ANNUAL REPORT
1964-1965

MUSEUM OF COMPARATIVE ZOOLOGY

HARVARD UNIVERSITY

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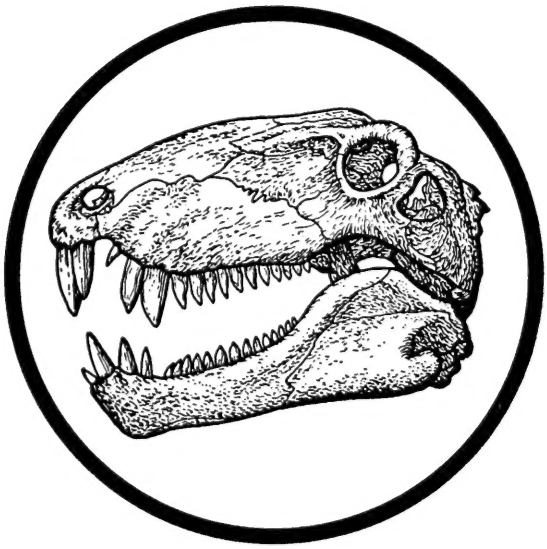

Dimetrodon, a Permian pelycosaur

HARVARD UNIVERSITY
CAMBRIDGE, MASS.
1966

MUSEUM OF COMPARATIVE ZOOLOGY

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MUSEUM OF COMPARATIVE ZOOLOGY

REPORT OF THE DIRECTOR

There is abundant justification for the frequently heard statement "This is the Century of Biology." Biology increasingly stands in the forefront of science. It is evident in the number of publications, in the number of students entering biology, and in the increasing interest of man in himself and in his living environment. The numerous breakthroughs in molecular biology have been duly extolled, but it is perhaps not nearly as well known that other areas of biology are correspondingly active and that they have undergone in recent years a gratifying rejuvenation. This is certainly true for systematics and evolutionary biology, the two branches most actively pursued at the MCZ. Although the describing and naming of newly discovered organisms will continue to be one of his tasks, the taxonomist increasingly studies also the living organism in relation to its environment. Behavior, distribution, niche occupation, population structure, environmental physiology, and all aspects of evolution are more and more his concern. This is why the systematist insists on field work; this is why the Museum of Comparative Zoology is now in the process of acquiring a field research station in Concord; and this is why it is planning a new wing, largely devoted to the study of living animals. Museum zoology is now a far cry from what it was 100 years ago when Louis Agassiz founded the MCZ. Perhaps for a moment he would wonder where he was if he returned today! And yet the basic quest remains the same—to investigate the diversity of the living world in order to understand the causes of this diversity.

STAFF

The increasing involvement of the Museum in teaching has continued this year. More staff members have participated in more courses than ever before. New teaching facilities are being installed in the Museum, to be ready in the next academic year. Research has continued at the same high level as in past years. There is need and there are resources for additional appointments which will be made as soon as suitable candidates can be found.

New staff appointments include: John Francis Lawrence, Assistant Curator of Insects; Michael Tenant Ghiselin and Barry Robert Wilson, Research Fellows in Malacology; Thomas Henry Frazzetta, Associate in Herpetology; and Richard Wainwright Thorington, Jr., Associate in Mammalogy.

We record with regret the death of Richard Winslow Foster, Associate in Malacology since 1950, in his 44th year. He was an indefatigable worker on marine mollusks, and his efforts, both in the Mollusk Department and in the field, have contributed to one of the largest and best ordered collections in North America.

Of awards and honors received by staff members, the following may be singled out for special mention: Professor Simpson received the Daniel Giraud Elliot Medal of the National Academy of Sciences for his book, *Principles of Animal Taxonomy,* written after he joined the Museum staff, and was awarded an honorary SC.D. from Cambridge University, England; Professor Mayr was elected a member of the American Philosophical Society.

Staff members continue to be active in many national and international organizations; herewith a bird's-eye view: Professor Mayr—President-elect, Society of Systematic Zoology, member of the Divisional Committee on Biology and Medicine of the National Science Foundation, and member of the International Commission on Zoological Nomenclature;

Professor Romer—President-elect, American Association for the Advancement of Science; Professor Simpson—President, American Society of Zoologists, member, International Commission on Zoological Nomenclature, Associate Editor, *American Journal of Science;* Professor H. B. Whittington—President, Paleontological Society; Dr. Williams—Vice-President, Society for the Study of Evolution; Dr. Levi—Vice-president, Centre Internationale de Documentation Arachnologique; Dr. Mead—Editor-in-chief, Volume V, *Fishes of the Western North Atlantic;* Professor Kummel—Treasurer, Paleontological Society.

TEACHING

Teaching commitments of the scientific staff are steadily increasing. For the first time, staff members are participating in the Freshman Seminar Program. Other course offerings included: Biology 40 (Newman, Paynter); Biology 121 (Newman, Fell); Biology 127 (Carpenter); Biology 129 (Lyman, Patterson, Mead, Paynter, Williams); Biology 130 (Mead); Biology 149ab (Levi); Biology 221 (Carpenter); Biology 238 (Newman); Biology 248 (Mayr, Simpson); Geology 151 (Whittington); Geology 153 (Patterson); Geology 155 (Whittington); Geology 250 (Kummel); Geology 257 (Whittington); Natural Sciences 10 (Kummel). Research courses were offered by Carpenter, Clench, Darlington, Evans, Fell, Kummel, Levi, Lyman, Mayr, Mead, Newman, Patterson, Paynter, Romer, Mrs. Schevill, Whittington, Williams.

Many staff members gave individual lectures in a number of additional graduate and undergraduate courses. These include Professor Darlington and Dr. Turner, as well as most of those listed above. Professor Romer gave the inaugural lecture of the "Principles of Natural History" series at the United States National Museum; Dr. Turner lectured on Mollusca at Yale University Summer School; Dr. Newman gave seminars at Boston University and Duke University,

and lectured at Southern University (Baton Rouge); Dr. Lawrence gave two lectures at Southern University (Baton Rouge).

The following students, doing their basic research in the Museum, were awarded Ph.D. degrees: Richard Haedrich, Frederick Shaw, and Barbara Stahl.

A special event of interest was the Museum's centennial celebration of the highly successful Agassiz-Thayer expedition to Brazil during the winter of 1864-65, when Louis Agassiz and his assistants collected over 80,000 items of natural history. In commemoration of this event the Museum presented three lectures by George Sprague Myers, Curator of Fishes and Professor of Biology at Stanford University. Following the first lecture, a reception was held for about one hundred guests and senior staff members. In Brazil, the University of Rio de Janeiro and the National Museum also commemorated the expedition with a series of lectures and an "Agassiz Week."

EXPEDITIONS AND TRAVEL

Field research again took students and staff to all corners of the world. Worth noting here are: Professor Romer's six-month fossil collecting expedition to western Argentina; Professor Patterson's second summer in East Africa, working in the Miocene deposits in the vicinity of Loperut in southern Turkana; Dr. Levi's three-month spider collecting expedition to Peru, Argentina, and other areas in South America; Dr. Evans' participation in the Smithsonian-Archbold Biological Survey of the Lesser Antilles, with special emphasis on the collecting of wasps; and Dr. Turner's three and one-half months in India, working with the Wood Preservation Scheme of the Forest Research Institute.

Arnold Lewis spent part of the summer in the Uinta Basin, Utah, where he succeeded in collecting a number of fossil mammal skulls and jaws, augmenting one of the finest collections of small mammals ever to come out of the Uinta.

A number of successful collecting expeditions to South America, Lesser Antilles, Mexico, and the Samoan and Hawaiian Islands, were undertaken by students during the summer months.

A major portion of the funds for field and museum research was made available by the National Science Foundation and the National Institutes of Health, and their generous support is gratefully acknowledged.

RESEARCH

Research interests of the staff cover the usual wide range to be expected from a modern museum zoologist. This short survey will attempt to record some of the more noteworthy research projects and their results.

