The United States National Entomological Collections

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Preface

This brochure has been prepared by an advisory committee of entomologists working at the National Museum of Natural History, to provide the members of the XV International Congress of Entomology with information on the entomological specimens which comprise the National Entomological Collections, the past and present individuals concerned with the collections, and bibliographical references on entomology at the United States National Museum (USNM).

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Introduction

Taxonomic entomologists of the U. S. Department of Agriculture (USDA) and those of the Smithsonian Institution (Museum) have worked together closely and effectively for so many years that they are widely considered to be one organization: Entomology at the National Museum. Inevitably, a historical account of entomology at the National Museum of Natural History must include much about both organizations, especially for the many years in which USDA and Museum entomology were so closely interwoven that they were actually joined in the person of an individual who was at once Chief Entomologist for USDA and Curator of Insects for the Museum. From that beginning, cooperation between USDA and Museum has been closely knit and has been directed toward the common objective of developing the National Entomological Collections for research and reference.

Assignments of areas of research and of responsibility for the care and development of the collections are coordinated so that no duplication occurs between USDA and Museum taxonomists. In general, USDA personnel direct their attention to groups of economic importance to American agriculture, whereas the Museum staff tends to direct its attention to groups of general evolutionary or ecological interest.

A National Museum was established by the U. S. Government in 1842, before the founding of the Smithsonian Institution in 1846. In 1880 the first separate "departments" with curators were organized in the National Museum. Departmental status for entomology was achieved in 1881 with the appointment of C. V. Riley as Honorary Curator. This first "department" was later the Division of Insects, and the latest reorganization (1963) raised it to the status of a department coequal with those of Anthropology, Botany, Invertebrate Zoology, Mineral Sciences, Paleobiology, and Zoology. The first salaried Museum entomologist was the lepidopterist John B. Smith who served as Assistant Curator from August 1885 to April 1889; he was followed by a Museum Aid, Martin Linell, from 1889 until the latter's death in May 1897. From July 1, 1897, with the appointment of an Assistant Curator and an Aid (W. H. Ashmead and Rolla P. Currie, respectively), until October 1940, the Museum had only two

salaried positions in entomology, exclusive of clerical. They were one professional (assistant, associate, or, from 1934, full curator) and an aid. As would be expected, the Museum staff in entomology has often come from USDA personnel already at work on the collections. Since July 1, 1897, most of the principal entomologists of the Museum (in addition to Honorary Curators Riley and Howard, 1881-95, 1895-1950) have been chosen from USDA personnel: W. H. Ashmead, 1897-1908; J. C. Crawford, 1908-19; J. M. Aldrich, 1919-34; E. A. Chapin, 1934-54; J. F. Gates Clarke, 1954-65; and K. V. Krombein, 1965-71. The most recent chairmen of Entomology were Smithsonian staff members before their election: P. D. Hurd, 1971-76; and D. R. Davis, 1976-present.

Prior to 1862, entomological work in agriculture for the U. S. Government was carried on under the Patent Office. The Act of Congress of May 15, 1862, that established the Department of Agriculture, made specific provision for an entomologist; and in 1863, Townsend Glover, formerly with the Patent Office, was appointed to the post. He continued in the position until failing health forced his retirement in 1877.

In 1878, Entomology became a Division, and in June of the same year the famous Missouri entomologist, C. V. Riley, succeeded Glover as Chief Entomologist. Riley resigned in April 1879, after a personal disagreement with the Commissioner of Agriculture and was succeeded by Professor J. H. Comstock of Cornell University. Comstock served until June 1881, when, after a change of administration and the reinstatement of Riley, he returned to Cornell. Riley then served continuously until he resigned because of ill health on June 1, 1894. When he returned to office in the USDA in 1881, he was appointed Honorary (i.e., unpaid) Curator of Insects by the Museum. He served in this capacity until his accidental death on September 14, 1895. L. O. Howard, Riley's successor as Chief USDA Entomologist, was then appointed Honorary Curator, and likewise served concurrently in the two posts until his own retirement in 1927.

In February 1925, taxonomic work was established as a separate division of the then Bureau of Entomology, and it has continued as a distinct entity to the present time, with some changes of name and of rank during successive reorganizations. The present name, Systematic Entomology Laboratory, was established in 1967. The Systematic Entomology Laboratory is one of two laboratories in the Insect Identification and Beneficial Insect Introduction Institute, Beltsville Agricultural Research Center, Agricultural Research Service, USDA. Entomologists in charge of the taxonomic section since its separate status are: S. A. Rohwer, 1925-27; Harold Morrison, 1927-35; C. F. W. Muesebeck, 1925-54; P. W. Oman, 1954-60; W. H. Anderson, 1960-66; R. I. Sailer, 1967-72; and R. H. Foote, 1972-76.

In the beginning, natural history collections of the National Museum

accumulated in the care of the Patent Office until they were transferred to the Smithsonian in July 1858. At the time of the transfer, it appears that a collection of insects was being maintained. By the 1860's, however, insects were distributed for study to distinguished collaborating specialists: Diptera to Baron Osten Sacken (and thence in part to H. Loew in Germany), Neuroptera to Hagen, Coleoptera to Le Conte, Orthoptera to Scudder, Hemiptera to Uhler, etc. Later, in the early 1870's, insect material from the Smithsonian was deposited in the collection of the Department of Agriculture.

In the Department of Agriculture, a collection of insects was one of the early exhibits, and there was a large central museum space on the second floor of the Agriculture building constructed in 1868. Townsend Glover gave much emphasis to developing the Department's museum, and Professor Comstock greatly furthered the development of the collection. He brought the most eminent entomologists of the United States into close relations with the Division of Entomology. As one example, Comstock was able to get Professor Charles H. Fernald of Massachusetts to spend the winter of 1880-81 in Washington working on the Microlepidoptera. Mrs. Fernald, also an entomologist, worked on the Tineidae as a volunteer.

Whatever the plans of Comstock, there is no question but that with Riley's return to office in the summer of 1881 and his designation as Honorary Curator of Insects in the Museum, a marked change took place in the status of the entomological collections. In that year, the Department of Agriculture officially transferred its insect collection to the Museum. At the time of the transfer, Riley placed on deposit in the Museum his own private collection of insects, with the idea of using it as a nucleus for the development of a collection fitting the dignity of a national museum. Riley formally donated his collection after he was assured of increased Museum support for entomology by the establishment of a salaried Assistant Curatorship for Insects. The fine collection, by Riley's account, contained 766 boxes with 115,000 pinned specimens and 15,328 species, plus 2,850 vials of alcoholic material and 3,000 slides of minute insects, for an estimated total of 150,000 specimens and 20,000 species. It may be stated assuredly that the Department of Entomology of the Museum and its collection owe a great deal to the foresight of this great USDA entomologist who insisted on one systematic collection, to be housed in the National Museum; who pressed constantly for salaried professional personnel and greater monetary support for the purchase of collections and the proper care of the existing ones; who voluntarily and without pay acted as Curator of Insects for its first 14 years; who gave to it his own outstandingly valuable personal collection; and who, in the years when Museum support was scanty or non-existent, furthered the interest of the collection by detailing USDA specialists to curate, classify, and expand the collection while using it as a tool for their work for the Department of Agriculture.

These efforts were continued by Riley's assistant and successor, L. O. Howard, who notably expanded the number of USDA employees assigned to work with the collection. In recent years, especially since the early 1960's when the Museum entomology staff more than doubled in size, the Museum has assumed much of the responsibility for the routine collection work and has developed strong research programs of its own. Some of the more significant accessions of recent years are detailed on the following pages.

The Collections

Protura

The Protura are a relatively small group of generally soil inhabiting arthropods of considerable phylogenetic interest. Much of the early taxonomic work on this group in North America was done here by H. E. Ewing (USDA). Consequently the collections are of great historic importance. This material has been studied and redescribed in modern terms by Bonet and S. L. Tuxen. In addition, types have been received from Glance and Copeland.

The collection is housed in 10 microscope slide boxes and contains 23 types.

Thysanura

These primitive insects primarily inhabit the ground surface, although some are subterranean and others are household pests. Except for the few economic species, this order has never been actively studied at the USNM. Consequently, there is little material. The collection occupies about 1/3 of a quarter case and 2 slide boxes. A single type is present.

Diplura

As with most of the primitive wingless insects, this group is primarly litter inhabiting. Important early studies of H. E. Ewing and Fox were based in part on material in the Museum's collection. The recent studies by L. Smith have also enriched the collection, especially with types. This collection occupies less than 1 quarter case and 10 slide boxes. Nineteen types are present.

Collembola

These minute, usually soil inhabiting arthropods are often encountered in great numbers in soil samples. The material that was received in the early years was sent to S. W. Folsom for study, with the subsequent publication in the *Proceedings* and *Bulletin* of the U. S. National Museum of a number of large family revisions. Many of the new species described in these papers were based on series which were divided among various institutions, making it very difficult to assess the true status of many "types" at the USNM. More recently, J. T. Salmon has designated many lectotypes from these cotypes, but few designations have yet been published. The collection of E. A. Maynard, upon which he based his book on the Collembola of New York, was recently received. This contains almost all of his type material. At the present time, Christiansen and Bellinger are studying most of these older types.

The collection is contained in 2-1/2 quarter cases and includes 58 types. This number may change substantially when final lectotype designations are published.

Ephemeroptera

The mayflies are an order of insects wholly aquatic in the immature stage and, like many of the smaller orders, are poorly represented in the collection. Materials have slowly increased from many different sources, but without any outstanding accessions. Recently, through the efforts of William L. Peters and his students, much of the collection has been determined and curated; and more rapid growth is occurring, especially through efforts of staff members. The collection comprises 11 museum drawers and 3 quarter cases of specimens. Eight types are present.

Odonata

The Odonata collection is large and generally well curated although not very rich in type material. The collection received its first major impetus from the efforts of Rolla P. Currie, who was employed at the Museum from 1894 to 1904 and was ably assisted by his sister, Bertha P. Currie. At that time very extensive collections were made locally. Other important early additions were those from

the Mississippi Valley Pearl Mussel Investigations reported on by C. B. Wilson, the early western U. S. studies of C. H. Kennedy, and duplicates deposited by E. B. Williamson and others. The Baker Collection from the Philippines and the Graham collections from southwestern China were the basic materials for the Needham studies on the Odonata of the Philippines and China. More recently, important synoptic collections have been received from M. A. Lieftinck, E. C. G. Pinhey, and others. In addition large collections from the Neotropical and other regions made by the staff of the Museum have been identified by J. Belle, T. W. Donnelly, D. R. Paulson and M. J. Westfall, Jr., among others. Recently, 2 very large and valuable collections especially rich in North American material were accessioned, one jointly from B. F. Montgomery and Purdue University, and the other from R. H. Gibbs, Jr.

