved Hydrogen Electrodes and Methods of Using Them, J. F. McClendon, University of Minnesota.

Papers: General Zoology

S. J. Holmes, University of California, presiding

The Importance of Description and Classification in Philosophical Biology and in Education: W. E. Ritter, Scripps Institution for Biological Research, La Jolla.

The Physiological Analysis of Behavior: H. B. Torrey, Reed College, Portland.

Problems Concerning the Relation between Germ Cells and their Environment: Bennet M. Allen, University of Kansas, Lawrence, Kansas.

There is an increasing body of evidence to show that the germ-cells may be influenced by the environment. These influences may strike deep—injuring the germ-plasm so greatly as to produce abnormal development. They may bring about the appearance of mutants, as shown by Tower, MacDougal, Gager and others. In some forms the external influences upon the germ-cells produce only evanescent changes lasting but a few generations at the most. In still other cases they may merely serve to determine dominance in heredity. Sex determination in some forms at least appears to be brought about by these factors. The organism must be able to resist influences of the environment that are frequently met with in their normal life, otherwise animals and plants would be far more unstable than we find them to be.

Much needs to be done in studying the factors that govern the rhythm of germ-cell production, the increased or decreased fertility due to change of external factors such as climate, social life, etc., and the effects of domestication upon reproduction.

The recent marked increase in our knowledge of the glands of internal secretion shows how far-reaching may be their influence upon the organism as a whole. These and other substances present in minute quantities in the blood may well exert powerful influences upon the germ-cells.

Giant Fiber Action and Normal Transmission by the Nerve Cord of Earthworms: John F. Bovard, University of Oregon.

The peripheral nerves in a certain number of segments of an earthworm may be anesthetized and the nervous impulses responsible for locomotion will travel through the cord in the affected region. The distance which these impulses will pass without any reenforcement from muscular contractions is limited to about twenty ganglia. The rate at which these impulses are transmitted is a slow one and is about 22 mm. per second.

The giant fibers are not concerned directly with the locomotion, but with contractions of the longitudinal muscles in quick end-to-end movements. The speed of transmissions in these larger fibers is very rapid, 1,500 mm. per second. In regeneration from simple traverse section of the nerve cord, the recovery is very rapid, and the locomotor fibers resume activity before the giant fibers. When short pieces of the nerve cord are removed, recovery is much slower, but the order in which fibers transmit impulses again is the same as in simpler sections.

Drugs, such as stovaine, when applied to the cord show the same relations as in regeneration. The locomotor fibers recover first and the giant fibers later.

Afternoon Session, Papers: General Zoology

Trevor Kincaird, University of Washington, presiding

The Action of Simple Reagents on Nerve Cells: W. A. Hilton, Pomona College, Claremont, California.

In order to learn something further in regard to the physical constitution of nerve cells, simple solutions which might act in various ways were used. In some cases the nervous tissues were treated directly with the reagent; in others the ganglia, or parts of the brain, were placed in boiling water first. Similar results were obtained by both methods. Acids, alkalies and other powerful reagents were used with the result that in almost every case a fibular groundwork for both

nucleus and cell body was revealed. A similar, but less dense perinuclear arrangement of fibrils was shown in nearly every case. Experiments with vertebrates and arthropods gave somewhat similar results, although the position of the cells and the surrounding parts differ. Living tissues were examined as a check, and by comparison the reticular arrangements of fibrils between and in cells were regarded as artifacts in most cases. Osmic acid gave the least distortion of any single reagent.

Observation on the Laws of the Correlation of Parts: J. C. MERRIAM, University of California (read by title).

Provision for the Study of the Anthropoid Apes: ROBERT M. YERKES, Harvard University.

It is doubtful whether there is any group of organisms of greater importance for biological study than the Anthropoidea. Nevertheless, our ignorance of most representatives of this suborder is more impressive than our knowledge. Of the anatomy, histology, embryology we know much, far from all; of the pathology, physiology and behavior of the apes, baboons and monkeys we know pitiably little: of their psychology and sociology, even less.

Surely it is high time to make provision for the thorough biological study of those organisms which are most similar to man and from whom, therefore, experimental pathology, genetics, psychology and the social sciences and technologies may be expected to obtain information of immeasurable theoretical and practical value.

The need of an anthropoid station is obvious. I know of only one attempt to provide facilities for the study of the apes. That has been made by the Germans in the Canary Islands. I have seen no published reports of data or progress, but through correspondence with the present worker, Dr. Wolfgang Koehler, I learn that observations have not been interrupted by the war. For reasons which may not be stated within the limits of this abstract, it seems wiser to establish an American station rather than to cooperate with the Germans.