Taxonomy

Science, as Vannevar Bush has said so rightly, is an endless frontier. This is surely true for taxonomy where some 5,000-10,000 new species of animals are described annually. Indeed, the task ahead seems almost unlimited. This poses real problems of research strategy and moral obligations. Every taxonomist must make for himself a list of priorities and do the things first that are most important. What are they? There is no easy answer to this question but one is fairly safe in saying that his research should be a well-balanced mixture between alpha, beta, and gamma taxonomy. The mere describing and naming of countless new species is not good enough. The author who, for instance, devotes his life to the description of unimportant parasites of an unimportant group of hosts in a remote corner of the globe is certainly not making much of a contribution to biology. Considering that so many new species still have to be described, a taxonomist might well single out for his attention a group that will in due time permit significant conclusions concerning evolution, biogeography, ecology, or taxonomic theory.

The task of the scientist is to further the understanding of nature. Merely to describe the contents of a small nook or cranny of the universe does not make a person a scientist. Such descriptive work is an indispensable first step in research but by itself it does not qualify as science. We must realize that much of taxonomy is merely a means to an end. It is a full understanding of this true meaning of science which is responsible for the many-sided research of the Museum's taxonomists. Even though they all contribute a fair share to the descriptive basis on which taxonomic science rests, nevertheless a serious effort is always made to go beyond this basis, to interpret the findings, and to advance basic theory and general understanding.

Dr. Clench completed a survey of the family Ampullariidae for the treatise on invertebrate paleontology and coauthored with Dr. Turner a revision of the genus *Rhynchotrochus* from the Papuan region. Dr. Evans is revising the genus *Anisepyris* of the bethylid wasps. There are at least 60 species in this strictly American genus, all of them confined to the warmer parts of the Americas. Two stocks of the genus have entered the West Indies and radiated there, producing some unusually large and brightly colored bethylids. Classification of the Indo-Australian birds of the family Zosteropidae (white-eyes) has been reviewed by Dr. Mayr for Peters' check-list. He also examined the generic classification of the avian family Estrildidae. Findings of recent behavior studies by Hall, Immelmann, Nicolai, Wolters, and others were compared with morphological evidence, resulting in certain modifications of the previously adopted classification.

While sorting the many eel larvae (the peculiar leaf-like leptocephalus stage) brought back by the Indian Ocean Expedition, Dr. Mead made the extraordinary discovery of a metamorphosing young fish strikingly similar to a young eel but clearly referable to an entirely different order of fishes, the Heteromi. This has provided for the first time incontrovertible evidence for the close relationship between

the two orders, a question on which there has been much speculation but little fact for many years.

Dr. Paynter continued his studies of the New World buntings (Emberizinae) with particular emphasis on some of the little known South American genera. Revision of the fossil Lorisidae (lower primates) has been completed by Dr. Simpson, and he has prepared a paper on a fossil Australian penguin. Mr. Sill completed his work on the origin and evolution of the crocodiles in which he proposed a new suborder on the basis of material discovered by the 1958 MCZ expedition to Argentina.

Dr. Williams continues to investigate the lizard genus *Anolis*. Study of the *punctatus* group in South America has necessitated a revised definition, including with it not only the four species with a flexible nose appendage, but two new species in which the head is elongated by an extension of the bony snout. Nearing completion by Mr. Shreve is a study of the Hispaniolan gecko genus *Sphaerodactylus* of the *difficilis* group. What was previously considered a single species proved to be a group of five full species, some consisting of several races. This differentiation is especially interesting when occurring in a group, the Gekkonidae, which is prone to waif transportation and thus not expected to be subject to much isolation and speciation. The complexity in Hispaniola is, however, paralleled by a similar complexity on Puerto Rico.

In continuation of his work on the Carabidae of New Guinea, Dr. Darlington completed a revision of the Harpalini of New Guinea and is now well along with the Lebiini, the last big tribe of the family to be done. It has turned out to be a particularly interesting and difficult one. The genus *Xanthophoea* in particular is notable for the diversity and beauty of the species. Some are hairy and some are not; some have spines at the tips of the wing cases and some do not; some are plain brown, some bi-colored black and brown, and some metallic blue, green, purple, etc. The body form

varies considerably, too, and there are other, more technical specific characters within the genus. Nevertheless, in spite of the striking differences, there is great difficulty in separating the species. The characters seem extraordinarily good when only a few specimens are at hand, but all kinds of intermediate individuals turn up in more extensive material. Dr. Darlington has also succeeded in preparing a fairly satisfactory key to what he believes to be the species of this genus (45 of them!), but feels nevertheless that the genus is uniquely difficult. "I have worked on other genera," reports Dr. Darlington, "that seem to have 'exploded' recently, but this genus seems to be in the very midst of an evolutionary explosion, and the explosion is the more dramatic because of the diversity of characters. What makes the work still more exciting, and rather dismays me, is that all of the 45 species now recognized by me are new! The genus *Xanthophoea* was heretofore known principally from Australia. Most of the Australian species live on tree trunks in eucalyptus woodland, but the New Guinean ones, on foliage in rain forests."

Hans Reichardt has nearly finished his taxonomic work with *Galerita* and its close relatives. This group of carabid beetles has been not only interesting taxonomically, but also has permitted the study of geographical and evolutionary problems. For example, he is now able to discuss the relation of fully developed and atrophied wings to the distribution and evolution of the beetles in question, and he has established some interesting clines of size in relation to climate.

Dr. Lawrence re-examined the generic concepts applying to certain Holarctic species-groups of ciid beetles, with the aim of stabilizing the generic names used by European, Japanese, and American workers. He continued work on the taxonomy, distribution, and host relationships of the North American species of Ciidae with emphasis on the genera *Ceracis, Eridaulus,* and *Strigocis.* Species concepts in this group have been clarified through a study of host preference

and geographical distribution. Of note is the discovery of a new species of *Macrocis* from South Carolina; the genus had never been recorded north of Veracruz.

Morphology

Comparative morphology contributes most of the evidence for sound taxonomy and much for evolutionary studies. It has been an active field of museum research since the days of Cuvier and Louis Agassiz.

In connection with his studies of Permian insects, Dr. Carpenter reviewed various competing theories concerning the homology of wing veins in insects and particularly in the Orthoptera. He concluded that the "tracheation" method of homologizing the veins, developed by Comstock and Needham is not supported by the evidence. His research led him to accept the Lameere concept as expanded by studies on Paleozoic insects during the past twenty years. This assumes, as a working hypothesis, the presence of both MA and MP (anterior and posterior media veins) in the early neopterous stock, specifically in the Protorthoptera and the Perlaria. This is the most reasonable basis for explaining the behavior of these two veins in the evolution of the neopterous insects. Study of the Permian Orthoptera from the Kansas and Oklahoma localities has convinced Dr. Carpenter that Sharov's interpretation of the venation in the Orthoptera confuses the CuA with MP; the vein which arises from the stem of M is actually CuA. This basic pattern holds throughout all of the families of the Orthoptera. From a further development of this line of study, and also from investigations on the Carboniferous insects of Commentry in France, and on the extensive material in the Moscow collections, Dr. Carpenter concludes that the generally accepted classification of the extinct orthopteroid groups, recognizing the Protorthoptera, Paraplecoptera, and Protoblattoidea as distinct orders, is artificial. The evidence for this involves

the correct homology of the main veins and the recognition of convergence in various characters. It is now his conviction that only one of these extinct orders is valid, the Protorthoptera. This may be polyphyletic, but at the present time we have no way of recognizing the divergent lines within this complex.

Ellis MacLeod completed his doctoral thesis on "Comparative Morphological Studies on the Head Capsule and Cervix of Larval Neuroptera." On the basis of a more logical interpretation of their morphology, he has proposed several important changes in the existing classification, including the removal of the Polystoechotidae and Psychosidae from the Hemerodioidea to the Ithonoidea and Myrmeleontoidea, respectively, emphasizing the specialized nature and isolated position of the Coniopterygidae and suggesting that the apparent myrmeleontoid facies of the adults of Osmylidae is probably the result of convergence. He has continued his investigations on the generic classification of the family Chrysopidae. This has involved a study of the comparative diapause dynamics of different species-groups of *Chrysopa* and *Meleoma* and an extensive investigation of the chromosome numbers and structure of representatives of all the principal Nearctic genera. Karyotype determinations were made of 28 species in seven genera.

The variation in certain Indian Ocean lantern fishes was studied in Dr. Mead's laboratory. One of the graduate students discovered a progressive change with age in the number of gill rakers, a character not known to be environmentally controlled as are most other meristic characters in fishes.

