Systematics in Agriculture Canada at Ottawa

1886 · 1986

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Canada

ONE HUNDRED YEARS OF PROGRESS

The year 1986 is the centennial of the Research Branch, Agriculture Canada.

On 2 June 1886, *The Experimental Farm Station Act* received Royal Assent. The passage of this legislation marked the creation of the first five experimental farms located at Nappan, Nova Scotia; Ottawa, Ontario; Brandon, Manitoba; Indian Head, Saskatchewan (then called the North-West Territories); and Agassiz, British Columbia. From this beginning has grown the current system of over forty research establishments that stretch from St. John's West, Newfoundland, to Saanichton, British Columbia.

The original experimental farms were established to serve the farming community and assist the Canadian agricultural industry during its early development. Today, the Research Branch continues to search for new technology that will ensure the development and maintenance of a competitive agri-food industry.

Research programs focus on soil management, crop and animal productivity, protection and resource utilization, biotechnology, and food processing and quality.

Systematics in Agriculture Canada at Ottawa

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Biosystematics Research Centre
Agriculture Canada

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Fletcher memorial fountain at the Central Experimental Farm

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Contents

Foreword

This publication commemorates 100 years of systematics in Agriculture Canada, from 1886 to 1986. James Fletcher inaugurated systematics in the department when he donated his personal collections of insects and plants to Agriculture Canada in 1886. Although he assumed his duties in that year, he was only officially appointed Dominion entomologist and botanist in the following year. In 1973, all of the systematic programs in the department were united in the Biosystematics Research Institute. In 1984, systematic studies on nonmedical bacteria were added to the mandate. In 1986 the institute was renamed the Biosystematics Research Centre (BRC).

At the present time, BRC conducts systematic research on the classification of insects, arachnids, nematodes, vascular plants, fungi, and nonmedical bacteria. The centre, with a staff of 55 professionals, provides an identification service that is widely used by other government agencies, both federal and provincial, by universities, and by individuals. It is responsible for developing and maintaining the Canadian national collections of insects, arachnids, and nematodes (12 800 000 specimens), for the Agriculture Canada Vascular Plant Herbarium (780 000 collections), for the National Mycological Herbarium (250 000 collections), and for the National Collection of Fungus and Bacterial Cultures. Two separate libraries support the activities of BRC, the zoology library in the K.W. Neatby Building and the Plant Research Library in the William Saunders Building.

The following mandate guides the Biosystematics Research Centre in its present operations:

- to conduct research to discriminate and correctly name taxa that occur in Canada or are otherwise of importance to Canadians, and to publish the results;
- to contribute to science and its uses by developing natural classifications and interpreting evolutionary relationships;
- to develop and maintain the national collections of living or preserved organisms from Canada and elsewhere to provide a reference base for biosystematic research on diversity and distribution, and for identification purposes;
- to provide a national identification service for clients, publish guides to help others make identifications, and supply relevant information;
- to provide inventories and floristic and faunistic studies for selected regions, habitats, or host groups to permit effective assessment and monitoring of environments, their quality, and their changes;
- to provide leadership and cooperation in the development of biosystematics in Canada by making expertise available for training and other educational purposes.

Gerald A. Mulligan
Director

3 March 1986

CHAPTER 1

Introduction

The Canadian government involvement in botany and entomology had parallel beginnings with the appointment of one individual. This was James Fletcher. Fletcher, a young Englishman in the employ of The Bank of British North America, was posted to Canada from London in 1874. He was born in Ashe in Kent County, England, in 1852 and was educated at King's School, Rochester. After 2 years he resigned from the bank to join the Library of Parliament as an accountant. In the following years he developed a considerable interest in natural history, and in particular, botany and entomology. As a result of this interest he was named honorary entomologist in the Dominion Department of Agriculture in 1884, but he retained his position in the Library of Parliament.

When the Experimental Farms Branch was organized in 1886, William Saunders, a distinguished pioneer entomologist, was named its first director. An order-in-council dated 18 July 1886, sponsored by the Minister of Agriculture, recommended that "James Fletcher, aged 35, at present in the Office of the Library of Parliament, and acting since 1884 as Honorary Dominion Entomologist, be appointed to fill such joint position [entomologist and botanist]."

When James Fletcher died in November 1908, he left behind him a well-laid foundation for entomology and botany in Canada.

The beginnings of systematic biology in Canada

To appreciate the problems faced by Fletcher and other biologists in the early years of the Experimental Farms System, we must look briefly at the early growth of biology elsewhere in Canada and in other countries. Systematics is at the foundation of all biology, because a system of nomenclature is the language by which knowledge of any group of organisms is communicated. Thus systematics approximately marks the start of any biological discipline.

Even in Europe, biology in the universities until after 1850 was mainly in the hands of the clergy--often dedicated but inevitably self-taught. Many such teachers, including Darwin's, were effective; but they were seriously limited in numbers and in scope. Mayr (1982) notes that European biology became markedly more professional after 1870. In the United States, as far as can be judged from Ewan (1969) for the botanical disciplines, the change seems to have been more gradual, perhaps from 1870 to 1890. Ewan notes that by 1900 the major American phanerogamic herbaria were in existence.

In Canada the development of systematic biology was inevitably further delayed by the small and scattered population. To judge from the conclusions of McKillop (1983) for the University of Toronto, although the decade 1881-1890 was one of intellectual pioneering in Canada (the Royal Society was founded in 1882), the universities were aiming only at cultivating the minds of students morally and socially. They offered little or no encouragement for original investigation or critical inquiry. Professional and practical

attainments were of little concern. A student determined to study biology seriously had to go to the United States or Europe and all too often did not return.

Forward (1977) notes that even after a biology department was formed at the University of Toronto, emphasis was almost entirely on zoology. E.C. Jeffrey, later to become a famous plant anatomist, joined the staff in 1891 as the first botanist; but he left in 1902 in utter frustration to return to Harvard. Thus, in this leading university there could be no source of trained phanerogamists, let alone mycologists, until after the turn of the century.

In these circumstances Canadian biology inevitably remained mainly in the hands of the amateur, trained in some unrelated field and pursuing biological studies as an outlet for his intellectual curiosity. Into this category fitted James Fletcher, trained as an accountant but studying insects, plants, and then plant diseases, in Ottawa; the school teacher John Dearness, studying general natural history, but especially the fungi, at London; Reverend C.J.S. Bethune, an outstanding amateur entomologist but without professional training in biology, who became head of the Department of Entomology and Zoology at Ontario Agricultural College, Guelph, as late as 1906; and William Saunders, pharmacist, who was a co-founder with Bethune of the Entomological Society of Canada in 1862, and later became the founding director of the Experimental Farms System in Ottawa. Anstey (1986) gives details of the career of Saunders. Thus the change to professional biologists in Canadian institutions must apparently be set after 1900 and perhaps closer to 1910.

The first professionally trained biologists in the Department of Agriculture were Fletcher's successors, appointed in 1909; C.G. Hewitt, Dominion entomologist, and H.T. Güssow, Dominion botanist, both trained in Europe. Note, however, that as late as 1911 P.A. Taverner, trained in architecture, was appointed in charge of vertebrates in the National Museum, and that he became a renowned ornithologist.

K.W. Neatby and growth of systematics in the department

Kenneth W. Neatby (B.S.A. and M.S.A., Saskatchewan) joined the young Rust Research Laboratory in Winnipeg in 1926 to take charge of wheat breeding. This was the start of the professional career of the man who was to influence agricultural research in Canada profoundly and who was ultimately to provide a marked stimulus to systematic biology in the department. For a more general account of Neatby's contributions, see Anstey (1986). Neatby left the Rust Laboratory in 1935 to teach at the University of Alberta; and he later became director of the Line Elevators Farm Service in Winnipeg, in which position he maintained close contact with research on cereal crops. In 1946 Neatby came to Ottawa as director of the Science Service, Department of Agriculture. His forceful leadership and intense interests in all research disciplines soon brought welcome encouragement to all researchers, but perhaps especially to the Ottawa-based botanists, entomologists, and mycologists. After long years of staff and travel restrictions, the expansion program of the late 1940s and early 1950s was a revelation and a delight. Suddenly we were encouraged, even urged, to get out and explore our country. Surely few of us <u>had</u> to be urged, but what a stimulus it was to be actively encouraged to undertake relatively

unrestricted and broadly based programs! And how the stimulus paid off in repeated conceptual breakthroughs. Brown's development of a biological species concept for his beetles, and Calder's and Savile's reinterpretation of the glacial history of the Canadian Cordillera, are two such examples. In the period mainly from 1948 to 1962 many staff members happily worked an average of 100 hours a week for most of the summer, and then put in 60-hour weeks all winter working up their results. As so often happens under such circumstances, some of the most critical findings were not in ecology and taxonomy for which the field work was mainly planned, but peripherally in, e.g., biogeography, late glacial history, dispersal, pollination behavior, or species concept.

Neatby very soon saw the drawbacks of having workers who were tackling different aspects of the same program placed in two separate directorates: the Science Service and the Experimental Farms Service. Certainly they did cooperate, but all too often it was in spite of the organization rather than because of it. In addition the nomenclature of the services inferred that the workers in units of the Experimental Farms Service were not doing research, which often had a deleterious effect on morale. Neatby was a major architect, probably the major architect, of the reorganization of these services into the Research Branch. He lived to see the reorganization accepted but tragically died of a brain tumor in November 1958, a few months short of the effective founding date of the Research Branch on 1 April 1959.

CHAPTER 2

Botany

Early collectors of plants in Canada

Some of the first specimens collected in Canada were gathered by the early explorers. These were taken back to Europe where, sometimes by circuitous routes, they have found their way into major herbaria.

Thus collections by members of the first Parry expedition (Sabine, Edwards, Ross, Parry, Fisher, and Beverley), which wintered on Melville Island in the Canadian Arctic archipelago, were recorded by Robert Brown in an appendix to Parry's journal (1824) and preprinted as Chloris Melvilliana (1823). This was the first detailed paper on botany of any part of Arctic America. Specimens are preserved in England.

Again, members of Parry's second (1821-1823) and third (1824-1825) expeditions to the Canadian eastern Arctic brought back extensive plant collections to England. These were reported upon by W.J. Hooker (1825, 1826).

Nicholas Polunin (1940) gave a history of exploration in the eastern Arctic.

Even before these, however, Peter Kalm had collected about Quebec City in 1748 (Boivin 1980, Ewan 1969). His personal herbarium was destroyed, but a set, which is now preserved in London, was given to Linnaeus, his mentor. Also André Michaux came to North America in 1785 and traveled from Florida to Lake Mistassini and the shores of Hudson Bay (Ewen 1969). His collections, which are preserved in Paris, were used as a basis for his Flora Boreali-Americana, published in 1803.

In the years 1819-1822 and 1825-1827, John Franklin made his great exploration trips through what is now the District of Mackenzie to the shores of the Arctic Sea. John Richardson, who accompanied him as surgeon-naturalist, made extensive collections along the routes. Drummond, who accompanied the second expedition as far as Carleton House, went west to the foothills of the Rocky Mountains. Their specimens, which are preserved in England, formed much of the basis of Hooker's Flora Boreali-Americana (1829-1840). Porsild and Cody (1980) gave a history of collecting in the continental Northwest Territories that included Richardson's travels, as well as other early collectors.

Not all collections made by these early naturalists were the subject of special publications. Thus those of Maclagan from southern Quebec and Ontario ended up in the herbarium at Edinburgh. His manuscript on the flora of Canada was never published. McNab, who collected from St. John, N.B., to Goderich, Ont., wrote up only a small part of his collections made along the Rideau Canal. His personal herbarium is now in Dublin. Goldie, who collected in southern Ontario, sent three seasons' specimens back to England. Unfortunately, two of these were apparently lost at sea.

Even in the 20th century large collections have been made in Canada by non-Canadians. Duplicates of many of these have, however, been deposited in Canadian herbaria. Examples of these are specimens that resulted from such botanically famous expeditions by M.L. Fernald (1910, 1911, 1921, 1926, 1933), who collected extensively in Nova Scotia, New Brunswick, Gaspé, and Newfoundland, and Hugh Raup (1936, 1947), who studied the vegetation in northwestern Canada.

Some early Canadian botanists

Bernard Boivin (1981, 1984) has presented a history of botanical societies in Canada, the earliest being established in Montreal in 1855. One of the leading members of this society was George Barnston, a Hudson Bay Company factor. He built up an herbarium of 715 specimens that eventually was given to McGill University.

George Lawson, a Scot, was instrumental in founding the Botanical Society of Canada at Kingston, Ont., in 1860. He brought a collection of plants to Queen's University when he arrived from Germany after receiving his Ph.D. In 1863 Lawson moved to Dalhousie University where he taught chemistry and mineralogy, as well as botany. His herbarium remained there inactive following his death but eventually in 1950 it was transferred to the herbarium of the National Museums of Canada. Lawson wrote a manuscript on the flora of Canada that was never published.

John Macoun, who was born in Ireland in 1831, emigrated to Canada in 1850. Following graduation from normal school, he taught for a year at Casleton in Northumberland County, Ont., and then moved to Albert College in Belleville. He collected extensively in both these areas. In the years 1872-1881, John Macoun traveled extensively in what are now the Prairie Provinces in expeditions sponsored by the Canadian Pacific Railway. On all of these expeditions he made large plant collections. His flowering plant specimens (7000 species) were purchased by the Government of Canada in 1882 when Macoun moved to Ottawa to begin work for the Geological and Natural History Survey. His collections were the nucleus of what is now the herbarium of the National Museum of Natural Sciences. Macoun's autobiography has recently been republished by The Ottawa Field-Naturalists' Club (1979).

James Fletcher and botany

James Fletcher was born in Ashe, near Wrotham in Kent County, England, in 1852 and was educated at King's School, Rochester. When he arrived in Canada in 1874 he must have brought a considerable knowledge of natural history with him. Certainly in the years leading up to his appointment as Dominion entomologist and botanist he accumulated much information on these disciplines. He was one of the founding members of The Ottawa Field-Naturalists' Club and in the early volumes of that organization's journal, published a series entitled Flora Ottawaensis (Boivin and Cody 1955). He had a personal herbarium numbering about 3000 species by 1886.