The older portions of the collection, especially those from the United States, are mostly pinned and spread. However, the recent collections and many old ones that were in paper triangles have been transfered to transparent plastic envelopes, placed in special cardboard storage boxes, and stored in slightly modified, metal herbarium cabinets.

The coverage of the Nearctic region is now nearly complete, and that of the Palearctic region almost as good. The generic coverage in the other regions of the world is very good, although many species are lacking. Recent collections by members of the staff at the Museum in the Neotropical region have tremendously expanded coverage and produced large series of many species. The collection of the immature stages is, however, very incomplete. This collection is contained in 325 museum drawers and 575 storage boxes (containing approximately 100 specimens each). Eighty types are present.

Plecoptera

The collection of Plecoptera, a primitive, phylogenetically important order of aquatic insects, remained small for most of its existence, although it was curated rather well. Recently, however, under the care of Richard W. Baumann (SI) it was completely reorganized and greatly expanded. Rapid growth ensued. Important collections have been received from R. W. Baumann, A. R. Gaufin, S. L. Jewett, and the recent expeditions of the staff of the Museum. Coverage is now good for the Nearctic and fair for the Palearctic regions, but rather weak for other parts of the world. These collections are contained in 20 museum drawers and 13 quarter cases. There are 67 types.

Orthoptera and Related Orders

Of the collections of minor orders of insects in the Smithsonian Institution, that traditionally called Orthoptera is one of the largest and most important, comprising 1,750 drawers of pinned specimens, 2 quarter cases of alcoholic specimens, and about 670 primary types. The former Orthoptera are now treated conservatively as 4 orders: Dictyoptera (cockroaches and mantids), Grylloblattodea (grylloblattids, rock crawlers), Phasmida (walkingsticks), and Orthoptera (grasshoppers, katydids, crickets, and allied saltatorial insects). In a broad sense, this entire assemblage may be referred to as orthopterans.

Two USDA entomologists have concentrated attention on the orthopterans: Andrew N. Caudell during 1898–1936 and Ashley B. Gurney since early 1936 (with some interruptions). Prior to 1898, the collection grew slowly and consisted chiefly of historic material from the collection of C.V. Riley (formally donated in 1885) and that resulting from collections made during early government land surveys in the western United States. Various specialists studied orthopterans from the latter expeditions, notably Cyrus Thomas who published in 1865–80. Early in 1928, the Charles F. Baker Collection of Far Eastern (chiefly Philippines) insects, rich in orthopterans, arrived. In 1968 the Argentine collection made by J. B. Daguerre was acquired. Many orthopteran specimens have been transferred to the Museum by other government agencies, including several laboratories of the USDA which have conducted important long-term research on grasshoppers. Other very significant additions have been obtained in purchased or donated private collections which were primarily but not entirely of other insect orders.

The Nearctic collection of orthopterans is fairly complete, and the series of many species is large. Grasshoppers of the genus *Melanoplus* are very well represented, especially flightless species from mountainous parts of the United States. Neotropical orthopterans, particularly cockroaches, are a very representative collection, though one which naturally will benefit from additional work, in view of the rich and only moderately well collected South American fauna. The distinctive and, until recent years, rather rare Grylloblattidae are represented by a choice collection containing primary types of 9 and representatives of 12 of the 15 species described.

An important adjunct of the orthopteran collection is the literature and card files (publication titles and species catalog) dealing with all orthopteran groups. The collected works of many outstanding authors are present as bound volumes; and unbound reprint files and general reference volumes merit the consideration of the special orthopteran library as one of the best in the world. The collection was particularly enriched by A. N. Caudell, who actively promoted the acquisition of bibliographic aids.

Dermaptera

The Dermaptera collection has grown considerably since 1910 when Malcolm Burr published on the earwigs in the USNM. It now comprises 38 drawers of pinned specimens and 8 jars of alcohol-preserved specimens, with about 65 primary types. During the past 8 years, Alan Brindle of Manchester, England, has studied an important part of the material, which is now a useful working collection for the world, though best for the New World and essentially complete for the smaller number of United States species (about 20).

Embioptera

The Embioptera (web-spinners, foot-spinners, living in silk-lined galleries on or under bark of trees, in soil cracks, under stones, etc.) constitute a representative collection for the New World, although no staff entomologist has made a special study of the group. The collection consists of 1/2 drawer of pinned specimens, 30 jars of specimens in vials, and 1 slide box of specimens. There are about 35 primary types; the great majority are species described by Edward S. Ross in the 1940's.

Isoptera

The Isoptera collection at the USNM is one of the larger collections in the world, mainly through the efforts of the late Thomas E. Snyder (USDA). Dr. Snyder arranged and identified much of the collection, which contains approximately 240,000 specimens, and identified examples of about 1,286 species, including 943 types. Though there is a good world-wide representation, the collection is especially rich in Nearctic and Neotropical termites such as those from the West Indies and Central America, and the material collected during the Mulford Biological Exploration to the Amazon Basin.

Psocoptera

No entomologist at the USNM has studied Psocoptera (psocids, booklice, barklice) extensively since Nathan Banks left in 1916, though A. B. Gurney has

had a secondary interest in them for some years. In recent years Edward L. Mockford has studied parts of the collection, which is representative for the Nearctic region and also includes a large, partially studied series from Brazil. Material from the Old World is not extensive. The collection consists of 8 drawers of dry and slide-mounted specimens and a quarter cabinet of specimens in alcohol. There are about 45 primary types.

Zoraptera

The collection of Zoraptera is an outstanding one, though this is one of the smallest insect orders, and the insects are of no economic interest. The order now consists of 1 described genus and 24 species present world-wide in warm countries. Andrew N. Caudell (USDA) published on Zoraptera intermittently from 1918 to 1927, and Ashley B. Gurney published the first review of the order in 1938. Of the 24 described species, 18 are present in the Smithsonian collection, including primary types of 9. There are 28 half-pint jars of vials containing alcohol-preserved specimens and 1/2 drawer of mounted specimens.

Mallophaga

Prior to 1959, the collection of Mallophaga consisted of approximately 1,000 slides assembled by H. E. Ewing (USDA) and H. S. Peters. In addition to the types of the species described by these 2 workers, the collection has about 60 "co-types" of species described by Vernon L. Kellogg and Herbert Osborn. Following the death of M. A. Carriker, Jr., in 1965, his extensive collection, which included more than 500 types, was incorporated into the USNM collection.

In the fall of 1959, K. C. Emerson initiated efforts to enlarge the collection. On January 1, 1976, the collection contained approximately 90,000 slides and 500 vials of material in alcohol. In addition, the collection contains 875 holotypes and several thousand paratypes.

Thysanoptera

The National Collection of Thysanoptera is housed at the Agricultural Research Center (West) in Beltsville, Maryland, and comprises about 100,000 specimens

mounted individually on slides. There are about 470 primary types. The geographical areas best represented are North America, western Europe, India, and Central and South America. The greatest improvement is needed in holdings from temperate Asia, equatorial Africa, and the eastern Mediterranean region. The Neotropical specimens are chiefly plant debris inhabitants. Otherwise, the Collection is reasonably balanced between these and feeders on living plants.

Begun by Theodor Pergande (USDA) before the turn of the century, and curated by USDA personnel to the present, the Collection was formally transferred from the USDA to the USNM during the mid-1930's. After Pergande's time, no one in Washington worked on thrips, but A. C. Morgan in Tennessee, J. R. Watson in Florida, and J. C. Crawford in New Jersey, among others, made identifications for the USDA; and Morgan and Crawford published research that resulted in accessions to the Collection. In the late 1930's, Floyd Andre was appointed as the first full-time thysanopterist in the USDA, and he added many specimens to the Collection. After about 2 years, J. C. Crawford succeeded Andre, and by his industry in collecting, exchanging, and identifying thrips he produced a balanced working collection of 30,000–40,000 specimens in the next 10 years. The aid of professional preparators greatly enhanced the output of both men.

In 1950 Kellie O'Neill succeeded Crawford. The purchase of the J. Douglas Hood Collection in the mid-1960's more than doubled the Collection; its long series forming an excellent complement to previous holdings, which were built up piecemeal chiefly from quarantine interceptions and other specimens received for identification. These usually represented many localities but were basically short series. From 1965–74, T. N. Ananthakrishnan, working under USDA's P. L. 480 funds, enriched the Indian holdings by more than 7,000 slides.

Hemiptera

Important growth of the Hemiptera part of the National Entomological Collections began with P. R. Uhler's donation of his private collection of Heteroptera and Homoptera in 1911. Uhler, although a professional librarian in Baltimore, Maryland, was associated closely with entomological efforts in Washington, D. C. He prepared several reports (1858–1904) on the Heteroptera and Homoptera assembled by the Federal Government's early explorations of western North America, and was one of the founders of the Entomological Society of Washington.

About this time, the USDA recognized the economic and scientific value of taxonomic entomology and began hiring hemipterists to whom the National Museum awarded honorary curatorship over parts of the National Collection of

Hemiptera. These persons not only studied and cared for the collection but also helped it grow. The first was Otto Heidemann, a contemporary of Uhler's, who was employed as a hemipterist in 1898 after his skills as a wood engraver were rendered obsolete by photoengraving. He used his engraver's skill to make beautiful illustrations for some of the 35 papers he published. Only a small part of his collection found its way into the National Collections; the other part was sold to Cornell University.

E. H. Gibson was employed at the Museum in 1912. He published several papers on Heteroptera as well as Homoptera, but apparently built no collection of his own. In 1919 he resigned to become what his business card described as a "Consulting Entomologist and Agricultural Engineer."

W. L. McAtee, although an employee of the USDA's Bureau of Biological Survey and later the U. S. Fish and Wildlife Service, was appointed "Acting Custodian of the Hemiptera" from 1920 to 1942. He spent many of his off-duty hours studying and caring for the National Collection of Hemiptera. His publications, often based mainly on the National Collection, included several large and important revisions; in some instances such papers were prepared in coauthorship with the dipterist J. R. Malloch. McAtee's private library and collection of 25,000 Hemiptera, including much type material, were donated to the USNM in 1942.

In 1930 the USDA employed H. G. Barber, a retired schoolteacher, as heteropterist. His new duties were simply an extension of his lifelong hobby which had already earned him a reputation as a scholarly hemipterist with a specialization in the family Lygaeidae. He expanded the Hemiptera collection not only by adding specimens obtained through his offical duties, but also by donating his own collection of more than 40,000 insects. Heteroptera comprised more than three-fourths of the total and included many Lygaeidae.