There is abundant reason for supposing that the apes may be kept in perfect health over long periods and bred in Southern California. Hence it seems desirable to establish a station there rather than in the tropics[1] where the conditions are much less favorable for research.

[1] The possibilities of Borneo, Jamaica, Porto Rico and other tropical regions have been carefully considered.

The following plan is one which I hope may be carried out: In a suitable locality in California temporary provision might be made for the housing of sexually mature orang utans, chimpanzees and gibbons during a three-year test of the possibility of breeding. At the same time adolescent apes—and monkeys—could be studied by the staff of the station. Since my chief interest is in behavior and mind, I should wish first of all to arrange for the study of their instincts, ideational behavior and social relations. Three years of concentrated effort should add vastly to our knowledge of the behavior and psychology of the apes, as well as settle the practically important question of breeding.

If the apes, as well as the monkeys, can be bred satisfactorily in California, a permanent station should be established at which the most diverse aspects of the lives of the Anthropoidea (including man) might be studied.

Studies on Echinoderm Larvæ (illustrated with lantern slides): TH. MORTENSEN, University Museum, Copenhagen, Denmark.

These researches were undertaken mainly with the view of ascertaining whether there is any interrelation between the shape and structure of the larvæ and the natural relationship of the grown forms of the Echinoderms. They were carried out at the biological station at Misaki, Japan, in Australia, New Zealand, the Hawaiian Islands, and at the Biological Station, Nanaimo, B. C., during the time from May, 1914, till now.

In all the development of thirty-five different forms, mostly Echinoids, has been studied more or less completely. The results completely bear out the conclusions that the larvæ are of considerable value for classification, so that in cases of doubt about the systematic position of some form or other, the larval characters may settle the question; *e. g.*, the genus *Strongylocentrotus*. Within the regular Echinoids distinct family characters are found in the larvæ. Thus the larvæ of the family *Echinidæ* have in their first stage the main rod of their body skeleton elongated and more or less club-shaped, while in the families *Toxopneustidæ* and *Echinometridæ* the body skeleton in the first larval stage forms a sort of frame. In the larvæ of the *Temnopleuridæ* the main rod of the body skeleton is slightly elongated, with some characteristic processes. Previously not a single larva of any Temnopleurid or Echinometrid was known; now the development of three Temno-

pleurids and seven Echinometrids has been studied. Special interest attaches to the larva of *Echinobrissa recens;* it proves to have no likeness to the Spatangoid larvæ, but more so to the Clypeastroid larvæ, from which it is mainly distinguished by the rods of its processes being non-fenestrated.

A remarkable shortened development was found to obtain in *Laganum decogonale* and in *Toxocidaris erythrogrammus.* In the former the larval shape is still distinct, although rudimentary; in the latter there is no trace of larval processes, the embryo being simply worm shaped. A similar shortened development will doubtless prove to occur in the *Schiaster* occurring in the strait of Georgia.

By the successful rearing of the larvæ of a deep-sea species, *Lagunum fudsiyama,* it has been proved for the first time that typical pelagic larvæ may be found among deep-sea forms, and the possibility of studying the embryology of deep-sea forms is shown.

In other groups of Echinoderms the results are not yet sufficient for definitely establishing family characters in the larvæ. An interesting fact is that two species of *Asterina, A. pectinifera* (Japan), and *A. regularis* (New Zealand), have been found to have typical pelagic larvæ.

Hydrogen Ion Concentration in Stomach and Duodenum: J. F. McClendon, University of Minnesota.

The hydrogen ion concentration of the stomachs of normal persons after normal meals was measured every half hour by means of a hydrogen electrode lowered into the stomach or by removing a small sample. The hydrogen ion concentration rises rapidly after injection of the food and reaches a constant level 1½ to 2½ hours after finishing the meal. This level varies with the individual and approaches a limit of 1/10 normal H +.

The hydrogen ion concentration of the duodenal contents removed with the duodenal tube is about 2×10^{-8}.

The hydrogen ion concentration of the infant's stomach rises slowly after nursing and in one hour is about 6×10^{-6}. As the stomach empties the hydrogen ion concentration rapidly rises and becomes .01 normal 4 hours after nursing. The hydrogen ion concentration of the infant's duodenum is about 8×10^{-4} or nearly a thousandth normal and is sufficient for peptic digestion. Pepsin was always present in the infant's duodenum and therefore peptic digestion goes on there.

Parthenogenesis of the Frog's Egg: J. F. McClendon, University of Minnesota.