Dr. Romer is completing a comprehensive description of the postcranial structure of *Cotylorhynchus*, the giant among the pelycosaurs with a probable weight of about a third of a ton. Discovered in the Permian of Oklahoma nearly three decades ago, this remarkable fossil reptile has never before been adequately described. The chimaeras or Holocephali,

an odd group of rare high sea fishes, are often considered distant relatives of the sharks but are actually of uncertain phylogenetic position. Barbara Stahl has made a thorough study of their venous system which, together with current work on fossil materials, may go far toward solving this evolutionary problem.

Dr. Turner continued her anatomical studies of mollusks. An analysis of land snails of the subfamily Papuininae indicates interesting relationships which were not apparent from a study of the shells alone. A careful comparison of two Indian ship worms, *Uperotus clavus* (nut borer) and *Teredora rehderi* (wood borer) produced unexpected results. Even though their shells are different, anatomical studies showed them to be identical, and an examination of large series shows a transition in the shells. Studies are now being made, exposing the larvae of *clavus* to wood and those of *rehderi* to nuts, in order to determine whether or not these two borers are merely ecological forms of a single species. Work on the anatomy of the Pholadidae continues and long range plans are to include additional families, eventually leading to a comparative anatomy of all the Bivalvia.

Faunistics and Stratigraphy

Dr. Clench continued his study of the land and freshwater mollusks of the Bismarck Archipelago. A single collection in a mountain stream at 1,000 meters made by the Danish "Noona Dan" expedition added four families of freshwater mollusks to the fauna of the Bismarcks.

Dr. Kummel's main effort during the year has been directed toward an evaluation of all the taxa of late Scythian (Triassic) ammonoids. This led to a unified scheme of all faunas of late Scythian ammonoids, permitting the evaluation of population structures, zoogeographic realms, and climatic zones, for a segment of time of four to five million years. The analysis of large population samples and their

correct placement in space and time has led in many cases to a considerable revision of the taxonomy.

During his sabbatical year, Dr. Whittington continued his studies of the Ordovician system in North Wales. He described the earliest Ordovician trilobites, and showed that they are related to faunas of southern France and the Mediterranean rather than to those of North America. He completed a modern account of the stratigraphy and the faunas of the area, showing that many of the faunas are so local that correlation over even 20 to 50 miles is difficult. Existence of unsuspected breaks in this standard section of the Ordovician was demonstrated. Finally, Dr. Whittington completed, with Professor Alvin Williams of Queens University, a critical review of the limits and subdivisions of the Ordovician system correlating it with radiometric dating. They consider that the Tremadoc series should be excluded from the system, and recommend a division into two sub-systems.

Zoogeography

A study of the history of faunas and the climatic and geographical conditions under which these faunas evolved has continued to be a major interest for several staff members. Dr. Fell recognized a number of Tethyan elements in the Tertiary marine fauna of the Caribbean. There actually seem to be two sets of immigrants, an earlier one which largely vanished from the American coasts toward the end of the Oligocene, and a much sparser one later in the Tertiary. This change in distributional pattern seems to coincide with and may well have been caused by the separation of the Mediterranean from the Tethys. The blocking of the Tethyan current combined with the gradual rise of the Isthmus of Panama may have led to a strengthening of the Gulf Stream and hence of the Labrador Current, suggests Dr. Fell, and thus to a drastic distributional shift of marine faunas. Discovery by New Zealand Antarctic parties of Ter-

tiary echinoderm fragments has led to a renewed consideration of Antarctic marine faunas. The indication that the South American sand dollar *Iheringella* was apparently present in the Ross Sea from late Oligocene to early Miocene points to an essentially warm, shallow water fauna in Antarctica during mid-Tertiary times. It further supports conclusions reached earlier that the Antarctic echinoderm fauna has had a long Tertiary interchange of elements with South America and no connection at all with the faunas of Australia and New Zealand, the latter falling in the Indo-West Pacific faunal assemblage.

During his study of the biogeography of Ordovician trilobites, Dr. Whittington discovered that at this period there are two major regions of trilobite distribution, the faunas of one region being almost entirely different from the other. Evolution appears to have proceeded independently, but in the upper Ordovician mixing of the faunas begins, owing to freer dispersal, and reaches its maximum at the end of the period.

Dr. Williams completed an analysis of Lesser Antillean zoogeography with particular attention to apparent cases of so-called "leap-frog colonization," that is, failure of colonization on an island already occupied by another member of the genus, but successful colonization further out on an island chain. Importance of predation in relation to extinction was studied and it was shown that many other factors must also be considered.

Ecology

Dr. Fell has used a series of sea-bottom photographs to draw inferences on the ecology of the benthic fauna. Certain organisms indicate by their behavior whether there is or is not a gentle bottom current and what its direction is. Some species, notably certain ophiuroids and holothurians, indicate by their behavior the source of nutrients—whether de-

rived from the water or from the substrate. Indicator species for various types of soft substrate have been suggested.

Analysis of Antarctic invertebrates has been continued by Dr. Dearborn. Bottom samples taken at depths down to 585 meters revealed at least five distinct animal associations, dependent upon substrate and depth. Primary production of organic material is carried out by diatoms, with most of the photosynthesis occurring between the months of August and April. The scouring action of the ice along the shore apparently prevents the establishment of a permanent intertidal fauna.

Dr. Paynter completed a demographic study of herring gulls using banding records accumulated over a period of 30 years. Results indicate that bands are lost at a rate approximating 10 per cent per year. The implications of this finding are disappointing but they ought to alert other workers to the possibility of band loss in most species of birds and will lead, it is hoped, to the development of more durable bands.

Owing to cooperation by various research offices of the Navy, Dr. Turner was able to extend her studies of fouling and boring organisms to deep water. Test boards placed at a depth of 6,800 feet off California and at 5,762 feet off the Bahamas were heavily attacked by species of *Xylophaga* (Pholadidae), but not by members of the Teredinidae. Most of the species taken from very deep boards appear to be new and confirm the impression that there is considerable endemism in deep waters. One remarkable new species produced calcium-lined tunnels 15 centimeters long.

Physiology

Dr. Lyman continued his studies in the physiology of hibernation. He found an increased sensitivity of the muscles of hibernating mammals to acetylcholine and demonstrated that muscular activity induced by acetylcholine can initiate

the complex process of arousal from hibernation. Study of the replacement of cells during hibernation is continuing. Not all stages of cell division react to cold temperature in the same way. Using radioactively tagged thymidine it has been shown that DNA is formed during hibernation but few if any cells reach mitosis until the animal awakes from hibernation.

Special attention has been given to the study of brown fat, a special fatty tissue found in hibernating animals and sometimes referred to as the "hibernating gland." Working with bats, one of Dr. Lyman's collaborators has been able to show that this tissue is extremely important in supplying a source of heat to these animals during the awakening from hibernation. Dr. Taylor is continuing his comparison of species of African ungulates which differ in their daily water needs. Some species must drink water daily while others live in the hot desert and need no water. Temperature regulation and water metabolism together with food consumption and general ecology are carefully studied in order to determine all dimensions of this adaptation.

Behavior

Dr. Evans continued his research on the role which specific behavior patterns play in the ecology of the various species of solitary wasps. The main setting of these studies is a series of restricted areas of sand in Jackson Hole, Wyoming. There, some 50 species of solitary wasps nest together, providing some nice examples of competitive exclusion, and exhibiting considerable sharing of parasites and predators. There are also several species of wasps in this area which prey upon other wasps and upon the parasites of wasps. The whole picture is extremely complex, and will take several additional summers' work to complete. Last summer, much of Dr. Evans' time was devoted to two of the special problems. One was a study of *Ammophila azteca*, the only North