When the Central Experimental Farm in Ottawa was established, the plans contemplated the formation of an arboretum and botanic garden. Its purpose

would be to bring together all the native species of plants in Canada and to test the hardiness and adaptibility of shrubs and trees growing in northern climates in other parts of the world to the climate of Ottawa.

The actual work of the garden was begun in 1889, when 210 species were planted. The direct management, at first in the hands of the entomologist and botanist, James Fletcher, was later transferred to W.T. Macoun, the son of John Macoun. In 1894 the arboretum and garden included 1000 trees and nearly 200 species and varieties of herbaceous plants, but by the close of the year 1895, these numbers had been raised to 1800 and 1000, respectively.

Fletcher carried on an extensive correspondence in the fields of his responsibility. His letters, which are bound in annual volumes, occupy about 2.5 m of shelf space in the Public Archives at Ottawa. He traveled widely across Canada and spoke to many groups on insects and plant pathology as well as on weeds and other plants, and he gathered specimens for the herbarium as time permitted. His publication The Farm Weeds of Canada (1906, 1909), coauthored with George H. Clark and illustrated in color by Norman Criddle, is now a collector's item.

Tributes to Fletcher and a list of his published writings may be found in a memorial number of The Ottawa Naturalist (Vol. 22(10): 189-234, 1909).

The development of the Vascular Plant Herbarium

When Fletcher joined the Department of Agriculture in 1886, he brought his personal herbarium with him. In the 1887 report of the first Dominion entomologist and botanist, the following was written: "In addition to the above [living material for possible cultivation] reference collections of preserved entomological and botanical specimens will, of course, be necessary for the advantageous prosecution of entomological and botanical work. Temporary cases have already been provided for the former, and no effort will be wanting on my part to build up, with all expedition, a collection showing the injurious and beneficial insects which affect our crops."

"The value of having an extensive collection of our indigenous Canadian plants is easily apparent. Already numerous enquiries have been received concerning the identity and economic uses of wild plants, and it is most desirable that all such inquiries should receive prompt answers. To further this end, which I consider one of great importance, I have much pleasure in presenting to the farm museum my own herbarium comprising upwards of 3,000 species, collected in Canada, mainly by myself."

The herbarium was at first under the Division of Botany of the Experimental Farms Service. In 1938 the Division of Botany was transferred to the newly formed Science Service of the Department of Agriculture and named the Division of Botany and Plant Pathology. In 1951 the Ottawa staff of this division was reorganized into three units: the Botany Unit, which encompassed the Phanerogamic Herbarium; the Mycology Unit; and the Plant Pathology Unit. In 1959 with the formation of the new Research Branch, the herbarium came

Hans T. Güssow (left) and Herbert Groh (right)

under the Phanerogamic Taxonomy Section of that institute. Another change in 1973 brought the herbarium as a part of the Vascular Plant Section to the newly formed Biosystematics Research Institute.

During the early years following its inception, the herbarium grew slowly. Fletcher, who died in 1908, studied plants mainly in the Ottawa region, although he did collect some specimens during his travels across the country. Herbert Groh was on staff between 1909 and 1911. His prime interest was weeds. H.T. Güssow was named Dominion botanist in 1909, a position he retained until 1944. He contributed little in the way of specimens to the collection, but during his term he brought in John Adams in 1915, as assistant Dominion botanist with a primary responsibility of developing the herbarium, Faith Fyles for a time, and Harold Senn in 1938.

In 1924 the collection was still small, numbering only 6128 specimens. By 1930 it had increased to 9293.

Following the arrival of Harold Senn there was a significant expansion in botanical activity. He himself collected a considerable number of specimens, mostly from the vicinity of Ottawa in the beginning. More important, however, he gradually built up a group of active taxonomists around him whom he encouraged to collect widely. In addition, he began to exchange specimens with other herbaria and to develop cooperative projects that brought in

The east wing of the old botany building, completed in 1942, was designed for the Mycology and Vascular Plant herbaria

specimens to the herbarium. By 1951 when he was named head of the newly formed Botany Unit, he had a group of 10 taxonomists working with him. In addition, he created an active seed exchange program in association with the Dominion Arboretum and Botanic Garden, an exchange that was continued through to 1973 and latterly was a responsibility of the curator of the herbarium.

In 1948 a cooperative project with the Division of Entomology and funded by the Defence Research Board was begun. This continued for several years and during this time various staff members had an opportunity to visit and collect specimens in then rather remote parts of northern Canada. By 1951, the herbarium contained 192 890 mounted specimens.

Through this time the staff developed various interests. Raymond Moore and Wray Bowden conducted cytological and taxonomic studies of Caragana, Buddleja, and various Gramineae. Bernard Boivin began his surveys of the plants of the Prairie Provinces. A survey of the plants of Prince Edward Island was made by David Erskine, a student assistant, in 1952 and 1953. His flora of that province was published by the department in 1960. W.G. Dore, who specialized in Gramineae, carried out surveys of this group, mainly in Ontario and southern Quebec. Surveys of Canadian weedy species were continued after the retirement of Groh in 1948 by a group lead by Clarence Frankton.

In 1959, with the formation of the Plant Research Institute within the Research Branch, Harold Senn was named director of the institute, and the herbarium became the responsibility of the Phanerogamic Section of the institute. William Cody was appointed curator of the Vascular Herbarium at that time, a function he had actually been carrying out since 1950. By that time the herbarium contained 370 305 mounted specimens. By 1964 the herbarium had passed the half million mark.

As the herbarium tool increased in usefulness, taxonomic studies of various groups were undertaken. Monographs in various families such as

Cruciferae, Gramineae, Chenopodiaceae, Gentianaceae, and Leguminosae have been published and such treatments are continuing. A series of papers entitled "Biology of Canadian Weeds" was proposed and various staff members have made contributions. Work on airborne pollen has resulted in publications such as Havens from Hay Fever and An Atlas of Airborne Pollen Grains and Common Fungus Spores of Canada. The botanical staff associated with the herbarium have a broad spectrum of expertise. For a time the Index to Plant Chromosome Numbers was edited by a staff member, and various individuals have played parts in the editing of scientific journals. Important contributions to botanical nomenclature have been put forward and studies in ecophysiology, gene ecology, numerical taxonomy, and chemotaxonomy have been undertaken along with the historical floristic and taxonomic studies.

By the end of 1986 the number of specimens in the herbarium should number about 800 000.

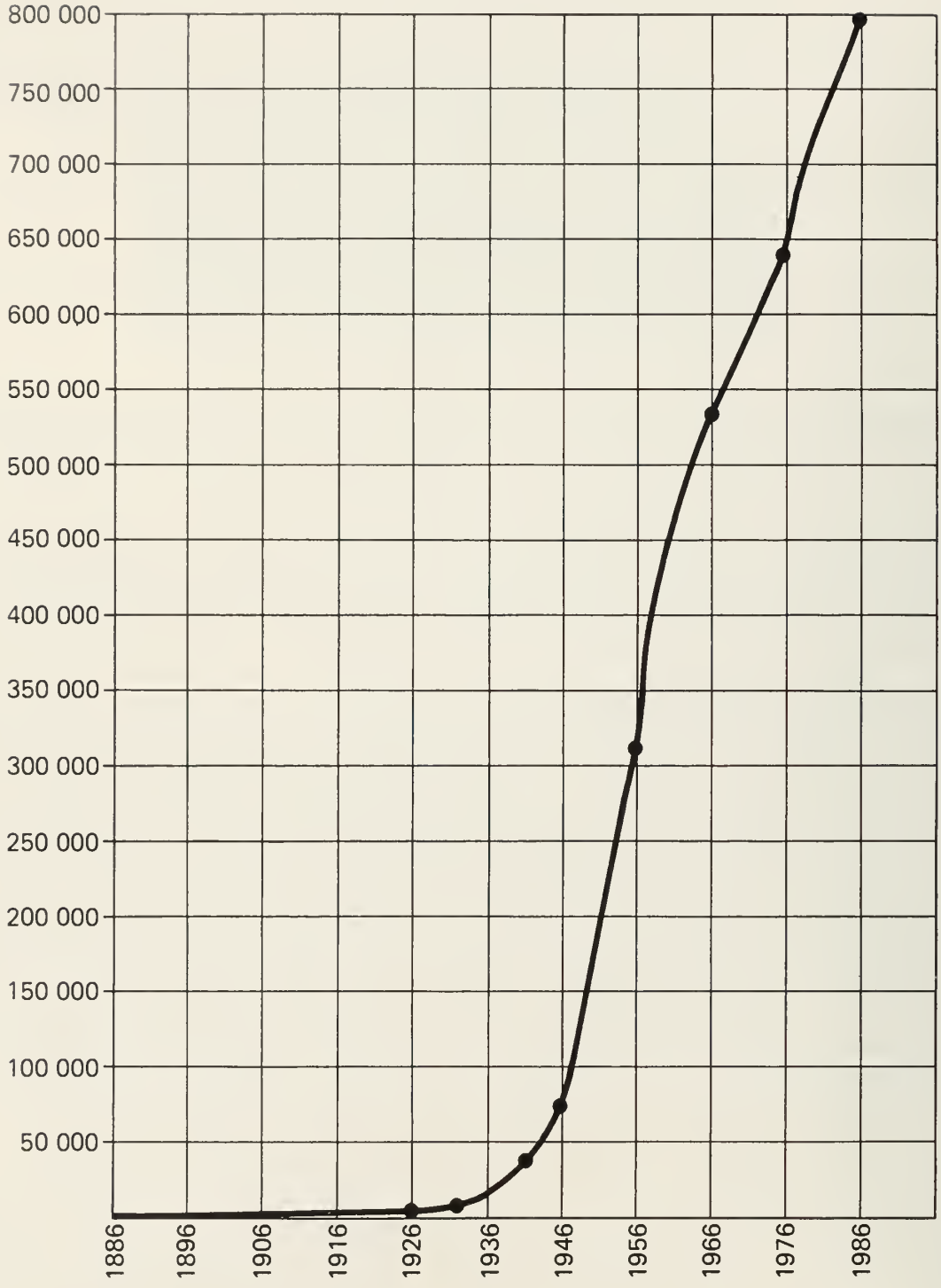
An approximate breakdown of the collection is as follows:

Canada (including Greenland and Alaska)	62%
U.S.A. (including Alaska)	20%
Europe	10%
Asia	1%
Central America (including Mexico and West Indies)	0.5%
South America	0.9%
Africa	0.3%
Oceania and Australia	0.3%
Cultivated	5%

The Canadian representation is from all parts of the country, east to west and north to south. The collection is particularly rich in Gramineae and Leguminosae, and the collection of adventive and naturalized plants is undoubtedly the best in Canada, as is the cultivated collection. Many vouchers for chromosome counts, particularly in the Gramineae, Leguminosae, Cruciferae, Epilobium, Linum, Cirsium, Lobelia, Buddleia, and weedy species, are included. There is type material for some 5000 to 6000 taxa in the collection, most of which are in protective covers. A catalog of these type specimens is in preparation. Also in the herbarium are some 16 000 to 17 000 enlarged photos of types, isotypes, and syntypes. In addition, there are some 5000 photographs of specimens other than types, which are of special significance to Canadian botany. Also, in our associated library there are complete photographic reproductions on microfiche of 15 herbaria that are of special importance to Canadian botany: Burser, de Candolle, Linnaeus (London), Linnaeus (Stockholm), Michaux, Thunberg, Willdenow, Rafinesque, Jussieu, Lamark, Desfontaines, Koenig, H.B.K. (Paris), Loureiro, and Tournefort (representing over 200 000 important specimens collectively).

The Vascular Plant Herbarium of the Department of Agriculture is now the largest and most important collection of specimens in Canada. Boivin (1980) published a survey of Canadian herbaria that included a description of this herbarium, as well as of all others known to him, both large and small.

VASCULAR PLANT HERBARIUM (DAO)



Botanical contributions by staff members

In this section we briefly present botanical contributions made by past and present staff members in chronological sequence.

Hans T. Güssow (1879-1961) was appointed in 1909 to continue James Fletcher's botanical work. His work in mycology is described in that section of this volume. His few strictly botanical writings were on weeds and medicinal plants. His plant collecting was limited, but of particular interest are the specimens he gathered in 1911 on Sable Island. An obituary was published in the Proceedings of the Royal Society of Canada, series III, 56: 191-195, 1962.

Faith Fyles (1875-1961) (B.A., McGill), an artist-naturalist, was born at Cowansville, Que. In the spring of 1911, she became the sole professional assistant to Hans T. Güssow who had recently been appointed Dominion botanist. She succeeded Herbert Groh when he returned to farming and in turn was succeeded by Groh when she transferred to the Division of Horticulture in 1922. Perhaps her most important publication was Principal Poisonous Plants of Canada. This was profusely illustrated with her own sketches, photographs, and paintings. Other publications were on weeds and wild rice. Her specimens from the test plots at the Central Experimental Farm and elsewhere in Canada and some of her paintings may be found in the Vascular Plant Herbarium (obituary in The Canadian Field-Naturalist 75: 220, 1961).

John Adams (1872-1950) was born near Ballymena, County Antrim, Ireland. He studied at Queen's College, Belfast, and received his M.A. from St. John's College, Cambridge. He taught in Dublin at the Royal College of Science and elsewhere before emigrating to Canada in 1914 where he held the post of assistant and later associate Dominion botanist until his retirement in 1939. He died in Ottawa. Prior to coming to Canada, Adams published on Irish algae, lichens, and fungi as well as on such topics as the longevity of seeds. In Ottawa he was concerned with economic botany and worked on such things as wild rice and ragweed. His writings include Guide to the Principal Families of Flowering Plants, Studies in Plant Life, A Survey of Canadian Plants in Relation to their Environment (1926), A Student's Illustrated Irish Flora (1931), A Short Guide to Canadian Genera of Seed Plants (1927), The Flora of Canada (1938), Medicinal Plants and their Cultivation in Canada (1940), and A Bibliography of Canadian Plant Geography (1928-1936), which was indexed and continued by Harold Senn. He was also concerned with the development of the Dominion Arboretum.