In 1911 I showed that the frog's egg may be caused to segment by a momentary electric shock, which takes the place of the spermatozoon. The immediate effect of the electric shock or the spermatozoon is increase in permeability since Na, K, Li, Mg, Ca, Cl, SO_4 and CO_3 diffuse out of the egg into the surrounding water at a faster rate. By very careful estimation of the chlorides with the Richard's nephelometer it was found that twice as much diffused out of the egg that had been stimulated electrically or fertilized as out of the unfertilized egg in distilled water. This increased permeability continues for 30 hours or perhaps longer.

The increased permeability protects the egg from swelling. Bachman and Rumstrom supposed the egg was protected by absorption of proteids, but they furnish no grounds for this assumption.

The increased permeability of the sea-urchin's egg lasts fifteen minutes after stimulation or fertilization and some fish eggs are impermeable to water and salt some time after fertilization. That stimulation and increased permeability are related is supported by the fact that increase in permeability of fish eggs is prevented by anesthetics.

Wednesday, August 4, Afternoon Session

Joint session of Section F, Zoology, the American Society of Naturalists, the American Society of Zoologists, the American Genetic Association and the Eugenics Research Association.

Demonstrations

In charge of Mary I. McCracken, Stanford University

Papers: The Rôle of Variation and Heredity in Evolution

David Starr Jordan, Stanford University, presiding

Heredity and Mutation as Cell Phenomena: R. Ruggles Gates, University of London.

Heredity consists in the perpetuation of the difference between related organisms. The older definition of heredity as the tendency of like to beget like is incomplete. Variations are divided into three classes, (1) those which are completely inherited, (2) those which are non-inherited, (3) those which are partially inherited; and these three kinds of variations must have very different evolutionary significance.

Mutations, or discontinuous variations, belong in the first class, and they are of many kinds, differing in their manner of origin and their manner of inheritance. Studies of the cell structure of mutants has made it possible to classify mutations into (1) those which are fundamentally morphological and (2) those which are primarily chemical. The hypothesis that each Mendelian character is the result of a chemical change in the nature of one chromosome in a germ cell, will account for not only the origin, but also the inheritance of every simple Mendelian character. Such a mutation is no more unlikely than mutations in bacteria, many of which are now known to occur. Each Mendelian pair of characters therefore represents a mutation which has occurred in past time.

The morphological mutations at present known consist in changes in the number of chromosomes in cell nuclei. The fundamental chromosome number in the genus *Œnothera* is 14, but *Œ. lata* has 15, *Œ. gigas* 28, etc. In these cases there has been a change in the constitution of the nucleus which may be considered to be morphological in nature. The change is propagated to every part of the organism by mitosis or cell division. Hence, for example, every cell of *Œ. lata* has 15 chromosomes, and the peculiarities of *Œ. lata* appear to result from this fact. One may conclude that each mutation, in plants at least, is a cell change originating in a particular germ cell and represented in every cell of the adult mutant organism.

The Idea of Multiple Causes as applied to Evolution: WM. E. RITTER, Scripps Institute for Biological Research, La Jolla, California.

To be published later.

Seventeen Years' Selection of a Character Showing Mendelian Inheritance: RAYMOND PEARL, Maine Agricultural Experiment Station, Orono (read by title).

Are there such Things as Unit Characters? S. J. HOLMES, University of California.

The doctrine that organisms are mosaics of independently varying elements is one that has figured largely in biological speculation from Darwin's time to the present. It is very intimately associated with many problems of heredity and evolution, and one is very liable to think in terms of the doctrine and unconsciously allow it to shape his opinions even though he may not avow his adherence to it. The doctrine is founded on the assumed independent variability of parts and the independent transmission of so-called characters. Many facts pointing to independent variability have been amassed by Darwin, De Vries and Weismann, and the latter has argued with especial force that it is impossible for several organs to be simultaneously perfected unless variations in the one occur independently of variations in the others. On the other hand, it may be pointed out that numerous variations have far-reaching correlations and that often a variation may be particularly manifest in some one feature, but nevertheless be the result of a general organic change which is only obscurely expressed in other parts of the organisms.

Mendelian inheritance which seems to lend support to the conception of the organism as a mosaic product is open to a quite different interpretation if we assume that what are segregated are not the bearers of unit characters merely, but the hereditary bases of organisms as wholes having this or that peculiarity. The bearing of the mosaic and organismal standpoints on various questions of evolutionary theory can be brought out only in the fuller paper of which this is a brief abstract.

Adaptation as a Process: HARRY BEAL TORREY, Reed College, Portland.

Some Genetic Studies of Several Geographical Races of California Deer Mice (projection of autochromes, with demonstrations and illustrations): F. B. SUMNER, Scripps Institute for Biological Research, La Jolla, California.