Subsequent hemipterists employed by the U. S. Department of Agriculture included the heteropterists:

R. I. Sailer, whose early taxonomic attentions to the Corixidae and the Pentatomoidea expanded to the genetics of Hemiptera and eventually into biological control work;

P. D. Ashlock, a specialist in the Lygaeidae;

D. M. Weisman, a coleopterist and lepidopterist who served as an intern hemipterist;

R. C. Froeschner, with research interests in the Pentatomoidea and Miridae; and

J. L. Herring, the current incumbent with research interests in the Anthocoridae and Gerridae;

and the homopterists:

P. W. Oman, a specialist in Cicadellidae who for a time was in administrative positions during his federal employment but returned to systematic studies

of Cicadellidae after retiring to teaching and research at Oregon State University;

J. S. Caldwell, a specialist in the auchenorrhynchous Homoptera who was employed during the years of World War II;

D. A. Young, a specialist in Cicadellidae who devoted his efforts to large revisionary studies while federally employed and has continued them at North Carolina State University; and

J. P. Kramer, the present specialist on Cicadellidae and Fulgoroidea.

In 1963 the Smithsonian Institution employed its first hemipterist, R. C. Froeschner, transferring nominal responsibility for the Hemiptera collection to him. However, the honorary collaborative role of the USDA hemipterists continues, and they still specialize in certain taxa and care for appropriate parts of the National Collection.

The most productive periods for one particular hemipterist, C. S. Drake, came during his years of retirement when he maintained an honorary association with the Department of Entomology, Smithsonian Institution. Drake came to the Department in 1957, and from that time until his death in 1965 more than 90 titles appeared over his name. Drake bequeathed to the Smithsonian Institution his personal library and private collection of over 100,000 specimens, mostly Heteroptera, among which there were more than 1,000 holotypes. He also left a considerable sum of money for expanding the collection after his death. Drake had built his collection through personal field work and by buying significant materials for incorporation into it. Among his major purchases were Henry Hacker's Australian Collection (holotypes had been previously deposited in Australian museums); the M. S. Pennington Collection, which was the basis for Pennington's several papers on Argentine Hemiptera; the C. E. Reed Collection, consisting almost wholly of the material, including types, on which Reed based the "Heteropteros" part of his "Synopsis de los Hemipteros de Chile;" and the N. A. Kormilev Collection, which is particularly strong in the Aradidae and Phymatidae, and contains many holotypes. The name Florence A. Ruhoff was closely associated with that of Drake while he was at the Smithsonian Institution; Ruhoff was officially a technician assigned to work part time with Drake. Her various skills, including library knowledge, experience with insect collections, and formal training in entomology, allowed her to function virtually as a research assistant for Drake and earned her coauthorship on many of his papers.

The Hemiptera collection generally emphasizes the New World fauna, a specialization that was augmented by the deposition of a series of voucher specimens resulting from the studies for the several volumes on Hemiptera in the *Biologia Centrali Americana.* Old World representation in the collection is limited; major exceptions being the enormous Baker Collection of Philippine Homoptera and Heteroptera; the Funkhouser world collection of Membracidae;

and Drake's world collections of the Tingidae, Aradidae, Phymatidae, and Ochteridae (the last 3 families originally obtained from Kormilev).

The Homoptera collection is especially strong in the Cicadellidae because of the efforts of a series of dedicated, productive USDA specialists: Oman, Young, and Kramer. Other collections of importance included in the Homoptera are the Ball Collection of North American Auchenorrhyncha; the Caldwell Collection of auchenorrhynchous Homoptera; the F. W. Goding Collection of South American Membracidae; the John L. Buys Collection of chiefly North American Cicadellidae; and the Henry Hacker Collection of Australian Auchenorrhyncha. The type collection of the auchenorrhynchous Homoptera contains many types of Baker, Ball, Caldwell, Davis, Fennah, Funkhouser, Goding, Kramer, McAtee, Oman, Osborn, Uhler, Van Duzee, and Young.

The strength in the Heteroptera collection lies in the Lygaeidae resulting from Barber's efforts; in the Cimicidae, through the courtesy of R. L. Usinger; and in the families of specialization in the Drake Collection: the Tingidae, Aradidae, Phymatidae, Ochteridae, and the New World semiaquatic forms. Numerous heteropteran types from the works of Barber, Carvalho, Drake, Harris, Heideman, Knight, Kormilev, Maldonado, McAtee, Slater, Uhler, and Usinger are represented.

In the Natural History Building, the Heteroptera collection occupies approximately 2,100 drawers and has about 2,800 holotypes. The Homoptera are contained in 1,550 drawers with 2,400 holotypes.

Portions of the USNM Homoptera collections, consisting of the Aphidoidea, Psyllidae, Coccoidea, and Aleyrodidae, are housed at the Agricultural Research Center, Beltsville, Maryland. Most of these collections consist of material that has been submitted to the USDA for identification.

Early workers on aphids whose material is in the collection are A. Fitch, C. V. Riley, and T. Pergande. The F. E. Strong and F. C. Hottes Collections were donated to the USNM. A. C. Baker (USDA) worked on aphids from 1915 to 1923, and P. W. Mason (USDA) was in charge of the collection from 1923 to 1947. L. M. Russell assumed this responsibility from 1947 until her retirement in 1975 and is still associated with the collection as a Cooperating Scientist (USDA). The Aphidoidea collection is composed of approximately 62,200 slides representing 2,250 species.

The psyllid collection contains many of the specimens of older USDA workers such T. Pergande, E. A. Schwarz, D. L. Crawford, and J. S. Caldwell. Some species described by D. Jensen and many described by L. D. Tuthill are also represented. The Psyllidae collection contains approximately 21,300 pinned specimens, 2,400 slides, and 3 drawers of psyllids *in situ* on hosts. These represent about 400 species and 90 types.

Large portions of the coccid collections of the following workers are deposited in the USNM: C. K. Brain, T. D. A. Cockerell, J. H. Comstock, E. M.

Ehrhorn, and W. M. Maskell. The Cockerell Collection is especially valuable because it includes the type material which is the only means of identifying many of his inadequately described taxa. Harold Morrison (USDA) who was Curator of the collection from 1917 to 1963, was primarily responsible for the development of the scale insect collection. Other significant USDA contributors have been C. L. Marlatt and L. M. Russell. The collection is currently curated by D. R. Miller and is composed of about 133,500 microscope slides with 238 holotypes. Also included is a large collection of unmounted, dry material which contains several million specimens. The dry collection is an extremely valuable resource for specialists interested in studying immatures and adult males. A very useful card catalog, which is based both upon the collection and the literature, is located at Beltsville. It contains approximately 600,000 entries and is composed of 4 subunits indexed by species, author, host, and location.

A. L. Quaintance was an early worker on the Aleyrodidae and began working for the Bureau of Entomology (USDA) at Washington, D. C., in 1903. In 1915, A. C. Baker joined the Bureau and worked on both aleyrodids and aphids. In addition to the Aphidae, L. M. Russell has also been associated with psyllid and aleyrodid collections since the early 1940's. These 3 groups are currently curated by M. B. Stoetzel. The aleyrodid collection contains about 17,000 slides and 6,400 envelopes of dry material. Approximately 675 species and 145 types are represented.

Anoplura

Prior to the mid-1950's, the collection of Anoplura consisted of a few hundred slides assembled mostly by H. E. Ewing (USDA). In the mid-1950's, Phyllis Johnson added material from Africa, Panama, Trinidad, and Asia to the collection, and its size increased to approximately 18,800 slides and 200 vials of alcohol material. Since the autumn of 1959, K. C. Emerson has continued to expand the collection, mainly through extensive collections from Southeast Asia and Africa made by personnel from the Division of Mammals. On January 1, 1976, the collection contained approximately 35,400 slides and more than 1,000 vials of material in alcohol. The collection also includes 106 holotypes and several hundred paratypes.

Neuroptera

The Neuroptera (in the broad sense) collection is rather extensive, although the coverage is uneven. In general, the North American species are well covered and

often in extensive series. Early collections made by Barber, Schwartz, and Currie in western North America, especially in Arizona and British Columbia, were studied by Rolla P. Currie during 1894-1904 when he was on the staff of the Museum. Other early materials were studied and named by Nathan Banks (USDA) until 1910, after which period the collection grew slowly until recent years when growth has been more rapid.

The C. F. Baker Collection from the Philippines and the D. C. Graham Collection from southwestern China provided substantial holdings from these regions and were partially studied when received. More recently, synoptic collections received from W. R. B. Hynd and M. Meinander in Europe, the Kenya National Museum in Africa, and W. Nakahara in Japan have greatly improved coverage from these areas. The Coniopterygidae were completely revised recently by M. Meinander; the Sisyridae, by S. Parfin and A. B. Gurney; segments of the Myrmeleontidae and Chrysopidae by H. Holzel, L. Stange, and C. A. Tauber; the Raphidioptera, by H. and U. Aspock; and the Megaloptera, by O. S. Flint, Jr. However, much additional material that has accumulated is only roughly sorted and needs to be studied.

The collection is housed in 110 museum drawers and 1-1/2 quarter cases. Ninety-three types are present.

Mecoptera

The Mecoptera collection, although rather small, is generally well curated and has excellent coverage of North American, European, Japanese, and Chinese species. The materials in the collection were an important basis for the reports on North American scorpion flies by J. S. Hine and F. M. Carpenter. The Chinese material primarily collected by D. C. Graham was important in the works of Carpenter and Cheng. The most outstanding recent addition has been the collection of Japanese Mecoptera amassed by S. Issiki. This collection is in 18 museum drawers. Eighteen types are represented.

Trichoptera

The collection of Trichoptera, one of the smaller orders of aquatic insects, has been in a generally neglected state for most of its history. Important materials have been received as part of certain general collections; i.e., the Harriman-Alaskan Expedition, the Baker Philippines Collection, and the Graham Chinese-

Tibetian expeditions. But mainly the collection has gradually increased by slow accretion of materials. Although Nathan Banks had charge of this order from 1890 to 1916 when most of the material was determined, the collection was not greatly enlarged.

Growth of the collection occurred after the addition of the first specialist on this order, Oliver S. Flint, Jr., in 1961. Since then, important exchanges and gifts have been received from F. C. J. Fischer, S. J. Jewett, M. Meinander, and F. Schmid; and the Ceylonese and Neotropical collections of F. Schmid have been purchased. However, the greatest growth has resulted from field collections of museum specialists. The collection is now reasonably complete for the Nearctic and Palearctic regions and probably the best in existence for the Neotropical region. The rest of the world has fair to good representation. The collection comprises 171 museum drawers and 5 quarter cases. Four hundred eighty types are present.

Lepidoptera

The National Collection of Lepidoptera began with the transfer of 50,000 insects from the USDA in 1881. It has grown through active collection by staff, bequests, and purchases to its present size of approximately 3.5 million specimens. It occupies about 30,000± drawers and contains about 25,000 primary types. Included are the majority or large numbers of types studied by Barnes, Barnes et al, Blanchard, Busck, Capps, Clarke, Davis, Diakonoff, Dognin, Duckworth, Dyar, Engelhardt, Ferguson, C. H. Fernald, Franclemont, Guenée (North American species), Heinrich, Hodges, Hulst, Issiki, McAlpine, McElvare, Schaus, J. B. Smith, and Todd. It also includes the types of many other lepidopterists who have studied material from this collection.