Herbert Groh (1883-1971) was a native of Preston, Ont. As a boy he had a keen interest in natural history around his father's farm, where he examined everything from silk worms to arrowheads. In 1908 Herbert graduated from the University of Toronto's Ontario Agricultural College at Guelph with a Bachelor of Science degree in agriculture. That year he became assistant botanist, on the staff of the Horticulture Experimental Station at Vineland, and the following year he moved to the Central Experimental Farm at Ottawa as an assistant to James Fletcher; Fletcher, however, died shortly after. Herbert left Ottawa in 1911 to manage the family farm. He did, however, keep in touch with Hans. T. Güssow, the Dominion botanist. In the fall of 1912, Herbert served as an inspector of potatoes in the Maritime Provinces for the newly

discovered potato canker and powdery scab. This he did again in New Brunswick in 1920. In 1921 he accepted a 6-month appointment as plant disease inspector in Manitoba, an appointment that was renewed twice until a position was again available for him in Ottawa.

While in Manitoba Herbert Groh developed a technique for recording his observations on weeds. This technique he put into practice over the next 25 years. These observations were published in seven reports of the Canadian Weed Survey (1941-1948), the last two in collaboration with Clarence Frankton. His observations on Canadian weeds were made all across the country. His publications were many and ranged from insects to birds, milk, weeds, boy's work, and people. A list of his publications may be found in the obituary written by Pierre Taschereau (The Canadian Field-Naturalist 86: 299-306, 1972). Other obituaries are in Greenhouse-Garden-Grass 10(4): 88-89, 1971 and The Canadian Botanical Association Bulletin 5(4): 4, 1972.

Ernest William (Cap) Hart (1881-1957), according to sketchy information available, came to Canada from England. He graduated from the Ontario Agricultural College at Guelph and then served in the British army as a colonel during World War I. He was appointed to the Division of Botany and Plant Pathology as junior botanist in 1932 at a salary of $1458 a year. His publication Contributions to Canadian botany. I Keys to goldenrods in Canada and Newfoundland (1937) resulted from his studies of that genus at Ottawa where he grew many species in the plots at the Central Experimental Farm. Earnest Hart's identifications appear on many labels of specimens collected by others during his working life in the Vascular Plant Herbarium, but only a handful were collected by him. In the latter days before his retirement and return to England in 1947, he was concerned with identification, keeping indexes, and keeping the collection in good order.

E(rnest) Grant Anderson (B.S.A. (Botany), 1933, Ontario Agricultural College; M.Sc. (Plant Physiology), 1940, McGill) was born in Vankleek Hill, Ont., in 1907. He joined the Division of Botany permanently in 1933 but had worked at the Central Experimental Farm sessionally in prior years. From 1949 to 1962 he served as secretary of the National Weed Committee but was still attached to the Division of Botany. From 1962 to his retirement in 1972 he was herbicide liason officer in the Scientific Information Section of the Research Branch of the Department of Agriculture. During his years with the Division of Botany he was concerned with economic botany and, in particular, in poison ivy and dodder. His plant collections, mostly weedy in nature, were gathered from all parts of Canada, but mainly from Ontario.

W(illiam) Harold Minshall (B.S.A., 1933, Toronto, Ontario Agricultural College; M.Sc., 1938, Ph.D., 1941, McGill) was born in Brantford Township, Ont. In 1933 he joined the Division of Botany and Plant Pathology as a summer assistant to Herbert Groh. This was extended into continuous employment. Up to 1941 he was concerned with phenology, life history of weeds, chemical weed control, and the Canadian weed survey. After 1941 these interests were expanded to include physiology of rubber plants, mode of action of herbicides, and the effect of herbicides on the physiology of plants. In 1951 Harold transferred to the new Agriculture Canada Research Institute in London, Ont., as senior plant physiologist. He retired from the department in 1975.

Harold A. Senn

Harold A(rchie) Senn (B.A., 1932, M.A., 1934, McMaster; Ph.D., 1937, Virginia) was born in Caledonia, Ont., in 1912. As with other of her promising students, Lulu Gaiser suggested that he should study under Orland E. White at the Blandy Experiment Station. There he worked on the cytotaxonomy of the genus Crotalaria. In 1938 he joined the Botany and Plant Pathology Division as an assistant to Herbert Groh. He became head of the Botany Unit and through his initiative the Vascular Plant Herbarium began to expand in specimens and in usefulness as a taxonomic tool. He also continued his interest in cytotaxonomy and developed facilities for growing plants in a controlled environment. He became the first director of the new Plant Research Institute in 1959.

Because of his many administrative duties, Harold Senn's botanical publications are few. He did, however, continue Adam's Bibliography of Canadian Plant Geography up to the year 1945 and provided that series with a useful index. He also edited the journal The Canadian Field-Naturalist, between 1943 and 1955. For the IX International Botanical Congress he was an organizer and vice-president as well as chairman of the field-trips committee, which set up field trips all across Canada and in the Arctic as well.

Harold left the department in 1960 to become a professor of botany and director of the new Biotron facility at the University of Wisconsin.

Murray Zinck (B. Comm., 1931, Dalhousie; B.A., 1936, B.Sc., 1938, Acadia; M.A., 1939, Wisconsin) was born in Chester, N.S., in 1909. At the University of Wisconsin he studied general taxonomy under Norman Fassett. In 1939 Murray replaced Faith Fyles as a laboratory assistant in the Botany Unit. There he was concerned with medicinal plants, the use of milkweed and Russian dandelion as rubber substitutes, the use of milkweed as a substitute for kapok, plant identification, botanical collecting for the herbarium in the Ottawa area, and assisting Harold Senn. After 6 years working in botany, because of his degree in Commerce, Murray was diverted into administration to assist Frank Drayton with the administrative affairs of the division. Murray left the department in 1951 to take over his father's store in Chester, N.S., and later taught school in that area.

Raymond J(ohn) H(erbert) T(homas) Moore (B.A., 1941, M.A., 1943, McMaster; Ph.D., 1946, Virginia) was born in Hamilton, Ont., in 1918. At McMaster, Ray studied botany under Lulu O. Gaiser. She sent him to the Blandy Experimental Station where he worked under Orland E. White.

Ray joined the Division of Botany and Plant Pathology as a cytotaxonomist in 1944. His interests were in Buddleia, Caragana, Medicago, and latterly Cardueae-Compositae. He retired in 1977 because of failing eyesight.

James H(erbert) Soper (B.A., 1938, M.A., 1939, McMaster; Ph.D., 1943, Harvard) was born in Hamilton, Ont., in 1916. Jim came to the herbarium section of the Division of Botany and Plant Pathology as a taxonomist in 1945 but left in 1946 to take an appointment as lecturer and curator at the University of Toronto. While in Ottawa he helped set up an exchange program and was involved in the identification service, the organization of the herbarium, the local Ottawa flora project, and a project on the correlation of ground surveys with air photography.

James A(lexander) Calder (B.Sc., 1941, McGill) was born at Regina, Sask., in 1915. His public and high school education was in Ottawa. After he received his B.Sc. in geology at McGill University in Montreal, he served in the Royal Canadian Air Force in Europe and India. He joined the herbarium staff of the Botany and Plant Pathology Division in the spring of 1946. Jim was the best plant collector to be found in Canada. His collections, which always carried excellent ecological information, numbered over 37 600 by the time he took early retirement in 1966. Duplicates of his collections may be found in many herbaria in North America and Europe. His collecting began in the Ottawa area in 1946 and 1947, but in 1947 he was sent to Ste. Anne de la Pocatière, particularly to collect the grass flora. In 1948, with the beginning of the northern surveys that were conducted under the auspices of the Defence Research Board, he was sent to Fort Chimo in northern Quebec and Frobisher Bay on Baffin Island. In 1949 he continued his northern collecting in the vicinity of Dawson, Yukon Territory, and in 1951 he worked on the Kenai Peninsula in Alaska. In 1953 Jim began his systematic survey of the flora of British Columbia, which was to have culminated in a flora of that province. In different years he was accompanied by Roy Taylor, Jack Gillett, Doug Savile (mycologist), J.A. Parmelee (mycologist), and I. Kukkonen, a Finnish botanist and mycologist. The excellent cooperation of these various teams was most productive.

Clarence Frankton (Ph.D., 1940, McGill) was born in Nottingham, England, in 1906. His doctoral thesis was on the grasslands of Quebec. Following his

graduation he worked in the field of pasture research at Macdonald College. Clarie joined the Botany and Plant Pathology Division in 1946 where he soon took over the responsibilities for the Canadian Weed Survey from Herbert Groh. He was head of the Weed Unit for many years and for a time before his retirement in 1970 had the responsibility for the Vascular Plant Herbarium Unit as well. During and leading up to the IX International Botanical Congress in Montreal in 1959, he served as secretary-general, a formidable organizational task. Clarie's interests have not been limited to weeds but extend also to native plants and many other facets of natural history as well. His publications include Weeds of Canada (1955, 1970), which is a standard reference for both specialists and nonspecialists. Perhaps the most important contribution that he has made, however, is the support and stimulus he has given to his colleagues and others in their research projects. He continued for a time after his retirement as an honorary research associate and even now still visits the herbarium, bringing in and examining specimens and offering advice.

In 1973 Clarie was presented with the George Lawson Medal by the Canadian Botanical Association in recognition of his contribution to Canadian botany.

William J(ames) Cody (B.A., 1946, McMaster) was born in Hamilton, Ont., in 1922. At McMaster University he studied botany under the late Lulu O. Gaiser. After working as a land use soil surveyor in southern Ontario for the Ontario Department of Planning and Development during the summer of 1946, he joined the herbarium staff of the Botany and Plant Pathology Division.

In 1948 Bill made his first botanical field trip in northern Canada under the auspices of the Defence Research Board. This was to Coral Harbor on Southampton Island. In 1949 he worked out of Yellowknife, in 1950 he was based at Fort Smith, and in 1951 at Big Delta, Alaska; he moved on to Norman Wells in 1953 and to Fort Simpson in 1955. In 1957 and again in 1963 he worked out of the Reindeer Station on the east branch of the Mackenzie River Delta, where he studied changes in the rangelands of the Reindeer Grazing Reserve. Other northern surveys were along the Liard River in 1961 and Lower Slave River in 1965 with John Day (Soils Division), in southeastern District of Mackenzie in 1966, and in the Mackenzie Mountains with a Geological Survey party in 1967. In the early 1970s he spent three summers surveying proposed sites in the District of Mackenzie for preservation under the international biological program (IBP/CT). All of these surveys contributed to Vascular Plants of Continental Northwest Territories, Canada (1980), which was coauthored with A.E. Porsild. Surveys in national parks were conducted in the St. Lawrence Islands (1975), Kouchibouguac (1977), and Riding Mountain (1979). Manual of the Plants of Riding Mountain National Park (1986) resulted from this latter survey. Since 1980 he has been conducting field work in the Yukon Territory toward writing a flora of that part of Canada's north.

Bill Cody has made over 35 000 plant collections. He has served as curator of the Vascular Plant Herbarium since 1959. He was made an honorary member of the Ottawa Field-Naturalists' Club in 1979 for his service as business manager of The Canadian Field-Naturalist since 1949 and for his contributions to Canadian botany.

Lucille Martin (B.Sc., St. Patrick's College, Ottawa) was born in 1925. She joined the herbarium staff of the Division of Botany in 1946, where she

worked mainly with cultivated plants from the Dominion Arboretum. She entered the Grey Sisters of the Immaculate-Conception religious order in 1949.

August J(ulius) Breitung was born in Muenster, Sask., in 1913. He had little formal education, but a great interest in plants. He amassed a substantial private herbarium mostly from the vicinity of McKague, Sask., and elicited the help of many experts such as W.P. Fraser, G.H. Turner, H.M. Raup, C.R. Ball, and M.L. Fernald in the identification of more the difficult taxa. In 1944 A.E. Porsild took him as a field assistant on his Yukon Canol Road expedition. August was with him again in 1946 for a botanical survey in Banff National Park. Bernard Boivin was also a member of this survey party. In 1947 August joined the Division of Botany and Plant Pathology as an assistant technician in the Vascular Plant Herbarium. Because of his special knowledge of western plants he was sent to Swift Current to aid in some pasture studies. He soon transferred his efforts to the Cypress Hills from whence he gathered a vast collection of herbarium specimens. His publication A Botanical Survey of the Cypress Hills (1954) resulted from this collecting. His Annotated Catalogue of the Vascular Flora of Saskatchewan (1957) and Plants of Waterton Lakes National Park, Alberta were written after he moved to California. August was a keen observer and an avid collector.

William G(eorge) Dore (B.A., 1933, Queen's; M.Sc., 1935, McGill; Ph.D., 1947, Ohio State) was born in Ottawa, Ont., in 1912. After receiving his M.Sc. in 1935, Bill worked at the Botany Division under Hans T. Güssow for 2 years. Then after teaching a summer course at Queen's University he moved to Dalhousie University in Halifax, where he was a lecturer and later assistant professor in botany for 8 years. While at Dalhousie he published The Grasses of Nova Scotia (1942) with A.E. Roland. Shortly after the war was over Bill moved to the Ontario Agricultural College at Guelph, where he was an assistant professor of botany for 2 years. It was there that he began his study of Ontario grasses, which culminated in his Grasses of Ontario (1980). In 1947 Bill returned to Ottawa to become supervisor of the Herbarium Section and shortly after completed his studies at Ohio State by taking a short leave of absence. As a part of his studies of Canadian grasses, Bill made collections from Nova Scotia to British Columbia. His interests, however, were not limited to the grass family. He had many small projects such as surveys of the land that was to be flooded by the St. Lawrence Seaway, the vegetation of the islands in the St. Lawrence River, plants used by the native Indian population, water weeds, and such special genera as Peltandra, Hydrocharis, and Caulophyllum. He also had a great interest in historical botany, in particular such early individuals as George Lawson. He was instrumental in starting David Erskine on his study of the Plants of Prince Edward Island (1960). His studies of the grass genus Zizania led to the publication Wild Rice (1969, 1975).