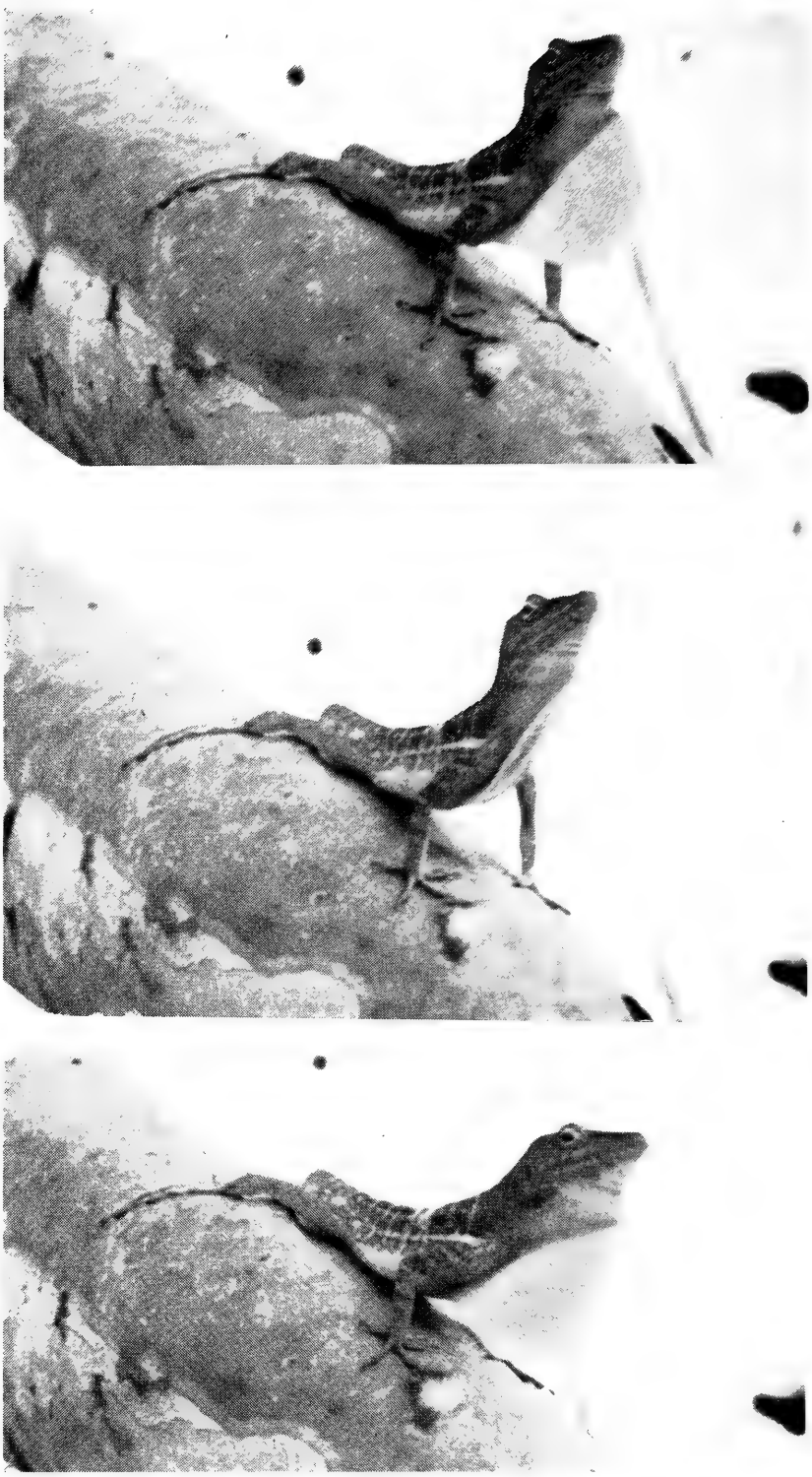
American digger wasp known to maintain more than one nest at a time. Actually, the females of the species appear to retain in their memory as many as three or four nests. Although not all of these nests are necessarily visited on any one day, the female nevertheless remembers the precise location of each one. Results of a preliminary study of this wasp have already been published. A second project concerned the factors which control clustering in another digger wasp, *Steniolia obliqua*. A series of experiments on clustering were only partially successful, but tend to suggest that this wasp does not produce a pheromone which attracts other wasps to the cluster as was at first assumed. There will be further exploration during another summer at Jackson Hole.

Dr. Levi started a new research project attempting to correlate web pattern with classification in spiders of the genus *Argiope*. Work on a single species of *Argiope*, or at least what on the basis of morphological characters is believed to be one species, showed that web characters are subject to a great deal of geographic variation. They differed between the southern United States, Peru, Chile, and Brazil. Jonathan Reiskind continued research on a group of spiders which mimic ants. It seems that this mimicry is of a generalized nature in the temperate zone but is often species specific in the tropics.

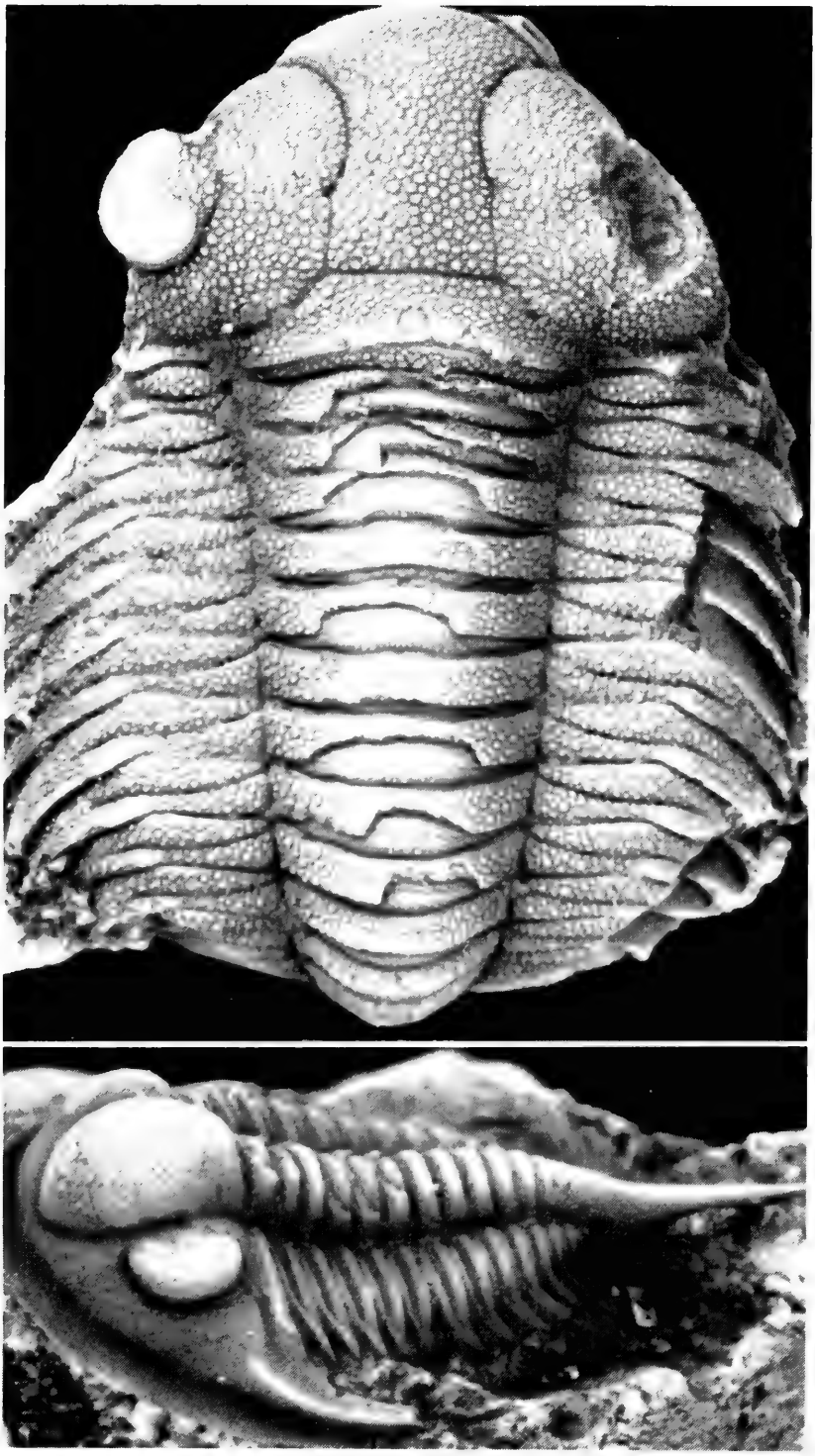
Evolution

Almost all of the research reported up to this point contributes to our understanding of evolutionary processes. Some research, however, was specifically directed to the elucidation of evolutionary principles.

Dr. Mayr found that there is a close (double logarithmic) correlation between the size of an island and the percentage of endemic species of birds. This relation holds within a given kind of island, but the more stable the environmental situation and the greater the isolation of the island, the



The Jamaican anole, *Anolis lineatopus,* pumps his throat fan in and out as a threat against intruders into his territory. (Photo by P. Rand.)