The collection is strongest in Nearctic holdings, but progressively less rich in Neotropical, Palearctic, Oceanic, Oriental, Australian, and Ethiopian material. Taxonomic groups or geographic areas that are well represented include: Palearctic Lycaenidae; Japanese and Formosan Microlepidoptera; Neotropical Geometridae; Philippine Lepidoptera; Szechwan, China, Macrolepidoptera; Egyptian Lepidoptera; and Nearctic Sesiidae. The William Barnes Collection of a half-million North American Lepidoptera was the largest single acquisition, followed by the J. G. Franclemont Collection.

Some of the more important accessions that are included in the National Collection are as follows:

Anastase Alfieri, 1966 (purchase). Egyptian Heterocera, including many types.

C. F. Baker, 1928 (gift). More than 300,000 specimens; contains perhaps the largest number of Philippine Lepidoptera assembled by one person, plus abundant material from Malaya.

William Barnes, 1931 (purchase). This collection consists mainly of North American material, incorporating specimens from the Oberthür, Taylor, Kearfott, Polling, Lacy, Field, Hill, Longley, Spalding, and Merrick Collections. With 473,000 specimens, including 1,950 holotypes, this was the largest single acquisition.

Harold Box, 1963 (gift). Contains 5,000 specimens of the important sugar cane feeding genus *Diatraea.*

The Brighton Museum, Brighton, England, 1949 (gift). There are 15,000 Microlepidoptera in this collection. Nearly all species from England are represented.

J. F. Gates Clarke, 1937 (gift). The original gift consisted of over 10,000 specimens from the Pacific Northwest. All Clarke types (over 300), except one, are in the USNM.

Paul Dognin, 1925 (purchase). The collection consists of 82,000 specimens including 3,000 Dognin types and over 300 Thierry-Mieg types.

H. G. Dyar, 1903 et seq. (gift). The first contribution recorded consisted of 20,000 specimens from British Columbia. In 1917 Dyar added 17,000 North American specimens. Numerous smaller gifts were made later.

G. P. Engelhardt, 1941–43 (gift). This collection contains over 9,000 Sesiidae. Nearly all specimens are reared; the larvae being associated with the adults.

Douglas Ferguson, 1970 et seq. (gift). Contains 53,000 specimens from the northeastern U. S. and eastern Canada, predominantly Nova Scotia. Newfoundland is also included.

C. H. Fernald, 1924–25 (purchase). This is a type collection of Microlepidoptera containing Fernald's tortricid types, Fitch's types of Pterophoridae, and also types from Fish. The collection contains cotypes of Walsingham, Hulst, Packard, and Grote.

W. D. Field, 1947 (gift). Contains 5,000 specimens of Japanese and European Rhopalocera.

J. G. Franclemont, 1976 et seq. (gift). This collection will contain 250,000–300,000 specimens when accessioning is complete. Although primarily North American in coverage, it is rich in material from the eastern Palearctic, the Neotropics, and the Philippine Islands.

R. W. Hodges, 1962 (gift). Consists of 25,000 specimens primarily of North American Microlepidoptera largely from Arizona, New York, and Florida.

Syûti Issiki, 1972 (purchase). This collection constitutes the most complete assemblage of Japanese and Formosan Microlepidoptera ever brought together; it contains about 95% of the known Japanese species. There are 78 holotypes and more than 200 secondary types in this material.

W. S. McAlpine, 1972 (gift). Consisting of more than 12,000 specimens, predominantly of the genus *Calephelis,* it is also strong in miscellaneous Michigan Lepidoptera.

A. Philpott, 1928 (gift). Included in this gift is a nearly complete collection of New Zealand Microlepidoptera.

William Schaus, 1901 et seq. (gift). This contains most of the approximately 200,000 Neotropical specimens collected by Schaus. About 5,000 of his types are included.

J. Adger Smyth, 1947 (gift). This worldwide Lepidoptera collection made by Ellison A. Smyth contains more than 16,000 specimens. In 1970, an additional 1,000 specimens were donated from the Americas and Africa.

The major geographic areas of special current interest are North America, Central and South America, West Indies, Sri Lanka, selected western and South Pacific islands, Philippine Islands, Africa, Australia, and Borneo. An extensive collection of Alaskan Lepidoptera is being formed as part of a cooperative arrangement with K. Philip.

Each major collection reflects curators' interests, activities, and field work; and the National Collection is no exception. The following is a list of those who have been associated with the Collection in the past, their years of association, their affiliation with the Smithsonian Institution (SI) or the United States Department of Agriculture (USDA), and their interests.

J. B. Smith, 1886-89, SI. North American Noctuidae.

A. Busck, 1896-1940, USDA. New World, particularly North American Microlepidoptera.

H. G. Dyar, 1897-1929, USDA. Adults and immatures of Macrolepidoptera and Pyraloidea of the New World.

C. Heinrich, 1913-49, USDA, North American Olethreutidae, New World Phycitinae, immatures of Microlepidoptera.

W. Schaus, 1895-1919, private support; 1919-38, USDA. Macrolepidoptera and Pyraloidea, particularly of the Neotropical region.

H. Capps, 1938-64, USDA. Immatures, North American Pyraloidea and Geometroidea.

J. G. Franclemont, 1947-52, USDA. Macrolepidoptera, especially Noctuoidea of the world.

Diptera

The study of North American Diptera is generally considered to have started with the arrival in 1865 of C. R. Osten Sacken, a Russian diplomat. The Smithsonian Institution played a prominent part in this early development by

publishing the first 4 parts (the only parts) of a mongraph of the North American Diptera as well as the first 3 catalogs to that fauna. When Osten Sacken returned to Europe, he gave his superb Diptera collection to the Museum of Comparative Zoology at Cambridge, Massachusetts. His departure left a void that was not filled until years later when personnel of the Division of Entomology, USDA, began their investigations of Diptera. The USDA provided the nucleus of the USNM fly collections; it purchased the initial Diptera collection, the Burgess Collection (1885), and employed the first dipterist, S. W. Williston (1886), to study these collections. Thereafter, Williston left his collection of Syrphidae to the USNM, adding the first Diptera types. As USDA programs expanded, D. W. Coquillett (1893-1911) took charge of the Diptera investigations and was made a Smithsonian Honorary Custodian. Since Coquillett (who donated his valuable collection of western Diptera through USDA in 1894), there has been a continuous succession of USDA dipterists who have brought not only their expertise to the USNM but also their libraries and collections (C. H. T. Townsend, (1911-19), R. C. Shannon (1912-16), J. R. Malloch (1912-13), C. T. Greene (1919-49), D. G. Hall (1935-45), and A. Stone (1931-71)). The present USDA staff of dipterists has continued the traditions of their predecessors, especially those of W. W. Wirth, who has collected and donated some 100,000 flies. The first and only dipterist employed by the Smithsonian Institution was J. M. Aldrich, who had been previously employed by the USDA. When Aldrich was appointed by the Smithsonian in 1919, he was truly the master of the North American Diptera fauna, having written a catalog for it (1905). As such, his eminence made the USNM the center for studies on New World Diptera. In 1923 Aldrich turned over his insect collection and card catalog file; his great library and author cards did not join his other collections until 1953 when they came with the Melander Library and collection. J. R. Malloch, another prominent dipterist, was associated with the USNM mainly through his employment with the Biological Survey of the USDA (1921-38). The Smithsonian purchased his personal collection and library.

R. C. Shannon was associated with the USDA Bureau of Entomology at the start of his career, but spent most of his life with the Rockefeller Foundation in many parts of the world. However, he never forgot his earlier ties with the Museum and left most of his library and collection to the Smithsonian. Shannon's collection is particularly noteworthy, being especially rich in Neotropical and Chilean material. Shannon and F. W. Edwards of the British Museum (Natural History) had made a joint expedition to Patagonia and southern Chile, which resulted in a monograph of the flies of that region.

The Diptera collection of the USNM is rather mixed in its coverage. The Nearctic region and the New World in general are represented best, although there is material from all faunal regions. In all families, there are good synoptic series of the genera and species; but only in a few areas are there long or

complete series for most of the included taxa. The strengths of the USNM Diptera collection are outlined below.

The most important general Diptera collections in the USNM are those turned over by the USDA and its scientists, those by J. M. Aldrich and R. C. Shannon, and those purchased from J. R. Malloch and A. L. Melander. With the exception of Melander, all these gentlemen were associated with the USNM as noted above. A. L. Melander was a general dipterist and a specialist on Empididae. His collection and library were acquired for the USNM jointly by the Smithsonian, USDA, and the National Institutes of Health. The collection contained numerous types and about a quarter of a million specimens; and the library, which incorporated that of Aldrich, was probably one of the finest in existence.

Among the nematocerous Diptera, 4 groups are particularly well represented at the USNM: the crane flies, mosquitoes, biting midges, and gall midges. The crane fly collection is unsurpassed by any in the world, as the Smithsonian has recently acquired title to the C. P. Alexander Collection: probably the greatest private collection of flies ever made. More than 11,000 of the 14,000 known species of crane flies are represented by types (8,000+ holotypes) in this collection which is still in Alexander's possession and to which he continues to add. The gall midges (Cecidomyiidae) were poorly represented in the USNM, but R. J. Gagné, the USDA scientist for this group, has significantly improved the collection with much fresh material. The E. P. Felt Collection, containing types of about 1,000 species, is on indefinite loan to the Systematic Entomology Laboratory from the New York State Museum in Albany. W. W. Wirth has built up the Ceratopogonidae collection from an insignificant one to probably the largest in the world, now containing about a quarter of a million slides; however, less than half of these have been identified as to species. There is also much reared associated material. The collection's coverage is world-wide, with strong representation not only for the New World but also for the Oriental and Australian regions.

The mosquitoes (Culicidae) have received considerable interest from the early 1900's when L. O. Howard served as Honorary Curator. Pioneering work, done on the collection by Howard, H. G. Dyar, and F. Knab (all USDA employees), culminated in the publication of *The Mosquitoes of North and Central America and the West Indies*, 4 volumes (1912-17). However, it was not until 1931 that a USDA dipterist, A. Stone, was able to devote a significant portion of his time to this family. Largely through his efforts, the USNM became known as a center for mosquito studies throughout the world. Aside from the early Dyar and C. S. Ludlow collections which were present when Stone arrived, significant collections were received from R. C. Shannon, W. V. King, H. Hoogstraal, K. L. Knight, J. L. Laffoon, L. E. Rozeboom, and D. C. and E. B. Thurman during the 40 years that Stone curated the collection.