Wray M. Bowden (B.A., 1936, McMaster; Ph.D., 1941, Virginia) was born in Brantford, Ont., in 1914. At McMaster University he studied under Lulu O. Gaiser. She sent him to Orland E. White at the Blandy Experimental Station where he was a Blandy Research Fellow from 1937 to 1941. Prior to his joining the Botany and Plant Pathology Division as a cytotaxonomist in 1947, he worked in the rubber investigations at the division for 6 months in 1942-1943 and then held annual appointments at several Canadian universities. He conducted extensive studies on the genus Lobelia, the Triticeae, and northern grasses. Since his early retirement in 1966, Wray has continued his interests in

gardening at his home in Simcoe, Ont., where he has many rare plants growing, and is still writing, particularly for horticultural journals.

Robert O(wen) Bibbey (1910-1963) (B.S.A., 1934, M.Sc., 1936, Saskatchewan; Ph.D., 1946, Iowa State) was born in England, where he received his early education. His M.Sc. thesis was "Influence of environment on the germination of weed seed." His Ph.D. thesis was entitled "Physiological studies of weed seed germination." During the period 1942-1945 he served as a lieutenant with the Royal Canadian Army Service Corps in Europe. Bob was attached to the Division of Botany and Plant Pathology as secretary of the National Weed Committee. He was succeeded in this position by Grant Anderson. In 1948 Bob left Ottawa to become a professor at the Ontario Agricultural College, Guelph, and in 1950 was named head of the Department of Botany at that institution.

Bernard Boivin (1916-1985) (B.A., 1937, L.Sc., 1941, Montreal; Ph.D., 1943, Harvard) was born in Montreal. His thesis at Harvard, where he studied with M.L. Fernald, was a worldwide monograph of the genus Thalictrum. Prior to that, in Montreal, he was greatly influenced by Marie-Victorin. In 1946-1947 Bernard was employed as a botanist at the National Museums of Canada. In 1947-1948 he was a Guggenheim Fellow at Harvard University. There he worked on the genus Lycopodium. From 1948 onward until his retirement in 1981 he was employed by the Department of Agriculture, but in 1965-1966 he took leave to be a visiting professor at Laval University and again in 1969-1970 took leave to be a visiting professor at the University of Toronto; then for the last year-and-a-half he worked in Quebec City at the Louis-Marie Herbarium at Laval University. Bernard's field work while with the department was conducted mainly in the Prairie Provinces during the years 1949-1960, where he collected widely. This work culminated in his Flora of the Prairie Provinces (five volumes, 1967, 1968-1969, 1972, 1979, 1981). His Enumération des plantes du Canada (1966-1967) was a monumental work. Bernard had a great interest in the history of botany and in botanists. His Survey of Canadian Herbaria (1980) resulted partly from this interest and partly from his work on the Enumération.

Gerald A(lfred) Mulligan (B.Sc., 1952, Macdonald College at McGill) was born in Ottawa, Ont., in 1928. He joined the staff of the Weed Unit of the Botany and Plant Pathology Division in 1947 as an assistant technician. Following the advice of his chief, Clarence Frankton, he left the unit to continue his education at Macdonald College, but returned each year for summer employment. On completion of his degree in plant pathology, he rejoined the division as a plant taxonomist. As a taxonomist Gerry was mainly concerned with weedy plants, particularly in the family Cruciferae, but in addition has become an authority on the genera Physaria and Draba. In addition to many scientific papers, he has authored such books as Common Weeds of Canada (1976), contributed a chapter to The Genetics of Colonizing Species (1965), and was a coauthor of the second volume of The Flora of the Queen Charlotte Islands (1968), which dealt with the cytology of the plants of that island. He was instrumental in setting up the series Biology of Canadian Weeds, which is being published in the Canadian Journal of Plant Science, and has edited two volumes in which the contributions to this series were brought together. Gerry's field work has taken him from Gaspé Peninsula in Quebec to British Columbia and south into the United States.

With the formation of the Biosystematics Research Institute, Gerry became head of the Noxious and Native Plant Section in 1973 and assistant director of the institute in 1974. He has since become director. Administrative duties have lessened his time for research, but he has still continued his research productivity. He was president of the Canadian Botanical Association for 1984-1985.

I(van) John Bassett (B.A., 1948, Toronto) was born in Lethbridge, Alta., in 1921 but spent much of his early life at Cannington, near Toronto, Ont. After service with the Royal Canadian Air Force during the years 1941-1945 (much of which was spent at Gibraltar), he returned to Ontario. He joined the Weed Unit of the Botany and Plant Pathology Division in 1948. His studies of Canadian weeds have taken him from Nova Scotia and Newfoundland to British Columbia. His major taxonomic interests have been in the families Plantaginaceae, Chenopodiaceae, and Urticaceae wherein many weedy species are to be found. In 1964 John had an opportunity to conduct pollen morphological studies with Richard West and Harry Godwin at Cambridge University in England. His pollen morphological studies have been in such families as Caprifoliaceae, Tamaricaceae, Plantaginaceae, and Leguminosae (Trifolium). Studies of airborne pollen across Canada resulted in the annual publication Canadian Havens from Hay Fever and in the book An Atlas of Airborne Pollen Grains and Common Spores of Canada. John has continued a productive career in spite of a serious physical handicap in recent years.

John M(ontague) Gillett (B.A., 1949, Queen's; Ph.D., 1952, Washington St. Louis) was born in Ottawa, where he received his early education. During the war years, 1940 to 1945, he served overseas with the Royal Canadian Air Force. On his return he immediately entered Queen's University to study biology, and during the summers of 1946, 1947, and 1948 he worked as a summer student in the herbarium of the Division of Botany and Plant Pathology. In 1948 he was sent to Churchill, Man., as part of the Defence Research Board's northern survey project. Upon graduation from Queen's in 1949, Jack joined the herbarium staff. That fall saw him at the Missouri Botanical Garden working on Gentianella under Robert E. Woodson. In the summers, however, he returned to Ottawa to undertake various field surveys. In subsequent years he conducted field surveys in the vicinity of Marmora, Ont. (1952), along the proposed St. Lawrence Seaway with W.G. Dore (1952 and 1953); Crater Lake, Labrador with the National Geographic Society and Royal Ontario Museum (1953); Florida with W.M. Bowden (1954); Quebec City area (1955); southern Ontario (1957); Churchill, Man., in preparation for an International Botanical Congress field trip in 1958 and a host on that trip in 1959; Alaska Highway, northern British Columbia, southern Yukon, and the Ogilvie Mountains with J.A. Calder (1960); southern Ontario for legumes (1961); western Canada and United States (1962, 1963, 1964, 1966, 1970); and a floristic study of Gatineau Park, Que. (1967, 1968).

In 1972, Jack left the Plant Research Institute to become curator of the herbarium at the National Museum of Natural Sciences. He retired from that position in 1983.

Douglas R(ome) Lindsay (B.A., 1946, Queen's; M.S., 1951, Wisconsin) joined the Weed Unit of the Division of Botany and Plant Pathology in 1949. He conducted field surveys in Ontario, Alberta, and British Columbia, perhaps the most important of which was Survey of common barberry (Berberis vulgaris L.)

in southwestern Ontario 1951 (1952). In 1956 he resigned to take up a position in the Biology Department of Lakehead University.

Hubert L(loyd) J(oseph) Rhodes (B.S.A., 1949, M.S.A., 1950, British Columbia) worked at the Division of Botany and Plant Pathology from 1950 to 1956. During that time he took leave of absence to undertake graduate studies in botany at the Bailey Hortorium of Cornell University. In Ottawa his work centered on the taxonomy of cultivated plants. He made a survey of the trees and shrubs currently cultivated in Canada by visiting and collecting specimens in botanical gardens and the major commercial nurseries. Bert left the department to spend full time with a private nursery business.

Jack F(ranklin) Alex (B.S.A., 1950, M.Sc., 1952, Saskatchewan; Ph.D., 1959, Washington State) was born in Rutland, Sask., in 1928. At the University of Saskatchewan he studied plant ecology under R.T. Coupland, where his thesis was on the underground parts of leafy spurge. He received his Ph.D. from Washington State University as a result of his studies on *Linaria dalmatica*. Jack joined the staff of the Weed Unit in 1958 where he worked as a weed ecologist under Clarence Frankton, after holding a teaching position at the University of Ceylon and a research associate position at the University of Saskatchewan. In 1962 he left Ottawa to join the staff of the Agriculture Canada Research Station at Regina, Sask., and in 1968 he returned to Ontario where he became a faculty member in the Department of Botany at the University of Guelph.

Clifford W(illiam) Crompton (M.A., 1982, McGill) was born in Antigonish, N.S., in 1941. After working for some time elsewhere at the Central Experimental Farm, Cliff joined the Weed Section of the Botany and Plant Pathology Division as a technician. In this capacity he took part in field surveys and in particular worked with John Bassett in his taxonomic and pollen studies. He is a coauthor of numerous publications, including *An Atlas of Airborne Pollen Grains and Common Spores of Canada*. In 1980 W.F. Grant and D.W. Woodland suggested that Cliff should work under them at Macdonald College for his masters degree. This was accomplished on a part-time basis through much hard work. After receiving his degree, Cliff was successful in 1983 in a competition for a weed biologist position.

Roy L(ewis) Taylor (B.Sc., 1957, Sir George Williams, Montreal; M.Sc., McGill; Ph.D., 1962, Berkeley) was born in Olds, Alta. Roy served as summer assistant to Jim Calder, particularly in British Columbia, for several years prior to his full-time appointment in 1962. He was author of a monograph on the genus *Lithophragma*, which was the result of his studies at Berkeley. He was the coauthor of the two volumes of *Flora of the Queen Charlotte Islands* (1968) and coeditor of the volume *The Evolution of Canada's Flora* (1965), among other botanical publications. His taxonomic interests were mainly with the family Saxifragaceae.

In 1968 he left Ottawa to take up the position of director of the botanical garden at the University of British Columbia.

Theodore Mosquin (B.Sc., 1956, Manitoba; Ph.D., 1961, U.C.L.A.) was born in Brokenhead, Man., in 1932. His studies at Los Angeles centered around the cytogenetics and evolution of the genus *Clarkia*. Ted joined the Plant Research Institute in 1963, where he worked on the cytology and reproductive

biology of such genera as Linum and Epilobium. During 1968-1969 he took a leave of absence to be a visiting lecturer at the University of California, Berkeley. His keen interest in natural history led him to become editor of The Canadian Field-Naturalist from 1968 to 1972 and he was president of The Ottawa Field-Naturalists' Club in 1970. In March 1972 Ted took another leave of absence to become the first executive director of the newly formed Canadian Nature Federation. In April of 1973 he decided to stay with the federation and submitted his resignation to the department.

Bernard R(ené) Baum (M.Sc., 1963, Ph.D., 1966, Hebrew University) was born in Paris, France, where he received his early education. After 3 years of military service in Israel, he continued his education in Jerusalem from where he received his M.Sc. in taxonomy, chemistry, and genetics. His Ph.D. studies centered on the taxonomy, cytogenetics, and statistics of the genus Tamarix. After he received his Ph.D. he spent some time at the Musée des Sciences Naturelles in Paris conducting postdoctoral studies. In 1966 Bernard immigrated to Canada where he joined the staff of the Plant Research Institute. In Ottawa he has been interested in evolution, nomenclature, and taxonomy (both classical and numerical). His book Oats: Wild and Cultivated--A Monograph of the Genus Avena L. (Poaceae) was one of the major reasons the Canadian Botanical Association awarded him the George Lawson Medal in 1979. Prior to this in 1973 he published an International Register of Oats that has been widely used by plant breeders, seed buyers, merchants, and scientists around the world and has been used as a model for other plant genera. Bernard's studies have now turned to the tribe Triticeae, in which among other aspects he is working on a monograph of the genus Hordeum. His field work in Avena and Triticeae has taken him across Canada to Alaska, the Near East, and southern South America. His writings have been prolific.

John McNeill (B.Sc., 1955; Ph.D., 1960, Edinburgh) was born in Edinburgh, Scotland, in 1933. After graduation he served as assistant lecturer and lecturer at the University of Reading, and deputy senior tutor and curator of the herbarium at the University of Liverpool. During this period his research centered on various aspects of the family Caryophyllaceae. John joined the Plant Research Institute in 1969, where for a time he was head of the Botany Section. While with us he was concerned with Canadian weeds (primarily in the families Caryophyllaceae and Polygonaceae), nomenclature, and numerical taxonomy. John left the department in 1981 to become head of the Biology Department at the University of Ottawa.

Ernest Small (B.A., 1963, B.Sc., 1965, M.Sc., 1966, Carleton; Ph.D., 1969, U.C.L.A.) was born in Ottawa, Ont., in 1940. While at Los Angeles he worked on the taxonomy of species of the genus Clarkia. Following his employment at the Plant Research Institute in 1969, he worked on a study of the ecophysiology of bog plants. Later work was with Cannabaceae and Daucus. He is now conducting taxonomic studies with cultivated and wild relatives of the Leguminosae genera Medicago, Trigonella, and Melilotus. Field work on these plants has taken him to the eastern Mediterranean region.

Mary E(lizabeth) Barkworth was born in Marlborough, Wiltshire, United Kingdom, in 1941. Mary obtained her B.Sc. in physics and mathematics in 1961 and a Professional Basic Teaching Certificate in 1965 at the University of British Columbia. In 1970 she obtained a M.Ed. from Western Washington State College and in 1975 a Ph.D. in plant taxonomy under Marion Ownbey and Noe

Higinbotham from Washington State University. Her thesis at Washington State was concerned with variation in Brodiaea douglasii. Following her graduation in 1961 Mary spent several years as a teacher, then a graduate assistant, a teaching assistant, and a curatorial assistant. She joined the Biosystematics Research Institute to work on grasses with an aim of preparing a manual of Canadian grasses. Particular studies were in the genera Poa and Stipa. Mary left Ottawa in 1979 to join the Department of Biology of the Utah State University at Logan, where she has continued her studies of grasses.