Complete trilobites, collected by Dr. H. B. Whittington, from a boulder of Ordovician age in western Newfoundland. Upper, 9 times natural size; lower, 15 times natural size.

greater the percentage of endemics per area of given size. The most likely interpretation is that percentage of endemics depends on the rate of faunal turnover. The larger the island, the lower the rate of extinction and the lower the faunal turnover. The most unexpected result of this study is the high calculated rate of extinction even on rather large islands. There are indications that this rate is much higher in birds than in insects and plants.

Dr. Mead, during his research in the Indian Ocean, found five oceanic species of the typically coastal fish family Cheilodipteridae. Two of these represent new genera; and the remaining three were hitherto known only from the Atlantic. These pelagic fishes are of particular interest because, in contrast to most deep-sea fishes, their relatives still live as typical, in-shore, tropical reef fishes. This provides an excellent opportunity for a comparative study of adaptation to the deep-sea environment.

General Zoology and General Systematics

Dr. Fell contributed a number of chapters dealing with marine biology and the systematics of echinoderms to various books such as *The Physiology of Echinoderms* (Booloo-tian, ed.), *Oceanography and Marine Biology* (H. Barnes, ed.) and the *Treatise on Invertebrate Paleontology* (Raymond C. Moore, ed.). Dr. Romer completed the revision of his *Vertebrate Paleontology*, the most authoritative work in its field. Dr. Simpson completed a thorough revision of *Life, an Introduction to Biology*, in collaboration with W. S. Beck of the Harvard Medical School. The theme of this widely adopted text is the unity of biological science and the inseparable relationship of all aspects of life.

Dr. Mayr undertook a critical analysis of various opposing theories of classification, particularly those of the cladists who classify strictly on the basis of phyletic branching, and of the pheneticists, who classify by "pure" similarity. He came

to the conclusion that both these schools overlook important considerations. The cladists ignore the fact that genealogical relationship is not the same as genetic relationship (owing to unequal rates of evolution in different phyletic lines), and the pheneticists overlook the fact that "similarity" is a meaningless term unless properly weighted. Is a porpoise more similar to a shark or to a cow? An unweighted answer to this question might well be very misleading. This research has not only led to a clarification of terms and concepts, but it may influence the selection of new techniques in classification. Dr. Mayr devoted a good deal of time to a complete rewriting of the text book *Methods and Principles of Systematic Zoology.*

PUBLICATIONS

Publications of finished research include some 75 titles, and approximately 2,175 pages.

Museum publications totalled 1,397 pages and included the "Bulletin" (Volume 131, No. 9 through Volume 134, No. 3) and 19 numbers of "Breviora."

Details of all publications are recorded in the appended bibliography.

COLLECTIONS

The comparative method is the method *par excellence* of taxonomy. Our name, Museum of Comparative Zoology, is an apt description for an institution in which taxonomic research plays a major role. To permit easy comparisons, collections must be in order, and rearranging is, therefore, a never ending responsibility for the curatorial caretaker. Improvements in this respect were made in every department. In some cases certain families were rearranged according to the latest revision, in others, they were transferred from substandard containers to modern steel cabinets, and in still others, separate collections were consolidated into a

single synoptic series. The endeavor in each instance was to make the collection a more efficient tool for research.

The old Hagen collection of European insects, for instance, is now transferred into new drawers to be stored in new steel cabinets. Dr. Lawrence made good progress in rearranging our beetle collection according to an up-to-date classification. Dr. Fell completely reorganized the echinoderms and consolidated a number of separate collections. One of our faithful volunteers, Miss Charlene Long, has started a reorganization of our polychaetes.

An intensive program was started to make the fossil mollusk collections more easily available by proper arranging and labelling. This task is now 40 per cent completed. Limited space, combined with rich new accessions, has led to serious overcrowding, particularly in our collections of marine prosobranchs and the anatomical collection of mollusks. Some expansion space for these specimens will have to be found. A similar condition of overcrowding exists in entomology and in the departments housed in the basement. It is hoped that the new wing will afford some measure of relief.

Owing to the lack of space we have not made any special effort to enlarge our holdings. However, in connection with the specific research carried out by various curators and graduate students, we have acquired a series of important new collections. Mentioned here are a few of the more noteworthy ones:

Collections of Teredinidae and Pholadidae have grown steadily as a result of the foreign test board program (run in cooperation with the William F. Clapp Laboratories), material received from various branches of the Navy, and Dr. Turner's collecting in India. These holdings are by far the largest that have ever been brought together, and are at least 100 times larger than all other existing collections of these families combined.

The Mollusk Department is indebted to Dr. Robert H.

Parker for a large collection of dredged material from the Gulfs of Mexico and California. These holdings are of great value as the two areas contain many "twin" species, closely related, but nevertheless quite distinct. Large additions to the Department of Entomology's Hymenoptera collection came from graduate student Charles Porter's successful collecting trip to South America, from Dr. Evans' western field trip, and by purchase of several thousand Hymenoptera from one of our collectors in Brazil. Dr. Levi acquired large collections of spiders on his South American field trip. Approximately 1,000 bird skins and skeletons were collected on a Museum sponsored expedition to Ecuador, and G. William Cottrell presented more than 200 specimens from Australia.

A collection of vertebrates from the African Miocene, particularly rich in remains of rhinoceroses, was made by members of an expedition headed by Professor Patterson; Professor Romer and his party collected a large number of early Triassic vertebrates in western Argentina.

Important additions to the herpetological collections were received from the Lesser Antilles and other West Indian areas, and from New Guinea and Australia.

LIBRARY

A streamlining of holdings in the library was initiated this year, resulting in the elimination of 22,500 unbound pamphlets, essentially duplicates of periodical holdings. Some 3,000 volumes were added.

EXHIBITS AND MUSEUM SHOP

The Museum Shop continues to be a popular asset and modest profits aid us in furthering our program of educational exhibits. Publication of "About the Exhibits," a guide-cum-history of the exhibits prepared by Elizabeth and Max Hall, has received many favorable comments.

ACKNOWLEDGMENTS

We are deeply appreciative of our many interested friends and associates who have made valuable additions to our collections, have given so generously of their time, and have made significant contributions to our resources.

We are particularly indebted to the following:

For valuable additions to our collections: Mr. and Mrs. G. W. Cottrell, Jared Diamond, George Gorman, Edwin Hicks, James Lazell, Mrs. Thomas Poultney Lindsay, Thomas Monath, Fred Parker, Robert H. Parker, Charles Porter, Juan Rivero, Ira Rubinoff, Albert Schwartz, and the Boston Malacological Club.

For volunteer help: Richard I. Johnson, Mrs. Milford Lawrence, Miss Charlene Long, Mrs. Bette A. Rachlin, Miss Deborah Ritter, Mrs. Edmund Ritter, Dr. Henry Russell.

For major contributions to our resources: Henry B. Bigelow, Sidney A. Hessel, Mr. and Mrs. Thomas Lamont, Mrs. Gordon C. Prince, Frank B. Smithe, Giles W. Mead Foundation, Richard I. Johnson Family Foundation.

PUBLICATIONS FOR THE YEAR 1964-1965

BREVIORA

No. 205. Redescription of *Amphisbaena dubia* Müller (Amphisbaenia: Reptilia). By Carl Gans. 11 pp. 7 figs. July 15, 1964.

No. 206. The aïstopod amphibians surveyed. By Donald Baird. 17 pp. 1 fig. July 15, 1964.

No. 207. Notes on the horseshoe bats *Hipposideros caffer, ruber* and *beatus*. By Barbara Lawrence. 5 pp. July 28, 1964.

No. 208. Three new species of frogs (Leptodactylidae, *Eleutherodactylus*) from Hispaniola. By Albert Schwartz. 15 pp. 4 figs. November 12, 1964.

No. 209. A new skate, *Raja cervigoni*, from Venezuela and the Guianas. By Henry B. Bigelow and William C. Schroeder. 5 pp. 1 pl. November 12, 1964.

No. 210. The ants of the Florida Keys. By Edward O. Wilson. 14 pp. November 12, 1964.

No. 211. A new species of the snake *Leptotyphlops* from Colombia. By Benjamin Shreve. 4 pp. December 21, 1964.

No. 212. A new species of freshwater gastropod mollusc of the genus *Saulea* from the Miocene of Kenya. By Thomas Pain and Dawn Beatty. 5 pp. 2 pls. December 30, 1964.