In 1964, under the auspices of a Smithsonian contract with the U. S. Army

Medical Research and Development Command, a definitive study was begun on the mosquitoes of Southeast Asia. This was continued until 1974 when a new contract was initiated for the Medical Entomology Project. From 1964 to date, these 2 projects have accessioned more than 250,000 specimens and have described 100 new species of mosquitoes. When this material is formally accessioned by the USNM, the combined holdings will total more than 300,000 specimens with 1,200 primary types.

The brachycerous Diptera are best represented by 3 families: the Bombyliidae, Asilidae, and Empididae. The USDA recently purchased the R. H. Painter Collection of Bombyliidae and placed it in the USNM. Painter, a specialist on these flies, amassed an excellent collection of Nearctic bee flies which is particularly rich in material from the southwestern U. S. and Mexico. The USDA also purchased the Bromley Collection of robber flies for the USNM. This collection along with that of A. E. Pritchard makes the USNM holdings of these predaceous flies outstanding. A. L. Melander was one of the 2 world specialists on Empididae and his collection brought to the USNM one of the most extensive collections of these flies in existence.

Of the cyclorrhaphous Diptera, the acalyptrate families are all well represented. Much significant acalyptrate material was acquired with the collections of A. H. Sturtevant, G. C. Steyskal, and A. L. Melander. The strong and continuing interest of the USDA in fruit flies (Tephritidae), as represented by the work of A. Stone, R. H. Foote, and G. C. Steyskal, has made the USNM holding of these flies one of the finest. The Sciomyzidae, snail-killing flies, are likewise well represented. L. V. Knutson, working throughout the world on the biology and taxonomy of Sciomyzidae and their application to biological control, has greatly expanded the collection's representation. The Ephydridae, or shore flies, also deserve particular note for the strong cosmopolitan collection built by W. W. Wirth.

Holdings of Tachinidae, Sarcophagidae, and Calliphoridae stand out among the calyptrate flies, although most of the families of this group are well represented. Most of the leading New World specialists on tachinid flies have worked with and left their collections to the USNM. This series of specialists began with D. W. Coquillett, who first monographed the Nearctic tachinids in 1897, and continued with C. H. T. Townsend and J. M. Aldrich, and now with C. W. Sabrosky. Many other tachinid workers have augmented the collection by adding their types to it, and the USDA greatly expanded its scope by purchasing the N. Baranov Collection which included much tachinid and sarcophagid material from the Old World. Thus the USNM collection of Tachinidae is unusually valuable. The collections of Sarcophagidae and Calliphoridae are also exemplary due to the contributions of such specialists as J. M. Aldrich, D. G. Hall, H. W. Allen, and H. de Souza Lopes.

The collection comprises more than 5,300 drawers of pinned material, 470,000 slide-mounted specimens, and 17 quarter cases of specimens in alcohol.

About 20,000 primary types are included.

Siphonaptera

The role of fleas as vectors of plague and other infections has encouraged the collecting and study of Siphonaptera, but factors such as the relatively small size of the order and the minimal economic importance of fleas, have militated against the establishment of separate Siphonaptera departments by museums, with the exception of the British Museum (Natural History). The general procedure at the USNM has been to assign the identification of Siphonaptera and care of the collection to specialists primarily interested in other orders. However, during the period October 1955–November 1958, an outstanding authority on fleas, Phyllis T. Johnson, served as Curator of Siphonaptera under the auspices of the USDA, but she was simultaneously responsible for Mallophaga and Anoplura as well.

Science and the U. S. National Museum were fortunate that C. F. Baker included Siphonaptera among the many interests he pursued for the USDA. In 1904 and 1905 he prepared some of the best revisionary works in the field at that time. As a result, 55 holotypes are on deposit in the USNM. Another versatile USDA worker was E. A. Chapin, who in the early 1920's described several new species of fleas and was Chief Curator of Entomology at the Smithsonian Institution from 1934 to 1954. H. E. Ewing, as a taxonomist for the USDA, worked on a variety of small orders and on all Acarina; but he was particularly interested in ectoparasites, describing a number of new genera and species in the process, and curating the Siphonaptera collection.

In the late 1930's and early 1940's the specimens of fleas in the National Collection were reserved for study by I. Fox, who based his doctoral thesis and several major works on that material. He devoted his spare time over a period of years on that assignment.

After E. A. Chapin retired in 1954, C. F. W. Muesebeck generously accepted responsibility for the collection of fleas and lice, even though his regular assignment as hymenopterist for the USDA and many other entomological activities might have proven an insurmountable task to most scientists. Until 1955, when P. T. Johnson appeared on the scene, Muesebeck provided definitive identifications of Siphonaptera, Anoplura, and Mallophaga (even for obscure species), despite the lack of monographic works in the current literature. He resumed such extracurricular duties after P. T. Johnson left in 1958 and until Robert Traub began serving as Honorary Curator in 1960. The latter is still functioning in a curatorial capacity, and several of his staff at the University of

Maryland School of Medicine are stationed at the Smithsonian Institution on a collaborative basis.

With its 345 types (primarily holotypes) and its 221 allotypes, the National Collection is outranked only by the N. C. Rothschild Collection of the British Museum (Natural History). The recent incorporation of the slides resulting from studies on plague by the National Institutes of Health (the Rocky Mountain Laboratory, via the good offices of William Jellison) and of material donated by R. Traub (more than 5,700 slides), makes the Smithsonian Collection the second best in the world regarding the numbers of genera and species represented, and probably first as to numbers of named slides. Thus there are currently more than 30,000 slides, including over 4,000 hystrichopsyllids, 1,300 pygiopsyllids, 1,500 leptopsyllids and 7,600 pulicids. When the Traub Collection, which has been willed to the Smithsonian, is fully described, at least 150 more type specimens of new species will be added. Since only about 1,600 species of Siphonaptera are known today, it is apparent that study of material at the National Collection would be a boon to serious students of Siphonaptera.

This collection is housed in 450 microscope slide boxes and 2,500 slide trays. Three hundred forty-five primary types are present.

Coleoptera

The collection of Coleoptera is one of the world's largest, consisting of more than 7,000,000 specimens, including nearly 20,000 types, all housed in about 12,000 museum drawers. Its representation is strongest in Western Hemisphere species due principally to general collecting by the Smithsonian staff on research expeditions, and through contributions from the USDA identification service. Staffs of both the Department of Entomology and USDA curate the collection.

The nucleus of the Coleoptera collection was formed in 1881 by the transfer of a moderately large, general collection from the USDA to the Museum. This, with the material from the C. V. Riley Collection, transferred in 1885, and several smaller collections received later (Belfrage, Koebele, Morrison, Linell, J. B. Smith and others) constituted a base of some 20,000 species for reference.

The appointment of E. A. Schwarz (USDA) in 1897 as Honorary Curator brought with it the valuable Hubbard and Schwarz Collection which, because of its size and richness of species, elevated the USNM collection of beetles to a size comparable with other world collections in this order. Shortly following Dr. Schwarz's appointment several additional collections were received: the Soltau Collection; the 1898 collections from Arizona by Hubbard and Schwarz; the 1901 Barber and Schwarz Collections from the same area; the Harriman Alaskan

Expedition Collections; the Turner Collections from Labrador; the Barber Collections from northern California and southern Texas; and a number of smaller collections. The A. D. Hopkins Collection of 15,000 wood-boring insects was the start of the scolytid and buprestid collections.

One of the most significant events in the history of the collection was the acquisition of T. L. Casey's private collection which added nearly 117,000 specimens of some 20,000 species including about 9,200 types. Because of the importance of this collection, it has been kept separate from the main collection; but it is available to serious students of Coleoptera.

In 1928, C. F. Baker's collection of Philippine beetles was added, and in 1934, the H. G. Wickham Collection of midwestern and southwestern beetles was acquired. The C. F. Schaeffer Collection, which included many types, was added shortly after that. The W. Robinson and E. Shoemaker general collections expanded the holdings from the eastern United States, and the Halik and Daguerre Collections expanded the representation from South America.

The carabid collection is very large and especially rich in Neotropical material. A collection of 43,520 specimens, given by W. Rosenberg, and T. L. Erwin, has recently added almost 100,000 specimens. O. L. Cartwright's collection of tiger beetles was another significant acquisition. The staphylinids are especially strong in Neotropical specimens, with many types present, principally due to the work of R. E. Blackwelder. The water beetle collection has expanded recently through the addition of several hundred thousand specimens by P. J. Spangler. A significant collection was also acquired from John D. Sherman. The lampyrid and phengodid collection is quite large, especially in North American material, because of the special interests of H. S. Barber (USDA). Dermestids were the subject of research by R. S. Beal, and Lathridiidae were a specialty of L. M. Walkley. The elaterid collection was recently expanded by the addition of 41,000 specimens, mostly North American, from M. C. Lane. This family was an earlier speciality of J. M. Valentine. The buprestid material is large and rich in types, principally because of the early work of W. S. Fisher (USDA) and the later efforts by G. B. Vogt (USDA). The anobiid type material has increased significantly because of the work of R. E. White. The tenebrionids were recently enlarged significantly by the acquisition of 39,450 specimens, mostly from Chile, from L. Pena. The oedemerids were intensively worked by R. H. Arnett, Jr. The mordellids have many of the types of E. Liljeblad, and the stylopid collection is extensive and rich in types due to the pioneering work of W. D. Pierce (USDA). The coccinellid collection, perhaps the largest in the world, is especially rich in material from the Western Hemisphere. Among the larger additions are G. H. Dieke's 24,400 specimens, E. A. Chapin's 9,150 specimens, and R. Korschefsky's many specimens used in preparation of the world catalog. Many types of R. Korchefsky, E. A. Chapin, and R. D. Gordon are included. E. A. Chapin (USDA and Museum) was a specialist in this family.

The scarabaeid collection is especially large, and several contributors should be mentioned: M. Robinson, O. L. Cartwright, L. W. Saylor (who added many types), and E. A. Chapin. The clerid material was intensively worked by E. A. Chapin, and the bruchids were the subject of studies by J. C. Bridwell (USDA). The chrysomelid collection is especially rich in material from the Western Hemisphere. A large collection of 58,360 specimens was acquired from F. A. Monros. The type material is extensive because of the work of Monros and D. H. Blake. This family was studied by H. S. Barber. The cerambycid collection is huge and especially strong in material from the Western Hemisphere and the Indo-Malayan area. It has many types, especially through the work of W. S. Fisher. F. Tippmann's large world-wide collection added thousands of specimens and many types. The curculionid collection is quite large. Of the acquisitions of the past, the E. Bovie Collection and the D. G. Kissinger Collection should be mentioned. L. L. Buchanan (USDA) worked actively on this family. The scolytid collection is especially strong in North American material. Several large collections with many types include those of H. Eggers, M. W. Blackman, and J. Murayama. The family was studied in the past by M. W. Blackman (USDA) and W. H. Anderson (USDA). The collection of immature Coleoptera, perhaps the largest in the world, is very diverse. A. G. Boving (USDA) was the prime mover in amassing the material. Among significant additions are the H. E. Burke Collection of buprestids and the J. W. MacSwain Collection of meloids. W. H. Anderson and J. G. Rozen, Jr., (USDA) worked intensively on this collection.