Suzanne I(rene) Warwick (B.Sc., 1974, Manitoba; Ph.D., 1977, Cambridge, England) was born in Winnipeg Beach, Man., in 1952. Her studies at Cambridge were in experimental taxonomy of weedy species. Suzanne joined the staff of the Biosystematics Research Institute in 1977. Her interests are in intraspecific variation in weeds, genecology, and electrophoresis. She has written a number of papers on the biology of weeds and particularly on her genecological and electrophoretic work.

Susan G. (Hamilton) Aiken (B.A., 1959, M.A., 1962, Queensland; Ph.D., 1979, Minnesota) was born in Wellington, New Zealand, in 1938. Her botanical interests in Canada after she arrived in 1965 centered around the aquatic plants of the Ottawa district and particularly of Gatineau Park. In 1972 she moved to St. Paul, Minn., where she studied the genus Myriophyllum under Gerald Ownbey. In 1979 she joined the Cultivated Crops Section as a grass taxonomist. Her interests included the grass flora of Canada and the use of the computer in constructing botanical keys. In addition to her publications on Myriophyllum and a number of smaller items, she authored the book Grass Genera of Western Canadian Cattle Rangelands.

Susan left us in 1984 to join the staff of the Botany Division of the National Museum of Natural Sciences in Ottawa, where she plans to continue her studies on Canadian grasses.

Paul M(iles) Catling (B.Sc., 1975, Ph.D., 1981, Toronto), born in London, England, moved to Canada at the age of seven. He received his public and high school education in Toronto. Paul's interest in natural history started early. Between 1965 and 1976 he was a park naturalist, a mammalogy technician, a vascular plant curatorial assistant, and a part-time teaching assistant. Paul joined the Vascular Plant Section of the Biosystematics Research Institute in 1980. His publications are numerous, including those on owls, butterflies, snakes, ecology, and plant geography. He has also published widely on various Orchidaceae, and in particular, the genus Spiranthes, which was the subject of his Ph.D. thesis. In Ottawa he has been working mainly on aquatic plants and sedges.

Guy Baillargeon (B.Sc., 1978, M.Sc.; 1981, Laval) was born at Shawinigan in 1953. His masters thesis, which was done under the direction of Robert Gauthier, was on the impact of urbanization on the flora in the vicinity of Quebec City. Guy joined the Vascular Plant Section in 1981 and left immediately for Berlin to work on the genus Brassica for his Ph.D. under Scholtz. He is expected to return to Ottawa in 1985, where he will be concerned with weeds, in particular, the Brassicaceae.

Alina E(lizabeth) Stahevitch (B.Sc., 1972, M.Sc., 1976, Ph.D., 1980, McGill) was born in Chicago, Ill., in 1945. Her thesis studies, which were on

the genus Impatiens, took her to India for related field work. Since joining the staff of the Vascular Plant Section in 1982, Alina has been concerned with cytology of weeds and is working toward a monograph of the genus Artemisia.

Jacques Cayouette (B.A., 1963, Lévis; B.Th., 1965, L.Th., 1968, M.Th., 1969, B.Sc., 1976, M.Sc., 1979, Ph.D., 1984, Laval) was born at Lévis, Que., in 1944. After studying theology for several years, Jacques entered the field of biology. His master's thesis, conducted under Robert Gauthier, was an ecological study of a limestone habit in the Saguenay region of Quebec. His doctoral thesis, under Pierre Morisset, was on the cytology of the Carex salina complex. Field work has included studies of the flora of the interior of Ungava to the New England states, but has centered mainly in the Saguenay area of Quebec. Jacques joined the staff of the Vascular Plant Section in late 1984 to be responsible for studies of Canadian grasses.

Jack Parmelee's contribution to the Mycological Herbarium is reported in that section. It would be remiss, however, not to mention his contributions to the Vascular Plant Herbarium. These are mainly collections from DEW line sites across northern Canada, which he visited in 1961, 1963, and 1967 in relation to his studies of parasitic fungi; but they also represent hosts of his collections of fungi resulting from field work in other parts of Canada.

Doug Savile's contribution to mycology is likewise recorded in that section of this volume. His contribution to Canadian botany is, however, considerable. Extensive field work in northern Canada resulted in several papers on the plants of that region and culminated in Arctic Adaptations in Plants (1972). Elsewhere in Canada, he has collected plants in Newfoundland and particularly in British Columbia where he worked with Jim Calder for several years. The interrelationships between fungi and their plant hosts have been of special interest to him. He authored several papers on the taxonomy of Saxifraga species with Jim Calder and has written other botanical papers on such topics as ecology and splash cup mechanisms.

CHAPTER 3

Mycology

Early collectors of fungi in Canada

Mycological study is almost wholly dependent on the microscope, and specimen examination time is much greater than it is for macroscopic organisms. Consequently mycology and bacteriology were late in starting and were slow in their early growth. Therefore very early dates for fungal reports in Canada are rare.

Reverend Arthur C. Waghorne (1851-1900), an English missionary who worked in Newfoundland from 1875 to 1899, collected foliicolous fungi as well as bryophytes and vascular plants (Brassard 1980). His fungi were named by J.B. Ellis and deposited in New York Botanical Garden, some duplicates being later sent by Ellis to H.T. Güssow as a contribution to the foundation of the Division of Botany herbarium (later the National Mycological Herbarium).

Haliburton (1829, p. 405) listed a few names of fungi in Nova Scotia. Wehmeyer (1950) listed several published records of fungi in Nova Scotia between 1865 and 1890, notably a series of papers by J. Somers, and one 1879 report for New Brunswick. There seem to be no other reports from Atlantic Canada prior to 1901.

Early reports for Ontario are given under the contributions of John Macoun (below), John Dearness, and James Fletcher.

The relatively late settlement of western Canada virtually precluded the possibility of early fungal records from that region; and there are none before mycology was modestly developed in eastern Canada. According to Bisby et al. (1938) the first mycological report from Manitoba was by the great naturalist Norman Criddle in 1906, concerning the effects of the fly agaric on cattle. It was followed in 1909 and onward by the publications of A.H.R. Buller. In Saskatchewan the earliest report was by W.P. Fraser in 1919, the first of a series of rust culture studies.

E.H. Moss was the first mycological collector of note in Alberta. His doctoral work at Toronto was on the structure and development of rust uredinia, but he was appointed to the Department of Botany at the University of Alberta specifically to study the vascular plants of the province. He maintained his interest in the rust fungi and collected them extensively, but he published little on them. His collections are at the University of Alberta, but many duplicates are in the National Mycological Herbarium. A few amateur botanists have collected some fungi in Alberta, but systematic mycological coverage was delayed until after 1950.

In British Columbia the main early collectors were John Macoun, A.W. McCallum, and Walter Jones. Macoun collected many fungi, mainly determined by Dearness, in the last years of his life (1912-1920), mostly at or near Sidney in southeastern Vancouver Island. McCallum collected microfungi near Trail and southward into Washington, between 1929 and 1936,

when he and G.A. Ledingham were surveying the Trail smelter damage. Walter Jones assiduously collected parasitic fungi in coastal British Columbia throughout his career at the Saanichton Plant Pathology Laboratory from 1929 to 1955. Except for wood-destroying fungi, collected by Irene Mounce and others of the Division of Botany, no other systematic collecting was possible until the large-scale botanicomycological exploration by the division in the 1950s.

John Macoun (1831-1920) was the most important pioneer-biologist-naturalist-explorer in Canada. He was a competent vertebrate zoologist and phanerogamic botanist. He was an avid collector; and, in the course of his travels across Canada, he picked up substantial numbers of fungi, which eventually were transferred to the Division of Botany. All his earlier collections seem to have been determined by J.B. Ellis and, when he later picked up specimens that macroscopically resembled earlier ones named by Ellis, he often applied the same name; but such attempts were generally unsuccessful. He seems not to have used a microscope until 1912 (age 81), after his retirement at Sidney, B.C. Although most of his collections were of conspicuous wood-inhabiting fungi, he did collect some microfungi, mostly rusts. Some of his collection data, from then unsettled regions or antedating modern political boundaries (e.g. "Moosejaw, Northwest Territories") may puzzle today's student. Fortunately his autobiography, recently republished with maps and additional notes (Macoun 1979), allows many of his collection sites to be located accurately.

Early collecting in the Canadian Arctic was extremely meager, nearly all specimens being salvaged from botanical collections. The main early collections were listed by Savile (1963). Only after mycologists visited the Arctic, from 1950 onward, was anything approaching a systematic coverage possible.

The first Canadian mycologists

Most early contributors to mycology in Canada were primarily involved in plant pathology. However, two outstanding exceptions must be discussed here: men of very different backgrounds and outlook, but both of great significance.

John Dearness (1852-1954) occupies an anomalous position in Canadian mycology. He was self-taught and technically an amateur, being a school teacher and school inspector by profession; but he was the first Canadian mycologist to receive international recognition. His development as a mycologist is shrouded in uncertainty. He kept no copies or records of his outgoing correspondence; and almost the only incoming correspondence on file is in the form of various postcards from Rehm, a telegram, and a few notes on small scraps of paper. It is suspected that most of his incoming letters were converted into specimen packets, as some certainly were. A search of all sections of the Dearness Herbarium showed abundant specimens collected in 1889 and 1890, but none collected earlier by him. The few older specimens on file were sent to him at later dates by other collectors. Yet in 1889 he was already sending bulk collections to J.B. Ellis for inclusion in his Exsiccati North American Fungi, which indicates that he was already experienced in mycological methods. It is believed that he had been collecting fungi for several years and sending his entire specimens to Ellis; and that Ellis persuaded him to start his own herbarium.

Dearness was by far the earliest competent mycologist in Canada and can have had few, if any, Canadian mycological contacts in his early years of collecting. He received material of a smut, Urocystis colchici, from Fletcher at Ottawa in 1894. He also received two rusts from John Macoun, Puccinia heucherae and Pucciniastrum pyrolae, collected in 1884; but, from the name he applied to the former, it is clear that he received them after 1903. He had considerable contacts with the Division of Botany in Ottawa in the 1920s and 1930s; and also with G.R. Bisby in Winnipeg in approximately the same period. However, there is no available correspondence to indicate that he had any earlier contacts with Canadian workers in mycology.

Among other achievements Dearness was the first Canadian to become president of the Mycological Society of America (in 1937, when he was a very spry 85). He was a keen botanist and entomologist, and was president of the Entomological Society of Ontario (1897-1998). He was also active in other fields (Tamlyn 1955).

William Pollock Fraser (1867-1943) can justifiably be regarded as the first fully professional Canadian mycologist, professional both in training and as a teacher. Raised on a farm in Pictou County, N.S., which he had to run after the early death of his father, his formal education was delayed and interspersed with periods of school teaching. After the farm was sold he was able to attend high school and graduated from Pictou Academy in 1896. From 1899 to 1901 he attended Dalhousie University for 2 years. He was already an avid field botanist. He entered Cornell in 1905 and graduated with his B.A. in 1906. He was strongly influenced by G.F. Atkinson and commenced serious studies of parasitic fungi on his return to Pictou Academy. His first paper in 1909 covered Erysiphaceae of Nova Scotia. It was followed by a series of papers on cultures of heteroecious rusts, which were continued after he joined the faculty of Macdonald College in 1912. At Macdonald he turned increasingly to diseases of economic plants, but his rust studies were continued even after he went permanently to Saskatoon in 1919 as the first officer in charge of the Dominion Laboratory of Plant Pathology. From the first he collaborated with the University of Saskatchewan in teaching biology.

Fraser pioneered in plant disease studies in Saskatchewan; but perhaps his greatest contribution in the last stage of his career lay in the training of plant pathology students. His fame as a mycologist rests both on his teaching and on his pioneering life-history studies of many rusts. Vanterpool (1944) published his biography.

James Fletcher and mycology

Even before his appointment James Fletcher was alive to the significance of fungi as plant parasites. In 1882 and 1883 he collected parasitized fruits of Potamogeton natans, P. pusillus, and P. vaseyi. Farlow (1884) identified the parasite as a smut, Doassansia occulta, previously unreported in the New World. The fact that Fletcher knew Farlow to be the logical recipient of his smutted material indicates the breadth of his reading. Fletcher was also the collector of the only known specimen of a rust, Puccinia arabicola, but the date of collection is uncertain. What seems to have been the phanerogamic voucher was made in 1878, but the rusted leaves seem to have been removed several years later and given to John Macoun who sent part of the collection to J.B. Ellis (Savile 1974).

When Fletcher transferred to the Central Experimental Farm as Dominion entomologist and botanist, he was already well informed on the major crop diseases and their pathogens; and he was dealing with growers' requests for help, as Estey (1983) has noted. How an accountant in the parliamentary library could acquire such knowledge is difficult to explain, but it seems probable that he had access to the American Plant Disease Bulletin in the library. Before the recognition of physiological disorders and virus diseases of plants, plant pathology and applied mycology were essentially synonymous; and Fletcher, a practising plant pathologist for part of his time, certainly appreciated the role of pathogenic fungi. He wrote on disease control topics in farm newspapers and departmental bulletins, as well as by letter. We cannot claim him as a mycologist, but there is good support for Estey's claim that he was the first Canadian plant pathologist. As far as we know he did not keep a mycological collection, for which he cannot be faulted in view of his manifold obligations. However, through his recognition of the importance of fungal pathogens he laid the foundation for systematic mycology in the department, which began to develop within a decade after his death.

After 1893 Fletcher turned over most of his plant pathology experiments to John Craig, the recently appointed Dominion horticulturist, but he remained involved in plant disease problems and correspondence.

There is on file in the National Mycological Herbarium a list of over 800 plant parasitic fungi in Canada on plants of forest, orchard, garden, field, and meadow, and a few weeds. This substantial list, in Fletcher's hand, was compiled in February 1896. It was perhaps modeled on the more extensive list published by Farlow and Seymour (1888-1891), to judge by its format. It is, of course, much less complete, but it also contains species (or at least names) that are not in Farlow and Seymour, and it is definitely not copied from that work. It is hard to imagine how he came by many of the records, but some may be based on specimens that he sent to Farlow.