No. 213. A hitherto overlooked *Anodonta* (Mollusca: Unionidae) from the Gulf drainage of Florida. By Richard I. Johnson. 7 pp. 2 pls. January 11, 1965.

No. 214. A revised classification of the dendrochirote holothurians. By David L. Pawson and H. Barraclough Fell. 7 pp. February 15, 1965.

No. 215. Two new subspecies of *Amphisbaena* (Amphisbaenia, Reptilia) from the Barahona Peninsula of Hispaniola. By Richard Thomas. 14 pp. 5 figs. February 15, 1965.

No. 216. The geographical variation of the frog *Hyperolius*

marmoratus (family Hyperoliidae) in Rhodesia, Nyasaland and Tanganyika. By R. F. Laurent. 9 pp. 2 figs. February 15, 1965.

No. 217. The auditory region of the borhyaenid marsupial *Cladosictis*. By Bryan Patterson. 9 pp. 2 figs. March 1, 1965.

No. 218. New frogs of the genus *Cornufer* (Ranidae) from the Solomon Islands. By Walter C. Brown. 16 pp. 2 pls. May 7, 1965.

No. 219. The early evolution of the Echinozoa. By H. Barraclough Fell. 17 pp. 13 figs. May 7, 1965.

No. 220. A new species of *Eleutherodactylus* from Guadeloupe, West Indies. By John D. Lynch. 7 pp. 3 figs. May 7, 1965.

No. 221. New Melanesian ants of the genera *Simopone* and *Amblyopone* (Hymenoptera-Formicidae) of zoogeographic significance. By Robert W. Taylor. 11 pp. 4 figs. May 7, 1965.

No. 222. The genus *Leptotyphlops* in the West Indies with description of a new species from Hispaniola (Serpentes, Leptotyphlopidae). By Richard Thomas. 12 pp. 3 figs. May 28, 1965.

No. 223. A new subspecies of *Clelia clelia* (Serpentes: Colubridae) from the island of Grenada. By Allen E. Greer. 6 pp. 2 figs. May 28, 1965.

BULLETIN

VOL. 131

No. 9. Revised generic diagnoses of the fossil fishes *Megalichthys* and *Ectosteorhachis* (family Osteolepidae). By Keith Stewart Thomson. 28 pp. 1 pl. 7 figs. July 7, 1964.

No. 10. The comparative anatomy of the snout in rhipidistian fishes. By Keith Stewart Thomson. 45 pp. 10 figs. August 12, 1964.

No. 11. The anoles (Sauria, Iguanidae) of the Guadeloupéen Archipelago. By James D. Lazell, Jr. 43 pp. 9 figs. September 15, 1964.

No. 12. *Anolis equestris* in Oriente Province, Cuba. By Albert Schwartz. 26 pp. 1 pl. 1 fig. September 15, 1964.

No. 13. The lynx spiders of North America, north of Mexico (Araneae: Oxyopidae). By Allen R. Brady. 90 pp. 20 pls. September 30, 1964.

VOL. 132

No. 1. A synopsis of the American Bethylidae (Hymenoptera, Aculeata). By Howard E. Evans. 222 pp. 144 figs. November 30, 1964.

No. 2. A photographic survey of benthic fishes in the Red Sea and Gulf of Aden, with observations on their population density, diversity, and habits. By N. B. Marshall and D. W. Bourne. 22 pp. 4 pls. 4 figs. December 21, 1964.

No. 3. The Lesser Antillean representatives of *Bothrops* and *Constrictor*. By James D. Lazell, Jr. 29 pp. 5 figs. December 21, 1964.

No. 4. Trilobites of the Ordovician Table Head Formation, western Newfoundland. By H. B. Whittington. 168 pp. 68 pls. 7 figs. March 30, 1965.

No. 5. A further account of batoid fishes from the Western Atlantic. By Henry B. Bigelow and William C. Schroeder. 35 pp. 2 pls. 9 figs. April 8, 1965.

No. 6. Variation and natural history of *Eleutherodactylus ruthae* on Hispaniola. By Albert Schwartz. 30 pp. 8 figs. April 8, 1965.

VOL. 133

No. 1. Gular musculature in delphinids. By Barbara Lawrence and William E. Schevill. 65 pp. 17 figs. May 21, 1965.

No. 2. A revision of the genus *Rhabdepyris* in the Americas (Hymenoptera, Bethylidae). By Howard E. Evans. 85 pp. 7 pls. May 26, 1965.

No. 3. *Neldasaurus wrightae*, a new rhachitomous labyrinthodont from the Texas Lower Permian. By John Newland Chase. 73 pp. 5 pls. 16 figs. June 25, 1965.

VOL. 134

No. 1. Relationships and evolution within the Cracidae (Aves, Galliformes). By François Vuilleumier. 27 pp. 21 figs. March 10, 1965.

No. 2. The distribution of the oceanic fish *Brama brama*. By Giles W. Mead and Richard L. Haedrich. 40 pp. 8 figs. June 17, 1965.

No. 3. Evolution of the tapiroid skeleton from *Heptodon* to *Tapirus*. By Leonard B. Radinsky. 38 pp. 3 pls. 23 figs. June 29, 1965.

PSYCHE

Vol. 71

No. 2. The first fossil tardigrade: *Beorn leggi* Cooper, from Cretaceous amber. By Kenneth W. Cooper. Pp. 41-48, 1 pl., 1 fig., June, 1964.

On neotropical Carabidae (Coleoptera). By Hans Reichardt. Pp. 49-52, figs. 1-7, June, 1964.

The status and affinities of *Duvaliopsis* Jeannel (Coleoptera: Carabidae). By Thomas C. Barr, Jr. Pp. 57-64, June, 1964.

No. 3. An undescribed species of *Melanichneumon* Thompson from New Jersey. By Charles C. Porter. Pp. 130-133, September, 1964.

Notes on the nesting behavior of *Philanthus lepidus* Cresson (Hymenoptera, Sphecidae). By Howard E. Evans. Pp. 142-149, figs. 1-4, September, 1964.

No. 4. Two new species of the genus *Accola* (Araneae, Dipluridae). By A. M. Chickering. Pp. 174-180, figs. 1-9, December, 1964.

JOHNSONIA

Vol. 4

No. 44. The family Pandoridae in the Western Atlantic. By K. J. Boss and A. S. Merrill. Pp. 181-216, 12 pls., 1965.

OCCASIONAL PAPERS ON MOLLUSKS

Vol. 2

No. 29. New species of *Tellina* from the Western Atlantic. By Kenneth J. Boss. Pp. 309-324, 2 pls., Aug. 7, 1964.

No. 30. Anatomy and relationships of *Temnoconcha brasil-*

iana Dall. By Kenneth J. Boss and Vida C. Kenk. Pp. 325-343, 5 pls., Aug. 7, 1964.

Supplement to the poison cone shell. By William J. Clench. Pp. 344, Aug. 7, 1964.

No. 31. Land and freshwater Mollusca of the Cayman Islands, West Indies. By William J. Clench. Pp. 345-380, 3 pls., Sept. 25, 1964.

Remarks on the relationships of the butterflies (excluding skippers) of the Cayman Islands. By Harry K. Clench. Pp. 381-382, Sept. 25, 1964.

Remarks on the relationships of the reptiles and amphibians of the Cayman Islands. By Ernest E. Williams. Pp. 383-384, Sept. 25, 1964.

PUBLICATIONS BY THE MUSEUM STAFF

1964-1965

BIGELOW, H. B.

A new skate, *Raja cervigoni*, from Venezuela and the Guianas. Breviora, No. 209: 1-5, 1 pl., 1964. (With W. C. Schroeder.)

A further account of batoid fishes from the Western Atlantic. Bull. Mus. Comp. Zool., 132(5): 443-478, 1965. (With W. C. Schroeder.)

CARPENTER, F. M.

Studies on North American Carboniferous insects. Part 3. A spilapterid from the vicinity of Mazon Creek, Illinois (Palaeodictyoptera). Psyche, 71(3): 117-124, 1964.

The structure of the Protelytroptera, with description of a new genus from Permian strata of Moravia. Psyche, 71(4): 183-197, 1964. (With J. Kukdlova.)

CLENCH, W. J.

Supplement to the poison cone shell. Occ. Papers on Mollusks, 2(30): 344, 1964.