Hymenoptera

Although early workers such as C. V. Riley, T. Pergande, E. A. Schwarz, and L. O. Howard contributed much material to the building of the Museum's collection of Hymenoptera, its serious beginnings started with acquisition of the Ashmead Collection in 1898. William H. Ashmead was a most energetic collector, especially of Hymenoptera, and the USDA, impressed by his thorough work with insect pests and their parasites, hired him in 1887. Thus began his professional entomological career. In 1895, while still employed in the USDA, Ashmead was given an honorary custodial appointment in Hymenoptera by the USNM and became the first hymenopterist at that institution. In 1897 he was given a salaried appointment as Assistant Curator by the Museum. The following year, Ashmead donated his private collection of Hymenoptera, numbering around 60,000 specimens, to the Museum. His collection was very strong in parasitic Hymenoptera because of his years working with insect pests and, of course, it was rich in Ashmead types and reared material. At the time of his death in 1908 after a long illness, Ashmead had described more than 3,000

species of Hymenoptera, most of whose types are in the National Collection.

James C. Crawford succeeded Ashmead as Assistant Curator of Insects in 1908. He was the last Smithsonian hymenopterist until 1965. Crawford's research centered on the Chalcidoidea until he left the Museum staff in 1919. A number of people employed by the USDA were stationed at the Museum during Crawford's time and all of them worked on various parasitic Hymenoptera. They were Henry L. Viereck, Sievert A. Rohwer, Robert A. Cushman, Arthur B. Gahan, and Arsene A. Girault. Some of these workers were stationed at the Museum for just a few years, while others such as Rohwer, Gahan and Cushman were affiliated with it during most of their active careers; the majority of their types are housed at the Museum. It is of interest to note that the unit tray system, now used at the USNM and many other museums, was developed by Crawford, Rohwer, and Viereck in 1910-11. After they had worked out the various tray sizes, the system was then first applied to the Hymenoptera Collection.

Because the main research interests of all of these early hymenopterists were in the parasitic wasps and sawflies, this part of the collection gained early recognition as one of the most important in the world. Possibly no other museum has as much reared material of these insects. The Chalcidoidea alone is contained in over 500 drawers and is the largest named collection of these economically important wasps in the world. Following Ashmead and Crawford, the following USDA people have been in charge of the USNM chalcidoids: Girault, Gahan, and Barnard D. Burks who retired in 1974. The current chalcidoid specialist is Gordon Gordh. Associated with the chalcidoid collection is one of the very few complete files of the privately published papers of A. Girault.

The collection of Symphyta is the largest in the Western Hemisphere and it has a good world-wide representation. It includes types of Rohwer, Marlatt, and others. David R. Smith is the current specialist in this group at the Museum.

The Ichneumonoidea collection is very rich in reared material and the braconid section is the second largest in the world. Ninety percent of all known North American braconids are represented. The ichneumonoid collection contains types of Ashmead, Cushman, Muesebeck, Townes, and Viereck among others. Besides Ashmead, the following ichneumonoid USDA specialists have worked at the Museum: Viereck, Cushman, C. F. W. Muesebeck, H. Townes, and L. Walkley. Paul M. Marsh and Robert W. Carlson are the current specialists in the Braconidae and Ichneumonidae respectively.

The proctotrupoid collection ranks second in the world. It contains over 700 holotypes, most of which represent Ashmead species or those of Fouts. The H. Priesner Collection (7,700 specimens), received in 1969, was an important acquisition because it contained many Old World species new to the collection and included many Priesner types. C. F. W. Muesebeck, though retired since

1954, still pursues his research on the proctotrupoids and comes to the Museum daily.

Although in rather poor curatorial condition, the cynipoid collection ranks as one of the important world collections. It contains about 50 drawers of galls: the W. Brodie gall collection, many types of Ashmead, and most of those of Lewis H. Weld. Weld came to the Museum in 1919, worked on the Cynipoidea officially until 1924 when he resigned his USDA position, and remained unemployed the rest of his life in the Washington area, although he worked on the cynipoid collection sporadically until his death in 1964. His large, personal collection did not come to the Museum; it is in the possession of Robert Lyon in Los Angeles, California.

Several of the early hymenopterists, especially Ashmead and Rohwer, worked with the aculeate Hymenoptera, but William M. Mann was the first entomologist at the museum to specialize within the group, working on the ants from 1917 to 1925. He left his USDA position to become Director of the National Zoo. Research in the Formicidae was continued by Marion R. Smith (USDA) who came in 1937 and retired in 1963. Grace A. Sandhouse, another early aculeate specialist, worked primarily with bees, but also conducted research on other aculeate families before she died at an early age in 1940. In 1941 Karl V. Krombein was employed by USDA to continue investigations in the aculeate Hymenoptera. He has worked widely in the group but especially in the Scolioidea and Sphecoidea. In 1965 he accepted an appointment with the Smithsonian as Chairman of the Department of Entomology, thus becoming the third hymenopterist employed by the Museum. Currently, the aculeate collections are curated by 5 individuals: D. R. Smith (ants); K. V. Krombein and Arnold S. Menke (wasps); and Paul D. Hurd and Suzanne Batra (bees).

The Aculeata collection, housed in about 2,000 drawers, is one of the largest in the world. Most of the superfamilies have good world representation, and, except for the Formicoidea, the collections are the largest in the New World. The ant collection contains many types of Mann, M. R. Smith, Emery, Forel, Wheeler, and others. Much important ant material came to the Museum in 1954 when the W. M. Mann Collection (117,000 specimens, 700 types) was acquired. The bethyloid collection is especially strong in the Chrysididae and Bethylidae. Authors represented in the type collection are: Ashmead, Evans, Fenton, Fouts, Rohwer, and others. The Scolioidea is especially rich in the Tiphiinae, Thynninae, Multillidae and Scoliidae, although the last 3 are in rather poor curatorial condition. Types of Allen, Krombein, Mickel, Rohwer, and Schuster, among others, are represented. The Vespoidea is strongest in the social wasps with much Neotropical material represented. Considerable nest material is associated with these insects. The type collection contains species of R. Bohart, Isely, Rohwer, and others. The collection of Pompiloidea has a good representation of North American species. Authors represented in the type collection are: Banks, Evans, Bradley, Dreisbach, Townes, and Priesner among

others. The sphecoid collection has representatives of nearly all of the genera, and the large type collection is represented by such authors as Fernald, Krombein, Leclercq, Mochi, J. Parker, Pate, Rohwer, Scullen, and van Lith. The bee collection is especially rich in material from North and South America, Europe, northern Africa, eastern Asia, and the Pacific Islands. Most recognized genera of bees are represented. There is a nearly complete world collection of carpenter bees (Xylocopinae); and several groups of pollen-collecting bees, such as squash and gourd bees, are exceptionally well represented, not only by extensive series but also by a tremendous amount of associated pollination data pertaining to their biologies and ecologies. The predominant authors in the bee type collection are Cockerell, Crawford, Lovell, Moure, Sandhouse, and Timberlake.

Over the years, the Hymenoptera Collection has been augmented through the acquisition of several important collections. Those of Ashmead, Mann, and Priesner have already been mentioned. The C. F. Baker collection of oriental insects, acquired in 1928, is especially rich in Hymenoptera, particularly those of the Philippines. The K. W. Cooper collection (30,000 specimens) has been donated in sections over the past 25 years. It is particularly strong in Eumenidae. The K. V. Krombein collection of aculeate Hymenoptera (25,000 specimens), acquired in 1975-76, is rich in type material of several prominent authors including those of the donor. The collection is world-wide in scope, but especially important because of the many wasps collected in eastern United States habitats that have been eliminated by suburban sprawl. The most oustanding, recent donation is the A. W. Stelfox collection of Irish Hymenoptera (88,000 specimens) which was received in 1967. This collection is particularly strong in the Braconidae and Ichneumonidae. The Stelfox collection gave greatly needed representation of European species in many families.

An important feature of the Hymenoptera collection is the large amount of larval material preserved in approximately 7,000 vials of alcohol. This material is especially strong in the Symphyta and Chalcidoidea. There is also a large voucher collection assembled by K. V. Krombein, in connection with his field studies on bionomics, ecology, and behavior of aculeate Hymenoptera, which is maintained as a separate unit. It includes adult wasps and bees, their larvae, and associated parasites, predators and symbionts.

In 1919 a count of the Hymenoptera collection revealed a total of nearly 500,000 specimens. Today the collection is housed in more than 4,300 drawers, and the number of pinned specimens is probably close to 2 million. There are more than 15,000 holotypes. These figures are close to those published for the British Museum Hymenoptera Collection in 1964, indicating that the two museums have comparable holdings.

Acarina

The history of the Acarina Section falls into three phases.

The first began with the appointment of Nathan Banks as a researcher with the Bureau of Entomology, USDA, in 1880, who left in 1916 to go to the Museum of Comparative Zoology (MCZ) at Cambridge. His work in the mite field was not profound, but he was the first acarologist to publish seriously on mites in this country. He published the first handbook or treatise on mites in 1915. This was used through the 1930's since no other publication in English was available. Much of his work was done on mites in general; he made no significant contribution to the field of acarology nor to the library or collection. When he left for the MCZ he took the library and collection with him.

The second phase dates from 1919 when H. E. Ewing was appointed by USDA to succeed Nathan Banks. He retired in 1945. His primary interest was in the Trombiculidae (chiggers) and his study became the basis of the USNM chigger collection, probably the most significant in the world. Ewing also worked on other mites, fleas, lice, and some primitive insect groups.

The third phase started when Edward W. Baker was appointed to the old Insect Idenficiation Unit (USDA) in 1944; he continues today as acarologist. His principal interest has been the study of mites important to agriculture but he has published considerable data in many other fields. Robert L. Smiley was appointed to the staff in 1961.

The basis of the collection in 1944, when E. W. Baker was appointed a member of the staff, was: (1) quarantine material, mostly undetermined, from many parts of the world; (2) Tetranychidae (spider mites), mostly North American, contributed mainly by E. A. McGregor of the Bureau of Entomology; (3) Trombiculidae (chiggers), which had been described by H. E. Ewing; (4) H. E. Ewing's personal collection, acquired prior to his appointment; (5) the A. P. Jacot Collection of Cryptostigmata (Oribatei), consisting mostly of mid-Atlantic States material; (6) a tick collection acquired by F. C. Bishopp and later combined with the collection at the Rocky Mountain Laboratory, National Institutes of Health, in Hamilton, Montana; and (7) miscellaneous small lots sent in for deposit or for identification.