Mice of the species *Peromyscus maniculatus* were collected in four regions of California, ranging climatically from the Mojave Desert to the humid northwest coast (Eureka). Fourteen characters of these mice have been measured, and the results subjected to statistical analysis. In general, the Eureka form (*rubidus*) differs more widely from the other three races than these do from one another, and hybridization has not thus far succeeded with it. *Rubidus* exceeds the others conspicuously in length of tail and foot, and to some extent in skull length and cranial capacity, comparison being made between animals of equal body length. This subspecies is also the darkest of the series. The increase in pigmentation, correlatively with increase in humidity, is a well-known principle to which these mice conform, but the increase in the length of the appendages toward the north (shown in *rubidus* and still more evident in Alaskan races) stands in contradiction to another well-known generalization, and is hard to reconcile with experimental evidence.

The subspecies *gambeli* from Berkeley or La

Jolla differs characteristically from the desert form (*sonoriensis*), but these differences relate almost wholly to pigmentation, that of the former being of a deeper shade and more extensive in distribution. Hybridization between these two races has proved easy, but I am not yet prepared to report upon the results.

The desert race has been transferred to the humid atmosphere of Berkeley and reared successfully. Neither the parent animals, nor an F_1 nor an F_2 generation has shown, however, any perceptible approach to the Berkeley type of coloration.

Some interesting modifications have resulted from captivity. Mice of the subspecies *gambeli* and *sonoriensis*, which have been reared from birth in confinement, have been found to differ from wild ones in having a distinctly shorter tail, foot, innominate bone and femur. No significant difference has been found in cranial capacity.

These experiments are being continued at the Scripps Institute, La Jolla.

Fossil Insects and Evolution: T. D. A. Cockerell, University of Colorado, Boulder, Colorado.

The U. S. National Museum possesses a very interesting series of English fossil insects, which originally formed part of the Brodie collection, but came into the possession of Lacoe, and finally reached the museum with the Lacoe collection. In the course of working over these specimens, occasion was taken to review the fossil insects of the British Islands, and incidentally to consider the mesozoic insects of other countries. Since this work was done, it has been ascertained that the British Museum possesses very much larger collections from the same source, which it is hoped to describe during the coming fall and winter. Mesozoic insects are of special interest because it was during this epoch that most of the modern families were established. The rise of the higher flowering plants was necessarily contemporaneous with a great development of insect life, and all the main outlines of this development were certainly completed before the beginning of the Tertiary. Unfortunately our knowledge of Mesozoic insects is extremely defective, but we know enough to reach some interesting conclusions. The English Lias contained great numbers of Coleoptera, and not only were several of the modern families apparently well established, but some of the species showed a well-defined elytral pattern of longitudinal dark stripes or bands, quite like the pattern seen in various living beetles, and varying in the same manner. Thus the outlines of elytral ornamentation, which might be imagined to be recent and unimportant, are actually of enormous antiquity, having been laid down before there were any Lepidoptera, so far as we know, and even prior to the appearance of Hymenoptera.

Great advances have been made in recent years in our knowledge of Tertiary insects, with the result of showing that on the whole progressive evolution has been extremely slow, most of the new species and even genera coming into existence by a shuffling, as it were, of old characters. Wheeler's researches on the ants of the Baltic amber have shown that in the Oligocene the Formicoidea were almost or quite as far advanced as they are to-day. A comparison of the Miocene Bombycid flies with those of to-day shows that at least in certain features, the fossils are not rarely more specialized than their modern representatives. The Garnet Bay Oligocene, a deposit in the Isle of Wight, is full of beautifully preserved insects, and when these have all been worked over we shall know a great deal about the English insect-faunas of that period. The work so far done confirms the general opinion that evolution has been very slow since that period, say within the last two million years. Where genera are strikingly different from those now living, they have simply become extinct. All this is of course very different from the condition among the mammalia. We are bound to conclude that the rate of evolution is extremely different in different groups of animals. The insects are fairly comparable with the Mollusca in this matter, but with this great difference, that the number of species of insects is enormously greater, and the adaptations are much more numerous and more diverse. The great stability of the main features of insect organization is therefore more remarkable. On the other hand, we find in the rocks many evidences of insect migrations, or of the former existence of families and genera where they are now extinct; so that we are cautioned against assuming too much from the present distribution of groups of insects. Insects are in general mobile creatures, and, given vast periods, may readily travel over the greater part of the habitable world. They are, on the other hand, commonly dependent on particular sets of conditions, and thus they are likely to be locally exterminated, the general result being a shifting of insect populations in the course of time, obscuring the original centers of distribution.

H. V. Neal,
Secretary

(*To be continued*)