Land and freshwater Mollusca of the Cayman Islands, West Indies. Occ. Papers on Mollusks, 2(31): 345-380, 3 pls., 1964.

Monographs of the genera *Megalacron* and *Rhytidoconcha* (Papuininae: Camaenidae). Jour. Malacological Soc. Australia, No. 8: 36-71, 9 figs., 4 pls., 1964. (With R. D. Turner.)

Note on *Gastrocopta tappaniana* (C. B. Adams). Nautilus, 78: 106-107, 1965.

Review. Report on the Invertebrata of Massachusetts, by A. A. Gould. [Cambridge, Mass. pp. xiii + 373, 15 pls., 1841.] Johnsonia, 4(44): 216, 1965.

Review. Report on the Invertebrata of Massachusetts, by A. A. Gould. [Edited by W. G. Binney. Boston, Mass. pp. v + 524, 12 pls., 405 text figs., 1870.] Johnsonia, 4(44): 216, 1965.

DARLINGTON, P. J., JR.

Drifting continents and late Paleozoic geography. Proc. Nat. Acad. Sci., 52: 1084-1091, 1964.

Australian carabid beetles XIV. *Perigona*. Psyche, 71(3): 125-129, 2 figs., 1964.

Paussid beetles in Mexico. Psyche, 71(3): 150-152, 1964.

West Indian Carabidae X. Three more species from Jamaica, including a new cave *Colpodes*. Psyche, 71(4): 181-182, 1964.

Insects of Campbell Island. Coleoptera: Carabidae. Pacific Insects Monograph, 7: 335-339, 1964.

DICK, M. M.

Suborder Esocoidea. Mem. Sears Found. Mar. Res., 1(4): 550-560, 1964.

Scombroid fishes. Symposium on Scombroid Fishes, Part 1: 459-460, 1965.

EVANS, H. E.

Further studies on the larvae of digger wasps (Hymenoptera: Sphecidae). Trans. Amer. Ent. Soc., 90: 235-299, 1964.

Notes on the prey and nesting behavior of some solitary wasps of Mexico and southwestern United States (Hymenoptera: Sphecidae and Pompilidae). Jour. Kansas Ent. Soc., 37: 302-307, 1964.

Observations on the ethology of digger wasps of the genus *Steniolia* (Hymenoptera: Sphecidae: Bembicini). Amer. Midl. Nat., 72: 257-280, 1964. (With J. E. Gillaspy.)

The classification and evolution of digger wasps as suggested by larval characters (Hymenoptera: Sphecoidea). Ent. News, 75: 225-237, 1964.

A synopsis of the American Bethylidae (Hymenoptera, Aculeata). Bull. Mus. Comp. Zool., 132: 1-222, 1964.

Notes on the nesting behavior of *Philanthus lepidus* Cresson (Hymenoptera, Sphecidae). Psyche, 71: 142-149. 1964.

A revision of the genus *Rhabdepyris* in the Americas (Hymenoptera, Bethylidae). Bull. Mus. Comp. Zool., 133: 69-151, 1965.

Simultaneous care of more than one nest by *Ammophila azteca* Cameron (Hymenoptera, Sphecidae). Psyche, 72: 8-23, 1965.

FELL, H. B.

A list of Echinodermata collected by N.Z.O.I. from Milford Sound. N. Z. Dep. Sci. Industr. Res. Bull., 157 (N.Z.O.I. Memoir No. 17): 95, 1964.

A revised classification of the dendrochirote holothurians. Breviora, No. 214: 1-7, 1965. (With D. L. Pawson.)

The early evolution of the Echinozoa. Breviora, No. 219: 1-17, 1965.

KUMMEL, B.

Treatise on Invertebrate Paleontology, Part K, Mollusca 3, Cephalopoda—General Features, Endoceratoidea, Actinoceratoidea, Nautiloidea, Bactritoidea, 519 pp., 1964. (With other contributing authors.)

Handbook of Paleontological Techniques. W. H. Freeman and Co., 852 pp., 1965. (With Dave Raup, eds.)

LAWRENCE, B.

Notes on the horseshoe bats *Hipposideros caffer, ruber,* and *beatus.* Breviora, No. 207: 1-5, 1964.

Review. Evolution of neotropical cricetine rodents (Muridae) with special reference to the phyllotine group, by Philip Hershkovita. Quart. Rev. Biol., 39(4): 409-411, 1964.

Gular musculature in delphinids. Bull. Mus. Comp. Zool., 133(1): 1-65, 17 figs, 1965. (With W. E. Schevill.)

LEVI, H. W.

The spider genus *Helvibis* (Araneae: Theridiidae). Trans. Amer. Micros. Soc., 83(2): 133-142, June, 1964.

Nineteenth century South American araneology. Pap. Avul. Dept. Zool., Sao Paulo, 16(1): 9-19, June, 1964.

The spider genera *Stemmops, Chrosiothes* and the new genus *Cabello* from America. Psyche, 71(2): 73-92, June, 1964.

Redescription of the type species of the spider genera *Artonis, Chorizopes* and *Mecynidis* (Araneae: Argiopidae and Linyphiidae). Ann. Natal Mus., 16: 209-214, December 1964.

The theridiid spider *Steatoda paykulliana* poisonous to mammals. Toxicon, 2: 149-154, February, 1965. (With L. R. Levi and Z. Maretic.)

LYMAN, C. P.

The effect of some autonomic drugs on *Citellus tridecemlineatus* during the hibernating cycle. Second Symposium on Natural Mammalian Hibernation. Ann. Acad. Sci. Fennicae, Ser. A IV, 71: 311-324, 1964.

The effects of hibernation on the *in vitro* synthesis of DNA by hamster lymphoid tissue. J. Cell. Comp. Physiol., 65: 319-324, 1965. (With F. J. Manasek and S. J. Adelstein.)

MAYR, E.

The new systematics. *In* C. A. Leone (ed.), Taxonomic biochemistry and serology. The Ronald Press, pp. 13-32, 1964.

Schizophrenia as genetic morphism. Nature (London), 204: 220-221, 1964. (With Sir Julian Huxley, Humphrey Osmond and Abram Hoffer.)

The name *Cacatua* Brisson, 1760 (Aves): Proposed validation under the plenary powers. Z. N. (S.) 1647. Bull. Zool. Nomencl., 21(5): 372-374, 1964. (With A. Keast, and D. L. Serventy.)

On the taxonomy of *Cuculus pallidus* (Latham). The Emu, 64: 41, 1964.

Review. Hundert Jahre Evolutionsforschung. Gerhard Heberer and Franz Schwanitz (eds.). Quart. Rev. Biol., 39(4): 384, 1964.

Systematics and the origin of species. Reprinting in paperback form, Dover Publications Inc., New York, xiv + 334 pp., 1964.

Foreword. *In* Sir Gavin de Beer, Charles Darwin. Doubleday & Co., Inc., New York and in paperback form, 1964.

Polymorphism, polytypism, and monotypism. Internat. Social Sci. Jour., 17(1): 123, 1965. (Published by UNESCO.)

Races in animal evolution. Internat. Social Sci. Jour., 17(1): 121-122, 1965. (Published by UNESCO.)

Classification and phylogeny. Amer. Zool., 5: 165-174, 1965.

Dromaius Vieillot, 1816 (Aves): Proposed addition to the official list. Z. N. (S.) 1668. Bull. Zool. Nomencl., 22(1): 63-65, 1965. (With D. L. Serventy and H. T. Condon.)

Review. Insects of Campbell Island, by J. Linsley Gressit *et al.* Science, 148: 823-824, 1965.

Review. Die Vögel Deutschlands, by G. Niethammer, H. Kramer, and H. E. Wolters. The Auk, 82(2): 299, 1965.

Selektion und die gerichtete Evolution. Naturwissenschaften, 52: 173-180, 1965.

Review. Origin of adaptations, by Verne Grant. Evolution, 19(1): 134-136, 1965.

MEAD, G. W.

Reproduction among deep-sea fishes. Deep Sea Research, 11: 569-596, 1964. (With E. Bertelsen and D. Cohen.)

The identity of the North Atlantic fanfish, *Pteraclis*. Bol. Museu Munic. Funchal, 18(70): 114-120, 1964.

The distribution of the oceanic fish *Brama brama*. Bull. Mus. Comp. Zool., 134(2): 29-67, 1965. (With R. L. Haedrich.)

NEWMAN, W. A.