With Fletcher's death in 1908 the era of the gifted amateur in Canadian biology came nearly to a close. Inevitably he was replaced by two men: C. Gordon Hewitt as Dominion entomologist and Hans T. Güssow as Dominion botanist, both trained in Europe. We ordinarily date the establishment of these divisions from 1909, when Hewitt and Güssow were appointed. However, it should be noted that although Fletcher held a joint appointment he did not always use his joint title but often split it to suit the subject in hand. This seemingly whimsical action applied not only to letters but to publications. Thus we have on file a pamphlet on potato blights, published by him in 1894 as from the Division of Botany, Central Experimental Farm. Perhaps he was informing William Saunders, his director, that he was doing two men's work, as indeed he was.

Growth of mycology and its relationship to botany and plant pathology

In tracing the growth of systematic mycology we encounter a semantic problem. Although the words "mycology" and "mycological" go back in Latin form at least to Persoon in 1795, in English at least to 1836, and in French at least to 1842, the early practitioners of mycology were essentially botanists or general naturalists. Among the pioneers whom we remember chiefly

as mycologists were: Elias Fries, who made important studies on lichens and vascular plants; C.H. Persoon, who worked as much on vascular plants as on fungi; and A.C.J. Corda, keeper of the National Museum in Prague, who worked in several fields of natural science, including geology.

Until late in the 19th century mycology was still almost universally taught as an aspect of botany. Probably most botanists who did not work actively with fungi had some knowledge of them. Parmelee (1977, p. 1962) noted that George Lawson, a pioneer Ontario botanist, was aware that Phyllactinia (sub Erysiphe) guttata was to be sought on Celastrus scandens.

When mycology and plant pathology were first taught in the United States, they were covered in botany courses; but they began to be treated increasingly as separate subjects after approximately 1870. T.J. Burrill, University of Illinois, was a conspicuous pioneer in teaching plant pathology and mycology, with the use of the microscope, in 1868; and several of his students became accomplished plant pathologists or mycologists. Because most recognized plant diseases were caused by fungi the terms mycology and plant pathology were often used interchangeably. In the United States Department of Agriculture the first plant pathological unit was termed the Section of Mycology; but by the end of the 19th century the term plant pathology was in wide use in North America. In contrast, plant pathologists in England were termed mycologists until about the mid 20th century.

At Ontario Agricultural College, Guelph, a course in plant pathology became available in 1895, but for several years it seems to have had little mycological content. In 1905 J.E. Howitt, who had postgraduate training at Cornell, was appointed to give instruction on weeds and plant diseases. J.W. Eastham joined the staff in 1906, and he and Howitt took further training in cryptogams at Cornell in 1908, allowing a marked upgrading in their teaching of mycology and plant pathology.

In 1907 Macdonald College registered its first students; and the first degrees were granted in 1911. From that date Macdonald joined Guelph as a source of qualified workers in plant pathology and mycology. La Société de Protection des Plantes du Québec/Quebec Society for the Protection of Plants was founded in 1908 at the instigation of William Lochhead, professor of biology at Macdonald, uniting all workers in plant pathology, applied entomology, and weed control. As the first organization for plant pathologists in Canada, this society also stimulated concern for mycology, at first mainly through the work of W.P. Fraser. The appointment of Fraser as lecturer in biology in 1912 was crucial in the growth of mycology at Macdonald. Fraser continued at Macdonald the life-cycle studies of rusts that he had started in Nova Scotia. He instituted a full course entitled "Plant diseases and fungi," which he taught until he went to Saskatoon in 1919. His strong emphasis on mycology as an adjunct to plant pathology persisted for many years.

Thus soon after the appointment of Hans T. Güssow as Dominion botanist in 1909 a small but growing core of Canadian plant pathologists with mycological training started to become available for the new Division of Botany.

Gradually mycology and plant pathology came to be recognized as separate disciplines. However, in many institutions, notably agricultural colleges and universities that grew from them, mycology continues to be taught in plant pathology departments. This mariage de convenance has two disadvantages. First, as virus diseases and physiological disorders received increased attention the fungi received less. In the 1930s at Macdonald College, mycology occupied three terms (three-quarters of the time allotted to plant pathology courses); but by 1950 it was reduced to a single term, which is clearly inadequate for a student expecting to work professionally with fungi. A second disadvantage is that thinking in a plant pathology department inevitably centers on applied botany, particularly on topics important to pathology: a geocentric system with the botanical sun forced to revolve about the pathological earth. Only in a botany, or general biology, department is the student assured of a more balanced outlook, with fungi considered in relation to biogeography, ecology of natural as well as man-made habitats, evolutionary theory, and paleontology. This myopic downgrading of mycology came as the vital roles of fungi in mycorrhizal plant nutrition, biodegradation, biochemistry, and medicine were starting to be recognized.

Thus mycology was slow to develop as a distinct discipline; and its development is difficult to trace in detail because it was generally included first in botany and later in plant pathology. Its full recognition in our universities as an independent discipline generally developed after 1945. Finally we must note that although evidence had been building for many years to indicate that fungi are not plants, it was not until 1970 that it was finally and clearly shown that three higher kingdoms--animals, fungi, and plants--arose independently from Protista.

Foundation of the Division of Botany and development of the National Mycological Herbarium

The appointment of Hans Theodore Güssow as Dominion botanist in 1909 marked the inception of the Division of Botany as an independent unit, separate from entomology. The name Division of Botany was changed in 1937 to Division of Botany and Plant Pathology, perhaps reflecting Güssow's belief that when he retired the division would be split. In 1954 it became Botany and Plant Pathology Division; and in 1959 the Ottawa staff became the Plant Research Institute; for brevity we speak of it here as the division. Theoretically 1909 marked the start of the Mycological Herbarium, but its origin was actually delayed appreciably. First, Fletcher had no collection of fungi, as he had of plants, from which to form a nucleus. Secondly, Güssow faced so many new demands on his time that start of the herbarium had to wait.

Güssow was in fact a bacteriologist as well as an economic botanist. He was responsible for such varied activities as testing grass and clover strains for yield, and hemp and flax strains for yield and retting quality, preparation and distribution of legume Rhizobium cultures, and bacteriological testing of milk and water (Conners 1972). We must remember that all such work was done personally, long before laboratory technicians appeared on the scene.

In October 1909, 3 months after assuming his position, Güssow received from the Montreal Herald and Weekly Star a potato, grown in Newfoundland, that

he recognized to be affected by wart (Synchytrium endobioticum), a destructive pathogen in Europe but hitherto unreported in North America. He at once wrote a bulletin warning growers against the disease; and he and C.G. Hewitt collaborated in drafting the Destructive Insect and Pest Act, which (mirabile dictu) was promulgated in May 1910. This model of plant protective legislation, which included an embargo on potatoes from Newfoundland, paved the way for the institution of the seed potato inspection service in 1914, an important part of the division's work until the segregation of the Plant Protection Division in 1938. The publicity attending potato wart resulted in the recognition of powdery scab in much of Canada and in Maine. The United States put an embargo on Canadian potatoes, but an alert Canadian inspector recognized the disease in Maine potatoes being shipped in bond across New Brunswick.

Not unnaturally, action on the mycological herbarium was deferred in these hectic early years. Güssow did take steps to develop it later in the decade, but no pertinent correspondence survives to detail his actions. As noted elsewhere in this publication, fungi collected by Fletcher were evidently sent in toto to identifiers, and Güssow thus started from scratch. Güssow evidently asked J.B. Ellis for assistance. Ellis sent him a considerable number of duplicates of foliicolous fungi, including some of Reverend A.C. Waghorne's from Newfoundland, apparently as a gift and probably before 1920. At about this period he bought several sets of fungi exsiccatae, totaling some 12 000 specimens, from C.L. Shear at Washington, D.C. Our records show that in 1925 we received 660 exchange specimens of fungi from the Bureau of Plant Industry, Beltsville, Md., the start of an important exchange program that still flourishes. With several hundred myxomycetes, presented by J.W. Eastham when he left in 1914 to take up an appointment in British Columbia, this seems to have been the bulk of the herbarium until the work on forest pathology was started.

A.W. McCallum joined the division in 1920 to initiate the program in forest pathology. Irene Mounce was appointed in 1924, Ruth Macrae in 1931, and Mildred Nobles in 1935. Heavy emphasis was placed on the work of cultural identification of wood-destroying fungi.

When Ibra Conners was transferred from Winnipeg, in 1929, to the joint position of herbarium curator and compiler of the annual reports of the Canadian Plant Disease Survey, the herbarium seems to have consisted of the above-mentioned materials and about 1000 specimens of wood-rotting fungi, including dried cultures. Conners, with field and herbarium experience under W.P. Fraser in addition to his academic training, was eminently fitted for this undertaking. After visiting several important mycological herbaria in the United States, he organized the herbarium on a system that was flexible enough to allow its later expansion with minimal difficulty. Initially the herbarium was in two units: wood-decay fungi under Mounce; and all other fungi under Conners. Specimens in the two units were accessioned separately until 1943, a situation that required the forest fungi to have the letter F before the number to avoid confusion. Initially the "other fungi" were nearly all plant parasites, especially those of economic crops.

Conners quickly established a practice of not accepting a disease report from beyond the known geographic range, or for an unrecorded host plant, unless it was supported by a specimen. This practice greatly increased the

Ibra Conners

reliability of the survey reports, and gradually added to the scope and utility of the herbarium. Growth of the herbarium was inevitably slow, however, until after World War II. For most of this period Conners had at most one seasonal assistant; and both time and funds were extremely limited. Collecting, apart from crop pathogens, was practically limited to weekends in the Ottawa district and (surreptitiously) during disease inspection trips at experimental stations.

One stimulus to mycological work came about through the disruption of vegetable seed supplies during World War II. The establishment of seed growing in Canada was accompanied by an abundance of seedborne fungi, both saprophytes and pathogens. Seed testing yielded many fungi whose taxonomy was in chaos because they were little known as crop pathogens. J.W. Groves headed a group identifying these fungi, which led to a series of research papers and strengthened the holdings of especially various hyphomycetous genera in the herbarium.

From an early date, although heroic attempts were made to deal with all groups of Canadian fungi, in practice the emphasis was inevitably on pathogens of crop plants and forest trees. As long as there were no available staff other than Conners and the forest mycologists, no systematic coverage of other fungi was possible.

Because of the popular appeal of mushrooms, and the perpetual threat of mushroom poisonings, attempts were made to cover the mushrooms of the Ottawa district. Hans T. Güssow and a local amateur W.S. Odell published Mushrooms and Toadstools in 1927. Later F.L. Drayton and J.W. Groves continued mushroom study as time permitted, mostly as a spare-time hobby. Despite substantial difficulties Groves published Edible and Poisonous Mushrooms in Canada (1962), as an aid to amateur collectors. It made no attempt at completeness but corrected many errors of the 1927 work. Only after Groves' death was a staff position opened specifically in agaricology. It was filled first by D.W. Malloch and then by S.A. Redhead. The great recent progress in Canadian agaricology shows the importance of having a full-time worker in this field.

The Mycological Herbarium officially became national in 1932 when the roles of the Division of Botany and of the National Museum were clarified, but the depression and the onset of World War II curtailed its expansion. The first major step toward making it national in scope came with the initiation of the Northern Insect Survey by the Defence Research Board in cooperation with the Department of Agriculture. This project was aimed at understanding the ecology and ranges of the Subarctic and Arctic biting flies. During the first full season (1948) botanists of the division accompanied several parties to describe the ecology of the study sites and to collect plants. D.B.O. Savile screened the collections when they were named and removed many parasitic fungi. (It was not feasible to collect saprophytes on dead leaves and stems, as the work of packeting and labeling such a vast amount of material would have required about a man-year, each year.) He also screened all collections in several later years, during which time most participating botanists learned to spot many parasites and include them with host vouchers. In 1949, 1950, and 1951, with the enthusiastic support of H.A. Senn and K.W. Neatby, Savile accompanied Northern Insect Survey parties, doubling as botanist and mycologist in the eastern Arctic and Subarctic. These undertakings enormously increased our knowledge of a huge part of the country.

When J.A. Calder started his large-scale floristic and ecogeographic survey of British Columbia and adjoining regions, this interdisciplinary approach was extended. Savile joined the party in 1953, 1954, and 1957, and J.A. Parmelee did so in 1956.

Mycologists having thus collected plants and fungi from the Atlantic to the Pacific and north to Hudson Bay, it was only logical, when opportunities arose, to send a mycologist to work in both fields at other Arctic sites. Arctic field trips were accordingly made by Parmelee (1961, 1963, and 1967) and by Savile (1958, 1959, 1960, and 1962). Thus by 1967 we had a reasonably full coverage of the whole country, to 82°N, for foliicolous fungi. Except in the Arctic where they are relatively few, and at sites where the collector is relatively sedentary for long periods, this collecting system is not practical for fleshy fungi, for which collecting and processing methods are very different from those for plants and foliicolous fungi. Accordingly much field work is still needed on mushrooms and wood-rotting fungi in many parts of the country.

The collecting of foliicolous fungi from all of Canada by mycologists has been of immense value. Host and geographic ranges and ecology are much better known, many new species have been recognized, and the collection of abundant material has added greatly to the exchange program and thus to the growth of

the herbarium. Dearness (1923) could report only nine Uredinales and three Ustilaginales from the entire Canadian Arctic. In contrast Savile and Parmelee (1964) recorded 11 rusts and 12 smuts from the Queen Elizabeth Islands alone; and many more are known from lower Arctic regions.

The combined botanical and mycological collecting had some results that were probably not fully anticipated even by those who sponsored it. A mycologist working as a botanist is inclined to pay even more attention to the ecology of the host plants of parasitic fungi than most orthodox botanists. Thus from the start of Calder's British Columbia project relatively detailed attention was given to the habitats of specimens. Working in essentially fully glaciated country the collector is inevitably involved in the biogeography and postglacial movements of both plants and parasites. Even in 1953 Calder and Savile (the former with training in geology) were developing advanced biogeographic and biosystematic concepts, and were apparently ahead of most North American botanists in approaching workable biological species concepts. When Savile later worked in the high Arctic, the British Columbia experience allowed him to unravel the late glacial and postglacial history of the northwestern Queen Elizabeth Islands mainly through plant distribution patterns (Savile 1961). A liberal program in botanical exploration can seldom have paid higher dividends.