Outstanding individual collections emphasize the importance of these groups to man, animals, and crops.

The study of the Trombiculidae began in earnest during World War II. Work started by H. E. Ewing, George W. Wharton, and James M. Brennan is being continued by Brennan, now retired and working on the collection which is on loan to him at the Bishop Museum in Hawaii. This collection includes practically all types from the Western Hemisphere, South Pacific, and many other regions.

The tick collection, which is housed at the Rocky Mountain Laboratory in Montana, is world-wide in scope and is under the custody of Carleton Clifford of

that laboratory. The Tetranychidae and Tenuipalpidae collections are complete for North America and contain much material collected elsewhere. E. A. McGregor's contributions from 1912 to 1965 laid the basis for this collection. Subsequent collecting, especially by D. M. Tuttle of Arizona, has enlarged the number of species significantly, especially for the southwestern U. S. and Mexico.

The collection of Mesostigmata mites contains most of the North American species, as well as others, in both the parasitic and predaceous forms. The parasitic families such as Laelapidae, Haemegamasidae, and Macromyisidae are well represented. The predaceous families, Phytoseiidae and Ascidae, are also well represented.

The Cheyletoidea collections–both parasites and free living predators–represent North American fauna as well as that from other areas of the world.

There is a scattering of types in many other groups, but as indicated, emphasis is on mites of importance to man, animals, and crops.

An excellent collection of parasitic mites of central Africa has been deposited in the collection by Alexander Fain of the Institute of Tropical Medicine, Antwerp, Belgium.

The acarology library has grown tenfold in the past 20 years. It is one of the best in the United States, especially in the older literature which was donated by H. E. Ewing upon his retirement.

Scientific Staff

Arachnida and Miscellaneous Insecta

Edward W. Baker, USDA (Beltsville)
B. S. (1936), Ph.D. (1938), University of California (Berkeley)
Curatorial Responsibilities: Acarina
Research Interests: Agricultural mites and general acarology

Ralph E. Crabill, Jr., SI
B. A. (1949), Ph.D. (1952), Cornell University
Curatorial Responsibilities: Chilopoda, Diplopoda, Symphyla, Pauropoda, Arachnida and Onychophora
Research Interests: Chilopoda, with emphasis on systematics, evolution, distribution, morphology; coverage global

K. C. Emerson, Research Associate, SI
B. S. (1939), M.S. (1940), Ph.D. (1949), Oklahoma State University
Curatorial Responsibilities: Mallophaga and Anoplura
Research Interests: Insects of medical and veterinary importance

Oliver S. Flint, Jr., SI
B. S. (1953), M.S. (1955), University of Massachusetts; Ph.D. (1960), Cornell University
Curatorial Responsibilities: Trichoptera, Plecoptera, Ephemeroptera, Odonata, Neuroptera, Mecoptera, Collembola, Thysanura, Diplura, and Protura
Research Interests: New World Trichoptera and Megaloptera

Ashley B. Gurney, Resident Cooperating Scientist, USDA
B. S. (1933), M. S. (1935), Ph.D. (1940), University of Massachusetts
Curatorial Responsibilities: Orthopteroid orders, Dermaptera, Psocoptera, Zoraptera
Research Interests: Systematics, distribution and biology of above groups with emphasis on New World cockroaches and grasshoppers, and Zoraptera of the world

Robert L. Smiley, USDA (Beltsville)
B. S. (1959), Alabama A and M University; M. S. (1973), University of Maryland
Curatorial Responsibilities: Free-living Mesostigmata, Pyemotidae, Podapolipodidae, Cunaxidae, Tarsonemidae, Cheyletoidea and Cheyletiellidae
Research Interests: Tarsonemidae, Cheyletiellidae, Cunaxidae, and Cheyletidae

Robert Traub, University of Maryland School of Medicine and Research Associate, SI
B. S. (1938), College of the City of New York; M. S. (1939), Cornell University; Ph.D. (1947), University of Illinois
Curatorial responsibilities: Siphonaptera
Research Interests: Taxonomy, systematics, ecology and disease transmission of and by Siphonaptera and Trombiculid mites; zoogeography and convergent evolution

Coleoptera

Donald M. Anderson, USDA
B. A. (1953), Miami University (Ohio); Ph.D. (1958), Cornell University
Curatorial Responsibilities: Immature Coleoptera; adult Scolytidae and Platypodidae
Research Interests: Immature Coleoptera, especially Curculionidae; biosystematics of *Smicronyx* (Curculionidae); adult Scolytidae

Doris H. Blake, Research Associate, SI
B.A. (1913), Boston University; M. A. (1917), Radcliffe College
Research Interests: Chrysomelidae of New World, especially the United States and West Indies

Oscar L. Cartwright, Research Associate, SI
B. S. (1923), Allegheny College; M. S. (1925), Ohio State University
Research Interests: Scarabaeidae (Aphodiinae)

Terry L. Erwin, SI
B. A. (1963), M.A. (1966), San Jose State College; Ph.D. (1969), University of Alberta
Curatorial Responsibilities: Carabidae (s. lat.), Rhysodidae, Amphizoidae and Staphylinidae
Research Interests: Ecology, zoogeography, phylogeny, and systematics of Carabidae

Robert D. Gordon, USDA
B. S. (1963), M. S. (1966), Ph.D. (1969), North Dakota State University
Curatorial Responsibilities: Scarabaeidae, Coccinellidae and other families
Research Interests: Western Hemisphere Coccinellidae and Scarabaeidae

John M. Kingsolver, USDA
B. S. (1951), Purdue University; M. S. (1956), Ph.D. (1961), University of Illinois
Curatorial Responsibilities: Bruchidae, Dermestidae, Buprestidae, Histeridae, Erotylidae and other smaller families
Research Interests: Taxonomy, zoogeography and host relationships of Bruchidae, especially of Western Hemisphere

Paul J. Spangler, SI
B. A. (1949), Lebanon Valley College; M. S. (1951), Ohio University; Ph.D. (1960), University of Missouri
Curatorial Responsibilities: Dytiscidae, Haliplidae, Gyrinidae Hydrophilidae and other families of aquatic Coleoptera
Research Interests: Biosystematics, phylogeny and zoogeography of aquatic Coleoptera

Theodore J. Spilman, USDA
B. S. (1948), University of Louisville; M. S. (1951), Cornell University
Curatorial Responsibilities: Heteromera, Elateroidea, Cerambycidae and Bostrichoidea
Research Interests: Tenebrionidae and relatives

Rose Ella Warner-Spilman, USDA (retired)
Research Interests: Curculionidae

Richard E. White, USDA
B. S. (1957), Akron University; M. S. (1959), Ph.D. (1963), Ohio State University
Curatorial Responsibilities: Anobiidae, Chrysomelidae, Anthribidae, Brentidae and Cleridae
Research Interests: Chrysomelidae and Anobiidae

Donald R. Whitehead, USDA
B. S. (1961), Rutgers University; Ph.D. (1971), University of Alberta
Curatorial Responsibilities: Curculionidae
Research Interests: Curculionidae and Carabidae; Central American biogeography; theoretical systematics

Diptera

Richard H. Foote, USDA
B. S. (1941), Montana State University; D.Sc. (1952), Johns Hopkins University
Research Interests: Tephritidae and information handling in biology

Raymond J. Gagné, USDA
B. A. (1961), University of Connecticut; M. S. (1963), Iowa State University; Ph.D. (1967), University of Minnesota
Curatorial Responsibilities: Mycetophiloidea, Muscidae, Calliphoridae, Sarcophagidae and Oestridae
Research Interests: Cecidomyiidae and Mycetophilidae

Yiau-Min Huang, SI (Medical Entomology Project)
B. S. (1959), Taiwan Provincial Chung-Hsing University; M. S. (1963), Ph.D. (1967), University of Wisconsin
Curatorial Responsibilities: Culicidae: *Aedes*
Research Interests: Culicidae: *Aedes (Stegomyia)* of the world

Lloyd V. Knutson, USDA
B. A. (1957), Macalester College; M. S. (1959), Ph.D. (1963), Cornell University
Curatorial Responsibilities: Asiloidea, Empididae, and Sciomyzidae
Research Interests: Biosystematics of Sciomyzidae and their use as biocontrol agents for snail hosts of helminthid parasites; North American Empididae *(Megacyttarus);* immature stages of Diptera

Wayne N. Mathis, SI
B. S. (1969), Brigham Young University; Ph.D. (1976), Oregon State University
Curatorial Responsibilities: Diptera
Research Interests: Biosystematics of Ephydridae

E. L. Peyton, SI (Medical Entomology Project)
Curatorial Responsibilities: Culicidae
Research Interests: Culicidae: *Anopheles* and *Uranotaenia*

Curtis W. Sabrosky, USDA
B. A. (1931), D.Sc. (Honorary) (1966), Kalamazoo College; M. S. (1933), Kansas State University
Curatorial Responsibilities: Tachinidae, Cuterebridae. Chloropidae, Milichiidae, Asteiidae, Odiniidae, Anthomyzidae and Aulacigastridae
Research Interests: Chloropidae, Tachinidae, also *Cuterebra, Protocalliphora* and *Stenomicra*

Sunthorn Sirivanakarn, SI (Medical Entomology Project)
B. S. (1958), Chulalongkorn University (Thailand); M. S. (1960), University of Colorado; Ph.D. (1967), University of California (Los Angeles)
Curatorial Responsibilities: Culicidae: *Culex*
Research Interests: Culicidae: *Culex* of the world

George C. Steyskal, USDA
Curatorial responsibilities: Anthomyiidae and 45 families of acalyptrate Diptera
Research Interests: Anthomyiidae, Agromyzidae, Tephritidae and several other families

F. Christian Thompson, USDA
B. S. (1966), Ph.D. (1969), University of Massachusetts
Curatorial Responsibilities: Tipuloidea, Psychodoidea, Bibionoidea, Simuliidae, Tabanidae, Dolichopodidae, Syrphoidea, and 14 other small families of Diptera
Research Interests: Systematics and zoogeography of Syrphidae and related groups

Ronald A. Ward, Walter Reed Army Institute of Research and SI (Medical Entomology Project)
B. S. (1950), Cornell University; M. S. (1967), University of London; Ph.D. (1955), University of Chicago
Curatorial Responsibilities: Culicidae
Research Interests: Medical entomology, biosystematics of Culicidae and malarial parasites

Willis W. Wirth, USDA
B. S. (1940), Iowa State University; M. S. (1947), Louisiana State University; Ph.D. (1950), University of California (Berkeley)
Curatorial Responsibilities: 25 families of Diptera, including Chironomidae, Ceratopogonidae, Phoridae, Rhagionidae, Ephydridae, Stratiomyidae and Drosophilidae
Research Interests: Ceratopogonidae and Ephydridae