On *Balanus eburneus* Gould (Cirripedia, Thoracica) in Hawaii. Crustaceana, 7(2): 141-145, 1964. (With T. Matsui and G. Shane.)

Thoracic Cirripedia from a South Pacific guyot. Pacific Science, 18(4): 355-372, 1964. (With V. A. Zullo.)

PATTERSON, B.

The auditory region of the borhyaenid marsupial *Cladosictis*. Breviora, No. 217: 1-8, 1965.

PAYNTER, R. A., JR.

Generic limits of *Zonotrichia*. Condor, 66: 277-281, 1964.

Review. The birds of Colombia and adjacent areas of South and Central America, by R. Meyer de Schauensee. Wilson Bull., 76: 300-301, 1964.

Review. Biology of birds, by Wesley Lanyon. Amer. Scientist, 52: 228A, 1964.

ROMER, A. S.

Thomas Barbour. Syst. Zool., 13(4): 227-234, 1964.

Cope versus Marsh. Syst. Zool., 13(4): 201-207, 1964.

Diadectes an amphibian? Copeia, 1964(4): 718-719, 1964.

Memorial: Augusta Hasslock Kemp. Jour. Paleont., 38(5): 1008, 1964.

Bone in early vertebrates. *In* H. M. Frost (ed.), Bone biodynamics, Little, Brown and Co. (Inc.), pp. 13-40, 1964.

Problems in early amphibian history. Jour. Anim. Morph. Physiol., 2(1): 1-20 (C. J. George Felicitation Number), 1964.

SCHEVILL, W. E.

Underwater calls of *Trichechus* (manatee). Nature (London), 205(4969): 373-374, 3 text figs., 1965. (With W. A. Watkins.)

The noisy underwater world of the Weddell seal (Part 1). Animal Kingdom (N. Y. Zool. Soc.), 68(2): 34-39, 7 text figs., 1965. (With C. Ray.)

Application of satellites or high-flying aircraft to studies of cetaceans and other large marine animals. *In* G. E. Ewing (ed.), Oceanography from space. Woods Hole Oceanographic Institution, Ref. No. 65-10, pp. 177-178, 1965.

Gular musculature in delphinids. Bull. Mus. Comp. Zool., 133(1): 1-65, 17 figs., 1965. (With B. Lawrence.)

Underwater calls of *Leptonychotes* (Weddell seal). Zoologica (N.Y.), 50: 45-46, 1 pl., 1965. (With W. A. Watkins.)

SCHROEDER, W. C.

A new skate, *Raja cervigoni,* from Venezuela and the Guianas. Breviora, No. 209: 1-5, 1 pl., 1964. (With H. B. Bigelow.)

A further account of batoid fishes from the Western Atlantic. Bull. Mus. Comp. Zool., 132(5): 443-478, 1965. (With H. B. Bigelow.)

SIMPSON, G. G.

The evolution of behavior. *In* B. Berelson (ed.), The behavioral sciences today. New York, London, Basic Books, Inc., pp. 89-100, 1963. (With Anne Roe.)

Review. Alfred Russel Wallace. Biologist Philosopher: a study of the life and writing of Alfred Russel Wallace, by Wilma George. Science, 144(3623): 1209-1210, 1964.

Species density of North American recent mammals. Syst. Zool., 13(2): 57-73, 1964.

Organisms and molecules in evolution. Science, 146(3651):

1535-1538, 1964. [Also *In* H. Peeters (ed.), Protides of the biological fluids. Amsterdam, Elsevier Publ. Co., Sect. A, Phylogeny, pp. 29-35, 1964.]

Mammalian evolution on the southern continents. Synthesis and summing-up. Proc. 16th Internat. Congr. Zool., 5, Specialized Symposia, pp. 63-65, 1964.

Zoology. *In* A. Love and J. S. Childers (eds.), Listen to leaders in science. Atlanta, Tupper, & Love; New York, David McKay Co., pp. 121-139 (Chapter 10), 1965.

Review. Heredity and the nature of man, by Th. Dobzhansky. Science, 147: 392, 1965.

Foreword. *In* L. S. B. Leakey, Olduvai Gorge 1951-1961, fauna and background. London, Cambridge Univ. Press, pp. ix-x, 1965.

Description of *Galago senegalensis* E. Geoffroy, 1796. *In* L. S. B. Leakey, Olduvai Gorge 1951-1961, fauna and background. London, Cambridge Univ. Press, pp. 15-16, 1965.

Letter to the editor (Long-abandoned views). Science, 147(3664): 1397, 1965.

Review. Handbook of paleontological techniques, by B. Kummel and D. Raup (eds.). Science, 148(3668): 354, 1965.

Life: an introduction to biology. 2nd (revised) ed. New York, Harcourt, Brace & World, Inc., xviii + 869 pp., illus., 1965. (With William S. Beck.)

Polytypism, monotypism and polymorphism. Inter. Social Sci. Jour., 17(1): 142-144, 1965. (Published by UNESCO.) [Also as Polytypisme, monotypisme et polymorphisme, Rev. Int. Sci. Soc., 17(1): 151-153.]

Races in animal evolution. Internat. Social Sci. Jour., 17(1): 139-141, 1965. (Published by UNESCO.) [Also as Les races dans l'evolution animale, Rev. Int. Sci. Soc., 17(1): 148-150, 1965.]

Review: Teilhard de Chardin biography—the nomination of a saint? Teilhard de Chardin, a biographical study, by Claude Cuenot. New Haven Register, May 2, 1965.

SHREVE, B.

A new species of the snake *Leptotyphlops* from Colombia. Breviora, No. 211: 1-4, 1964.

Turner, R. D.

Monographs of the genera *Megalacron* and *Rhytidoconcha* (Papuininae: Camaenidae). Jour. Malacological Soc. Australia, No. 8: 36-71, 9 figs., 4 pls., 1964. (With W. J. Clench.)

Anatomical relationships in the Teredinidae. Ann. Rept. American Malacological Union for 1964: 16-17, 1965.

Mussel. Encyclopaedia Britannica, pp. 1096-1098, 2 figs., 1965.

Whittington, H. B.

Taxonomic basis of paleoecology. *In* Imbrie and N. D. Newell (eds.), Approaches to paleoecology. John Wiley and Sons, pp. 19-27, 1964.

Trilobites. *In* A. J. Boucot *et al.*, Reconnaissance bedrock geology of the Presque Isle Quadrangle, Maine. Maine Geol. Surv., Quadrangle Mapping Ser., No. 2, p. 21, 1964.

The Ordovician period. *In* The Phanerozoic time-scale: a symposium. Quart. Jour. Geol. Soc. London, 120 S: 241-254, 1964. (With A. Williams.)

Trilobita. *In* Fossils in Ordovician tuffs, northeastern Maine. Bull. U. S. Geol. Surv., 1181-E: 25-34, pls. 5-7, 1965.

Trilobites of the Ordovician Table Head Formation, western Newfoundland. Bull. Mus. Comp. Zool., 132(4): 275-442, pls. 1-68, 1965.

Williams, E. E.

The snake genus *Parapistocalamus* on Bougainville, Solomon Islands (Serpentes, Elapidae). Senckenberg. Biol., 45: 543-552, 1964.

Remarks on the relationships of the reptiles and amphibians of the Cayman Islands. Occ. Papers on Mollusks, 2(31): 383-384, 1964.

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BULLETIN 1863-

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JOHNSONIA, Department of Mollusks, 1941-

OCCASIONAL PAPERS ON MOLLUSKS, 1945-

Other Publications.

Bigelow, H. B. and W. C. Schroeder, 1953. Fishes of the Gulf of Maine. Reprint, $6.50.

Brues, C. T., A. L. Melander, and F. M. Carpenter, 1954. Classification of Insects. $9.00 cloth.

Lyman, C. P. and A. R. Dawe (eds.), 1960. Symposium on Natural Mammalian Hibernation. $3.00 paper, $4.50 cloth.

Peters' Check-list of Birds of the World, vols. 2-7, 9, 10, 15.

Turner, R. D., 1966. A Survey and Illustrated Catalogue of the Teredinidae (Mollusca: Bivalvia). (In press.)

Whittington, H. B. and W. D. I. Rolfe (eds.), 1963. Phylogeny and Evolution of Crustacea. $6.75 cloth.

Proceedings of the New England Zoological Club 1899-1948 (complete sets only).

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