In the meantime, in 1950 I.L. Conners realized that the increasing work load for the herbarium staff was becoming critical, and he proposed that a Mycology Section should be added to the Division with J.W. Groves as its head. With rigorous support from H.A. Senn, head of the Botany Section, this proposal went through with little delay. The Mycology Section came into being and Groves was empowered to recruit staff. This change was doubly important. It not only gave us increased staff, but perhaps even more importantly, mycological research became the official duty of staff members. Gone at last were the days when mycological work could be done openly only if it dealt with pathogens of economic plants. After 1951 the mycological herbarium, from being national in name, increasingly became national in scope.

The compilation of the Plant Disease Survey reports remained closely associated with the herbarium until 1954. From 1943 to 1953 Savile assisted Conners in compiling the survey and in curation of the herbarium. In 1954 Conners moved from the Botany Building to the Science Service (later K.W. Neatby) Building, as special assistant to W.F. Hanna, chief of the division. He took the survey with him, and Savile became curator of the herbarium.

The next major event in the history of the herbarium was its move to the newly constructed north wing of the Neatby Building in 1959. In theory the move coincided with the dissolution of the Botany and Plant Pathology Division and foundation of the Plant Research Institute (director, H.A. Senn) on 1 April 1959. In actual practice the move was spread over more than a week. Most staff members moved in late March. However, the building was unfinished and teemed with cigarette-smoking workmen. Owing to the serious fire risk involved in holding the entire herbarium in cardboard boxes until the new steel cases could be delivered after 1 April, Savile delayed the transfer. With 100 new cases *in situ* the move was made smoothly and quickly in early April. Savile and Letitia Taylor moved the entire collection from the top floor into the dumb waiter of the Botany Building. The arboretum staff loaded

the numbered boxes onto tractor-drawn wagons, towed them to the Neatby Building, and took them by elevator to the top floor, where Ruth Macrae supervised their placement. This was the last major move handled entirely by Agriculture personnel.

The William Saunders Building became the home of the Mycological and Vascular Plant herbaria in 1969

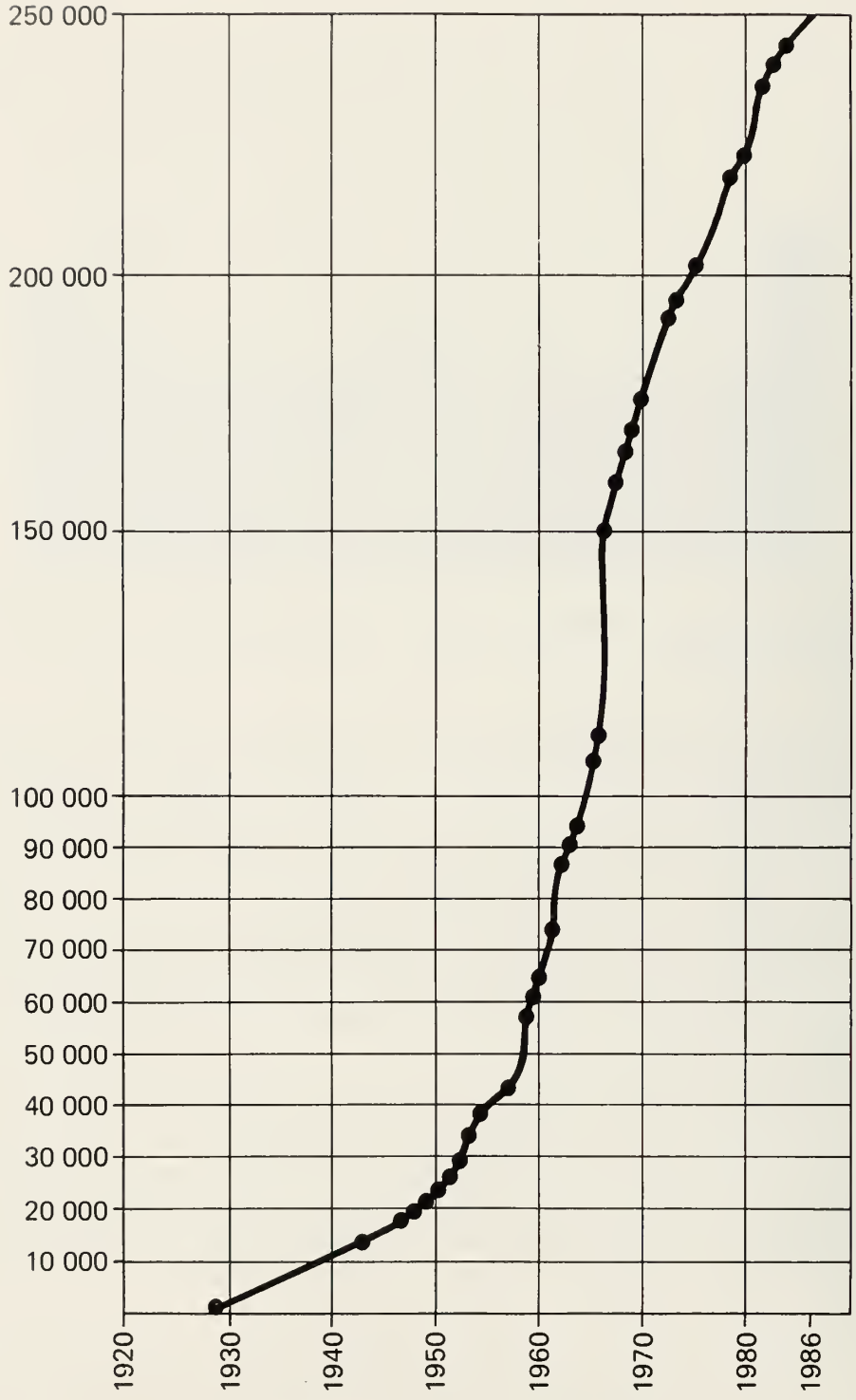
Quite apart from the reorganization and move, 1959 was a strenuous year for most of the Ottawa-based botanists and mycologists; for it was the year of the IX International Botanical Congress in Montreal, the largest international scientific meeting held in North America to that date. Many staff members were heavily involved in organization, programs, field trips, papers, and demonstration papers. The Plant Research Institute, with units housed in four buildings, also staged a successful (if occasionally chaotic) post-congress open house. Senn was inevitably very deeply involved with the congress, but, because of the departmental reorganization, had to delegate a great deal of correspondence and other work to Clarence Frankton who worked almost full time on the congress for about 2 years.

In 1967 D.B.O. Savile, after 11 years as assistant curator and 14 years as curator, was succeeded by J.A. Parmelee, who had been assistant curator since 1954. In due course Parmelee, who was at the University of Toronto during the 1959 move, supervised the move to the William Saunders Building in October 1969. This move and that of the Vascular Plant Herbarium were handled by professional movers, but staff members transported much light and fragile equipment.

From 1975 to 1977, while Parmelee served a term as section head, the curator's duties were handled successively by Mary Elliott and Luella Weresub, after which Parmelee resumed the position.

From 1920 to 1945 growth of the herbarium was very slow, averaging ca. 600 specimens per annum, nearly half of which was the initially purchased sets of

NATIONAL MYCOLOGICAL HERBARIUM (DAOM)



exsiccatae. Part of the slow growth was due to the impossibility of making many bulk collections to support an exchange program when nearly all collecting was confined to the Ottawa district. After 1953 there was an abrupt upward inflection of the growth curve to a sustained average annual growth of over 6000 specimens. Until 1965 this increase was due mainly to intensive field work and the receipt of abundant exchange specimens that resulted from our sending out many duplicates from all parts of Canada. Since that date, despite reduced field travel, the growth has been approximately maintained through gifts (notably G.D. Darker, W.L. Gordon, W. Jones, M. Larsen) or purchases (R.F. Cain, A. Melderis, W.D. Sutton, L.E. Wehmeyer), and acquisition of a few exsiccatae. At the end of 1983 the size of the herbarium, including about 50 000 exsiccatae, was about 230 000 specimens. By the end of 1986 it is estimated that the collection will number about 250 000 specimens.

Complementing the Mycological Herbarium is the important National Culture Collection, unified in 1972, with D.J.S. Barr as curator, from independent collections maintained by various staff members. It is proposed to expand it to include nonmedical bacteria; and the combined collections will be under a full-time biologist curator.

Housed with the National Mycological Herbarium, but not a part of it, is the Dearness Herbarium. John Dearness bequeathed his herbarium, totaling some 27 000 specimens, to the Montreal Botanical Garden. The garden was promptly besieged by requests for loans of types and other critical specimens, all unavailable in Dearness' lifetime. The garden had no mycologist to serve as curator, many of the boxes housing the specimens were disintegrating, and the sequence of the collection had become thoroughly shuffled in the transfer. The director of the garden requested accordingly that the National Mycological Herbarium take the Dearness collections on indefinite loan, so that they should be assured of adequate housing and be available (Parmelee 1978). Steel cases with close shelf spacing were purchased, and wooden trays were made to hold the specimen packets. Some specimens, notably agarics, had been severely damaged by dermestid beetles, but most microfungi were not seriously affected. Many packets were made of very poor sulfite paper and were disintegrating; and they were gradually replaced by bond paper packets to which the original manuscript data were glued. As loan requests came in it was found that, although the older specimens were easily located, the latest ones were not; most were not indexed and a physical search showed that they were not in the collection; and it is believed that as the work proved beyond John Dearness' strength, they were left in the original newsprint and were finally thrown out in spring-cleaning. Their absence, together with the severe insect damage, emphasizes the danger of holding important specimens in private herbaria.

An integral part of the Mycological Herbarium is a steadily growing collection of journal runs, books, and reprints, bequeathed directly or through the estates of former staff members, or occasionally presented on retirement. Contributions from the estates of Grant D. Darker and J. Walton Groves are particularly valuable. This collection is housed within the herbarium, which makes it very convenient to use. It also sometimes makes a work immediately available when the library copy is on loan; and it contains a few works that are not otherwise available in Ottawa.

Mycological contributions by staff members

In this section we briefly present mycological contributions made by past and present staff members. Plant pathologists whose work did not impinge upon biosystematics are omitted, as are a few mycological assistants who were not on staff long enough to make significant contributions. They are almost all referred to by Conners (1972).

In the following discussions of the mycological staff and herbarium, we refer to the (Mycology) Section, whether they were in the Division of Botany, Plant Research Institute, or Biosystematics Research Institute at the time in question. We start with the earlier members who were primarily pathologists; and in a second section with those who worked mainly in mycology although plant pathologists by title, and also with those recruited as mycologists after 1951.

The discussions partly group staff according to their fields of work, and are approximately chronological within a field; but multiple interests make a precise grouping impossible.

Hans T(heodore) Güssow (1879-1961), first Dominion botanist and chief of the Division of Botany, was appointed in 1909. He founded the Mycological Herbarium but, as explained elsewhere, his manifold duties limited his personal contributions. In 1927, with W.S. Odell, a keen amateur, he published Mushrooms and Toadstools, which, in spite of its now obvious shortcomings, was a substantial contribution in its day. He continued to submit some parasitic fungi even after his retirement in 1944 to Victoria.

John William Eastham (B.Sc., 1899, Edinburgh) was Güssow's first professional assistant in plant pathology, from 1911 to 1914. He taught chemistry and biology in England until 1906. He then taught at the Ontario Agricultural College in Guelph from 1906 to 1911, during which time he took further training in cryptogams at Cornell, where G.F. Atkinson stimulated his interest in fungi. Although officially involved in Ottawa in plant pathology, including surveys for powdery scab of potato, he studied the Myxomycetes (slime-molds), of which he built up a large collection. In 1914 he accepted an appointment as provincial botanist and plant pathologist in British Columbia and donated his myxomycete collection to the division, where it formed a substantial nucleus for the Mycological Herbarium. In British Columbia he worked almost exclusively in plant pathology and phanerogamic botany.

Frank Lisle Drayton (1892-1970) (Ph.D., 1932, Cornell) graduated in plant pathology from Macdonald College in 1914, and joined the division. He joined the army in 1915, was seriously wounded, and rejoined the division in 1919. Working both in North America and in Holland, he became a noted authority in diseases of bulbous ornamentals. Broadening his interest in Sclerotiniaceae he took his Ph.D. at Cornell under H.H. Whetzel, and spent another year at Harvard under W.H. Weston. His work, alone or later with J.W. Groves, in inducing these refractory fungi to produce ascocarps in culture was hailed as a milestone in mycology and led to a marked clarification of their taxonomy. He maintained an interest in agarics even in later years when he was overwhelmed by administrative work (obituary in Proc. Roy. Soc. Can., Ser. 4, 9: 48-50, 1971).

Ibra L(ockwood) Conners (1894-) (B.A., 1918, McMaster; M.A., 1920, Toronto) worked for the Division at Brandon, Sask., and Winnipeg, Man., before being transferred to Ottawa in 1929. Working with W.P. Fraser at Saskatoon made him a meticulous student, especially of the rusts and other parasitic fungi, which strengthened his approach to building up the mycological herbarium. In later years his assistants benefitted greatly from his example. He remained extremely active long after his formal retirement. He completed his invaluable book, An Annotated Index of Plant Diseases in Canada, in 1962, but its publication was deplorably delayed until 1967. It remains an important reference, but is now seriously out of date. J.H. Ginns is completing a very extensive supplement to it. A biographical sketch of Ibra Conners appeared in Fungi Canadenses No. 21-40 (dedication) in July 1974.

Alan W. McCallum (M.A., 1918, Toronto) joined the division in 1920 as its first forest pathologist after completion of his M.A. at Toronto under J.H. Faull. Although he was primarily a pathologist, he collected foliicolous fungi extensively during his field work, mainly in Gaspé Peninsula and, from 1929 to 1936, in southern British Columbia and adjacent Washington, in collaboration with G.A. Ledingham (National Research Council of Canada) during the Trail smelter injury investigations.

Arthur J. Skolko (B.Sc. F., 1935, M.A., 1938, Ph.D., 1941, Toronto) was primarily a forest pathologist but worked with J.W. Groves on the taxonomy of some groups of seedborne fungi during and immediately after World War II.