Hemiptera

Richard C. Froeschner, SI
B. S. (1941), University of Missouri; M. S. (1951), Ph.D. (1954), Iowa State College
Curatorial Responsibilities: Hemiptera-Heteroptera
Research Interests: Hemiptera-Heteroptera with concentration on Tingidae and Pentatomoidea

Jon L. Herring, USDA
B. S. (1948), M. S. (1949), University of Florida; Ph.D. (1958), University of California (Berkeley)
Curatorial Responsibilities: Hemiptera-Heteroptera (excluding 3 families)
Research Interests: Anthocoridae; marine Hemiptera; Heteroptera of economic importance, especially Miridae, Lygaeidae and Coreidae

James P. Kramer, USDA
B. S. (1950), Beloit College; M. S. (1952), University of Missouri; Ph.D. (1961), University of Illinois
Curatorial Responsibilities: Homoptera: Auchenorrhyncha
Research Interests: Cicadellidae of the New World and Fulgoridae of the United States

Douglass R. Miller, USDA (Beltsville)
B. S. (1964), M. S. (1965), Ph.D. (1969), University of California (Davis)
Curatorial Responsibilities: Coccoidea
Research Interests: Eriococcidae and Pseudococcidae

Sueo Nakahara, APHIS, USDA (Beltsville)
B. S. (1955), University of Hawaii
Research Interests: Coccoidea

Kellie O'Neill, USDA (Beltsville)
B.A. (1941), University of Texas
Curatorial Responsibilities: Thysanoptera
Research Interests: Plant-feeding Thysanoptera

Louise M. Russell, Resident Cooperating Scientist, USDA (Beltsville)
B. S. (1926), M. S. (1927), Cornell University
Research Interests: Aleyrodidae, Psyllidae and Aphidoidea

Manya Brooke Stoetzel, USDA (Beltsville)
B. S. (1966), M. S. (1970), Ph.D. (1972), University of Maryland
Curatorial Responsibilities: Aphididae, Phylloxeridae, Adelgidae, Aleyrodidae and Psyllidae
Research Interests: Aphididae, Aleyrodidae, Psyllidae and armored scale insects

Hymenoptera

Suzanne Batra USDA (Beltsville)
B.A. (1960), Swarthmore College; Ph.D. (1964), University of Kansas
Curatorial Responsibilities: Apoidea
Research Interests: Ecology, behavior and management of Apoidea; biological control of weeds; insect-fungus symbiosis

B. D. Burks, Resident Cooperating Scientist, USDA
B. A. (1933), M. A. (1934), Ph.D. (1937), University of Illinois
Research Interests: Chalcidoidea, especially Chalcididae

Robert W. Carlson, USDA
B. S. (1962), M. S. (1963), Ph.D. (1968), University of Michigan
Curatorial Responsibilities: Ichneumonidae, Stephanidae, Evanioidea and Trigonalidae
Research Interests: Genera of the ichneumonid subfamily Campopleginae and species of Campopleginae of the Holarctic region in some genera; catalog of Nearctic Ichneumonidae

Gordon Gordh, USDA
B. A. (1967), University of Colorado; M. A. (1972), University of Kansas; Ph.D. (1974), University of California
Curatorial Responsibilities: Chalcidoidea
Research Interests: Systematics, biology and behavior of parasitic Hymenoptera

Paul D. Hurd, Jr., SI
B. S. (1947), M. S. (1948), Ph.D. (1950), University of California (Berkeley)
Curatorial Responsibilities: Apoidea
Research Interests: Systematic entomology, emphasizing taxonomy and biology of bees, intrafloral ecology and pollination

Karl V. Krombein, SI
B. S. (1934), M. A. (1935), Ph.D. (1960), Cornell University
Curatorial Responsibilities: Curation of voucher specimens from field studies on bionomics and ethology of wasps; Ceylon Insect Project specimens
Research Interests: Ceylon Insect Project, field studies on bionomics and ethology of wasps and bees; systematic studies of certain groups of Scolioid and Sphecoid wasps; computerized Catalog of North American Hymenoptera

Paul M. Marsh, USDA
B. S. (1958), M. S. (1960), Ph.D. (1964), University of California (Davis)
Curatorial Responsibilities: Braconidae and Proctotrupoidea
Research Interests: Braconidae

Arnold S. Menke, USDA
B. S. (1957), University of California (Berkeley); M. S. (1959), Ph.D. (1965), University of California (Davis)
Curatorial Responsibilities: Aculeate Hymenoptera except bees, Cynipoidea and larvae of Hymenoptera
Research Interests: Sphecidae and Belostomatidae (Hemiptera)

C. F. W. Muesebeck, Research Associate, SI
B. S. (1916), Cornell University
Curatorial Responsibilities: Proctotrupoidea
Research Interests: Proctotrupoidea

David R. Smith, USDA
B. A. (1960), Ph.D. (1967), Oregon State University
Curatorial Responsibilities: Hymenoptera: Symphyta, Formicidae, and Isoptera
Research Interests: Symphyta of the world

Lepidoptera

John M. Burns, SI
B. A. (1954), Johns Hopkins University; M.A. (1957), Ph.D. (1961), University of California (Berkeley)
Curatorial Responsibilities: Hesperioidea
Research Interests: Evolutionary biology, systematics and biology of Lepidoptera; primarily the Hesperioidea and secondarily the Papilionoidea

J. F. Gates Clarke, Research Associate, SI
Ph.C. (1926), B. S. (1930), M. S. (1931), Washington State University; Ph.D. (1953), University of London
Curatorial Responsibilities: Exotic Microlepidoptera
Research Interests: Systematics, zoogeography and biology of Microlepidoptera

Donald R. Davis, SI
B. A. (1956), University of Kansas; Ph.D. (1962), Cornell University
Curatorial Responsibilities: Suborders Zeugloptera, Dacnonympha and Monotrysia; superfamilies Zygaenoidea, Tortricoidea and Tineoidea
Research Interests: Systematics and phylogeny of suborders Zeugloptera, Dacnonympha and Monotrysia and superfamily Tineoidea, biology of leaf mining and cave dwelling moths.

W. Donald Duckworth, SI
B. S. (1957), Middle Tennessee State University; M. S. (1960), Ph.D. (1962), North Carolina State University
Curatorial Responsibilities: Microlepidoptera: Yponomeutioidea and Gelechioidea (part)
Research Interests: Biosystematics of Stenomidae and Sesiidae

Douglas C. Ferguson, USDA
B. S. (1950), Dalhousie University; M. S. (1956), Ph.D. (1967), Cornell University
Curatorial Responsibilities: Drepanoidea, Geometroidea, Uranioidea, Pyraloidea and Saturniidae
Research Interests: Systematics of Geometridae, Saturniidae, Orgyiidae, Arctiidae and certain other Noctuoidea, particularly of the North American Fauna; problems of Holarctic and Pleistocene biogeography

William D. Field, SI
B. A. (1936), M. A. (1938), University of Kansas
Curatorial Responsibilities: Rhopalocera: Papilionoidea
Research Interests: Classification, evolutionary biology and zoogeography of Pieridae, Nymphalidae and Lycacenidae

Ronald W. Hodges, USDA
B. S. (1956), M. S. (1957), Michigan State University; Ph.D. (1961), Cornell University
Curatorial Responsibilities: Gelechioidea (except Stenomidae and Xyloryctidae), Tortricoidea (except Castniidae, Cochylidae, Olethreutidae), and Sphingidae
Research Interests: Systematics and higher classification of Gelechioidea, particularly North American Fauna; New World Sphingidae

Edward L. Todd, USDA

B. A. (1947), M. A. (1948), Ph.D. (1950), University of Kansas

Curatorial Responsibilities: Noctuoidea

Research Interests: Systematics and zoogeography of New World Noctuoidea, especially acontiine noctuids; Faunal studies of Antillean Noctuoidea; Gelastocoridae (Hemiptera)

Donald M. Weisman, USDA

B. A. (1950), Miami University; M.Sc. (1960), North Carolina State University

Curatorial Responsibilities: Immatures of all Lepidoptera

Research Interests: Description of immature Lepidoptera of economic importance

Lepidoptera
Seated: Duckworth, Batra (Hymenoptera), Clarke, Field
Standing: Burns, Ferguson, Hodges, Davis, Weisman, Todd

Hemiptera
Seated: Russell, Stoetzel, O'Neill, Kramer
Standing: Nakahara, Herring, Froeschner, Miller

Diptera
Seated: Ward, Gagné, Huang, Sirivanakarn
Standing: Peyton, Thompson, Knutson, Wirth, Steyskal, Foote, Sabrosky

Hymenoptera
Seated: Hurd, Muesebeck, Krombein, Burks, Gordh, Marsh
Standing: Smith, Menke, Carlson

Arachnida and Miscellaneous Insecta
Baker, Flint, Crabill, Gurney, Emerson, Smiley, Traub

Coleoptera
Seated: Gordon, Cartwright, Blake, Warner-Spilman, Anderson
Standing: Erwin, Spangler, Kingsolver, White, Spilman

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Clarke, J. F. G.
1955. Mann Collection to Smithsonian Institution. Ent. News. 66:165.

1955. Smithsonian Institution Receives Bromley Collection. Ent. News. 66(9):238.

1956. Outstanding collection to Smithsonian Institution. Ent. News. 67:217.

1959. Recent Smithsonian Institution Entomological accessions. Ent. News. 70:220-222.

1963. Smithsonian Institution's Department of Entomology. Bull. Ent. Soc. Amer. 9:273-277.

1974. The National Collection of Lepidoptera. J. Lepidopt. Soc. 28:181-204.

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Cushman, R. A.
1929. Bringing to America the Baker Collection of Malayan insects. Explor. Field-Work Smithsonian Inst. 1928:91-100.

Davis, D. R.
1971. Ferguson Collection to Smithsonian Institution. J. Lepidopt. Soc. 25:168.

1973. Issiki Collection of Microlepidoptera to the Smithsonian Institution. J. Lepidopt. Soc. 27:159-160.

Dyar, H. E.
1902. The collection of Lepidoptera in the National Museum. Proc. Ent. Soc. Wash. 5:61-72.

Flint, O. S., Jr.
1963. The Odonata Collection of the United States National Museum, Smithsonian Institution. Selysia, A Newsletter of Odonatology 1(2):1-5.

Kellogg, R.
1946. A century of progress in Smithsonian biology. Science 104:132-141.

Krombein, K. V.
1967. A. W. Stelfox Collection of Irish Hymenoptera donated to Smithsonian Institution. Irish Nat. J. 15:298-299.

Masner, L., and C. F. W. Muesebeck
1968. The types of Proctotrupoidea in the United States National Museum. Bull. U. S. Natl. Mus. 270:1-43.

Sabrosky, C. W.
1964. Taxonomic Entomology in the U. S. Department of Agriculture. Bull. Ent. Soc. Amer. 10:211-220.

Smith, R. C.
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