Kenneth A. Harrison (B.S.A., 1926, Macdonald) became J.F. Hockey's first assistant at the Kentville Plant Pathology Laboratory. As a hobby, he soon became a keen student of fleshy fungi. Eventually he concentrated on the stipitate Hydnum species, publishing first on those in Nova Scotia and later on new or rare species occurring elsewhere. Since his retirement in 1966 Harrison has continued his studies, mainly in collaboration with A.H. Smith, University of Michigan. Most of his specimens are now in the National Mycological Herbarium.

Other plant pathologists (staff members of various laboratories for at least parts of their careers) who were keen collectors of fungi include: D.L. Bailey, G.R. Bisby, D.W. Creelman, W.P. Fraser, W.L. Gordon, W. Jones, H. Racicot, C.G. Riley, R.C. Russell, and W.G. Ziller.

We now come to staff members who were predominantly involved in mycological work for most of their careers, although originally classified as pathologists, and to those post 1951 recruits who were engaged specifically as mycologists.

J(ames) Walton Groves (1906-1970) (B.A., 1930, Queens; M.A., 1932, Ph.D., 1935, Toronto) took his Ph.D. at Toronto under H.S. Jackson. He joined the division in 1936. He worked at first with Frank Drayton on Sclerotiniaceae, but also continued the work on Dermateaceae that he had started at Toronto. He eventually published 18 papers on these canker-inducing pathogens. His experimental studies with Sclerotiniaceae were also long continued, latterly with Mary Elliott. Problems with the production of vegetable and field crop seed during World War II plunged him into taxonomic studies of seedborne fungi. He also developed a serious interest in mushrooms at a time when no staff member had official responsibility for them, and published Edible and

Poisonous Mushrooms in Canada (1962), an important aid to serious amateurs. He was the first head of the Mycology Section, and was responsible for building it into a well-rounded unit. He was elected vice-president of the Mycological Society of America, but declined to stand for president owing to his deteriorating health (obituaries in Proc. Roy. Soc. Canada, Ser. 4, 8: 73-77. 1970; Can. Field-Nat. 86: 177-180, 1972).

Irene Mounce (Ph.D., 1929, Toronto) graduated from the University of British Columbia, and then studied at the University of Manitoba under A.H.R. Buller, before joining the division in 1924 to begin the pioneering work on cultural studies of wood-destroying fungi, which finally led to successful identification of the majority of such pathogens in nonfruiting culture. In her doctoral studies at Toronto Irene showed the complex genetic makeup of Fomes pinicola. In 1938 she transferred to the Saanichton laboratory to study vegetable diseases in vegetable crops.

Ruth Macrae (B.A., 1924, M.Sc., 1926, McGill; Ph.D., 1941, Toronto) was research assistant to Buller at the University of Manitoba, 1927-1930. She joined the division in 1931 to assist Irene Mounce. For her Ph.D. under H.S. Jackson she studied the genetics of Panus stipticus, using North American and European cultures. She worked mainly on the identification of wood-rotting fungi, using cultural characters and interfertility studies.

Mildred K(atherine) Nobles (B.A., 1929, Queen's; M.A., 1931, Ph.D., 1935, Toronto) joined the division in 1935. She concentrated on the cultural identification of wood-rotting fungi and the development of flexible keys into which further species could be added as they were determined. Her system proved enormously valuable to forest pathologists in Canada and abroad. Furthermore, this eminently practical work was highly influential in upsetting the Friesian (macroscopic) generic concept in which unrelated fungi were often grouped together, or closely related ones scattered in two or more families. Microscopic and biochemical characters are now so universally accepted that it is hard to realize that it was only in 1959, in her demonstration paper at the Montreal International Botanical Congress, that Mildred Nobles' then revolutionary conclusions were presented.

James H(erbert) Ginns (B.Sc., 1960, Conn.; M.Sc., 1962, W. Va.; Ph.D., 1967, Syracuse and State University of New York) joined the section in 1969. Earlier his studies in plant pathology included surveys for oak wilt disease in West Virginia, butt rot in yellow-poplar under R.P. True, and annosus root rot and fusiform rust of pines for International Paper Co., Georgia. Trained in mycology under H.L. Barnett and V.G. Lily, he studied forest mycology and systematics under J.L. Lowe at Syracuse. In 1967 he joined the Canadian Forestry Service in British Columbia, publishing on forest disease surveys, annosus root rot in western North America with C.H. Driver of Seattle, and rhizina root rot of conifer seedlings. The year 1977 was spent studying at the Royal Botanic Gardens, Kew, and with John Eriksson of Goteborg. In Ottawa he continued M.K. Nobles' work on the cultural characters of wood decay fungi and curated from 1975 to 1982 the National Collection of Fungus Cultures. He is currently working on a Compendium of Plant Disease and Decay Fungi in Canada, which supplements Conners' book (1967).

Luella (Kayola) Weresub (1918-1979) (B.A., 1950, Queen's; M.A., 1952, Ph.D., 1957, Toronto) was born in Russia, but emigrated to Canada with her family when she was five. Most of her schooling was in Winnipeg and Regina.

At 16 she won a nationwide scholarship to Queen's University. Family problems delayed her, and she worked mainly with a radio station in Hamilton before finally taking her B.A. in biology at Queen's. She then took her M.A. in mycology at Toronto, taught at the University of Manitoba for 3 years, and took her Ph.D. in mycology. She then joined the division as a research officer in mycology, studying the resupinate hymenomycetes. Her list of formal research papers was relatively modest; but they were only a part of her life. As occasionally happens in people with a strong intellectual drive she mastered English with a perfection seldom matched by those to whom it is their first language. She loved to debate and could not tolerate weak logic. Much of her time went into uncompromising reviews of manuscripts and theses, a somewhat thankless task for which she was in great demand. She also excelled in picking her way through the thorny wilderness of botanical nomenclature, and spent countless hours helping others with nomenclatural problems. Thus her contributions to mycology vastly exceeded her formal publications (obituaries in Mycologia 73: 211-215, 1981; Can. Bot. Assoc. Bull. 13(2): 14-16, 1980).

David W(arren) Malloch (B.A., 1963, M.A., 1965, San Francisco State; Ph.D., 1970, Toronto) was appointed to the section in 1971, specifically to work on mushrooms, our first such appointment and reflecting the enormous public and medical concern with these fungi. He made substantial progress with them, as well as completing papers started at Toronto under R.F. Cain for his doctoral studies. He has wide interests and inter alia worked with K.A. Pirozynski on development of a theory on the symbiotic origin of land plants. He returned to Toronto to replace Cain in 1975. Regret for his departure was tempered by the realization that he is an exceptional teacher.

Scott A(lan) Redhead (B.Sc., 1972, M.Sc., 1974, British Columbia; Ph.D., 1979, Toronto) replaced David Malloch as agaricologist in 1977. He has already added greatly to our knowledge of the geography, ecology, and systematics of these fungi. As recognized Canadian species multiply in genus after genus, it becomes continually clearer that the concept of a complete book on Canadian mushrooms is a mere pipe dream.

Maria Pantidou (Ph.D., 1956, Cornell) worked under J.W. Groves for several years, principally on Boletaceae. She cultured many species and persuaded several to fruit in culture. She left the section to return to her native Greece.

Constance A. (Loveland) Bowerman (B.A., 1947, Bishop's; M.A., 1949, Toronto) worked first with J.W. Groves on establishing the life cycle of Sclerotinia (Botryotinia) fuckeliana, and later made substantial progress in studies of gastromycetes; but she resigned in 1956.

Mary E(lizabeth) Elliott (B.A. in biology, 1949, Queen's) was appointed in 1946 to aid Groves in the work with seedborne fungi. She later worked with him on Sclerotiniaceae and finally assumed full responsibility for this project. She was a dedicated worker who gladly assumed many responsibilities including, on occasion, mushroom identification in poisoning episodes or for the public. She was elected president of the Canadian Botanical Association in 1975, in tribute to her years of work with the association. By the time of her tragic death in 1976 she was an acknowledged authority on Sclerotiniaceae (obituary in Mycologia 69: 460-462, 1977).

Sheila C. (Hoare) Thomson worked intermittently as J.W. Groves' assistant, and later as herbarium technician, as her family responsibilities permitted. She developed a remarkable knowledge of mushrooms but, mainly through handling countless specimens in identifying them for the public, finally developed a serious skin allergy, which hastened her retirement to work on a literary project.

Stanley J(ohn) Hughes (B.Sc., 1941, M.Sc., 1943, D.Sc., 1953, University of Wales) worked for several years under E.W. Mason at the Commonwealth Mycological Institute, acquiring an exceptional knowledge of hyphomycetous fungi, both temperate and tropical. He joined the section in 1952, as J.W. Groves' first recruit. He proposed (Hughes 1953) a completely new classification of the Hyphomycetes, based primarily on conidiophore structure rather than merely conidium morphology. His system has given considerably more stability and credibility to the classification of these important fungi. Through a prolonged trip to European herbaria he was able to study the types and other critical specimens of most genera. As a senior fellow of the Department of Scientific and Industrial Research he collected in New Zealand, in 1962-1963, great numbers of Hyphomycetes and sooty molds, which led to a long series of important revisions. His presidential address to the Mycological Society of America recapitulated his studies of the sooty molds, which he showed to be of several origins, with ecologically induced convergent similarities. In recognition of his contribution to our understanding of the Hyphomycetes he was awarded the Jakob Eriksson Gold Medal at the International Botanical Congress in 1969.

W(illiam) Bryce Kendrick, a postdoctoral fellow with Hughes in 1958-1959, was on the staff of the section from 1959 to 1965, before joining the faculty of the University of Waterloo. He published several papers on Hyphomycetes while in the section, and has combined teaching with an active research program at Waterloo.

Donald J(ohn) S(toddart) Barr (B.S.A., 1960, Macdonald; M.Sc., 1962, McGill; Ph.D., 1965, Western Ontario) was appointed in 1965 to work on the lower fungi, filling a serious gap in the section's expertise. Using advanced electron microscope techniques to study zoospore ultrastructure three dimensionally, he has thoroughly revised the classification of the chytridiomycetes and their allies.

Robert A. Shoemaker (B.S.A., 1950, Guelph; M.S.A., 1952, Toronto; Ph.D., 1955, Cornell) joined the section in 1955. Starting with his doctoral work on *Cochliobolus sativus*, he has studied many Pyrenomycetes and their conidial states. He succeeded J.W. Groves as section head, and later served another term in this capacity.

Ruth M. (Horner) Arnold (M.Sc., 1948, Western Ontario) joined the section in 1952 to work with Ruth Macrae on Dutch elm disease cultural work. She later worked on several tree canker pathogens. She died in 1978.

Michael P(hilip) Corlett (B.A., 1959, M.A., 1962, Ph.D., 1965, Toronto) joined the section in 1965. He has done cytological studies of several Pyrenomycetes. He is primarily engaged in taxonomic revisions of these fungi.

Grant D(ooks) Darker (Ph.D., Harvard), who trained under J.H. Faull, first at Toronto and later at Harvard, is best remembered for his meticulous study

of Hypodermataceae attacking conifers. He did extensive mycological collecting in North America and Europe. He spent most of his career with a biochemical company in the United States. He returned to Canada and joined the section in 1960. When he reached retirement age in 1965 he was retained by the Forestry Service to continue his work in our section until 1969. He continued to work as a research associate as long as his health permitted. During his time with the section he published his revision of the genera of Hypodermataceae.

Kris A. Pirozynski (B.Sc., 1957, Dip. P.P., 1959, M.Sc., 1964, Ph.D., 1969) was with the Commonwealth Mycological Institute from 1959 to 1967, when he joined the section. He worked mainly with ascomycetous fungi, but also with other groups including foliicolous conidial fungi. Becoming increasingly concerned with fossil fungi, and with the biogeography and evolution of the fungi and their host plants, he transferred to the Paleobiology Division of the National Museum of Natural Sciences in 1975. He is well known for his detailed development of the theory that land plants originated from an alga-fungus symbiosis; and he is concerned with the evolutionary aspects of mycorrhizae.

Douglas B(arton) O(sborne) Savile (Dip. Agr., 1930, B.S.A., 1933, Macdonald; M.Sc., 1934, McGill; Ph.D., 1939, Michigan; D.Sc.(hon.), 1978, McGill) joined the division in 1932 as a student assistant on the fireblight project at Abbotsford, Que. He spent a year at the Ottawa Laboratory before resigning to take his Ph.D. under E.B. Mains. He had joint interests in flowering plants and rust fungi from his undergraduate days, which were enhanced by contacts at Michigan; but these academic pursuits were inevitably subordinated during several years of work on fruit and vegetable diseases, and could not be freely developed until the onset of botanicomycological exploration in 1949. He then worked primarily with rusts and smuts but also with other groups of foliicolous biotrophic fungi. Thereafter his taxonomic work with parasitic fungi reflected ecological aspects of the parasites, co-evolution of hosts and parasites, use of parasites to indicate host relationships, and biogeographic history of Canadian plants. Savile was assistant curator from 1943 to 1953, and curator of the herbarium from 1954 to 1967. After retiring in 1974 he stayed on as a research associate, doing several interdisciplinary studies. He is currently developing the use of rust relationships as a guide to taxonomic relationships and comparative chronology of the various groups of grasses.

John A(ubrey) Parmelee (B.S.A., 1949, Macdonald; M.A., 1952, Ph.D., 1961, Toronto) joined the division in 1949 to work under Ibra Conners. Under the latter's guidance he quickly became alert to problems of rust life-cycle connections in eastern Ontario. While maintaining his interests in the rusts he has also studied other foliicolous fungi. His indoctrination into herbarium curation was hastened by the need to organize and house the Dearness Herbarium, received on indefinite loan from the Montreal Botanical Garden in crumbling cardboard boxes. He acted as assistant curator until he succeeded D.B.O. Savile as curator in 1967.

Gordon A(rthur) Neish (B.Sc., 1970, Acadia; Ph.D., 1977, British Columbia) joined the section in 1978. He works on the taxonomy of toxigenic fungi, especially *Fusarium*, in Canada: thus he continues work begun by W.L. Gordon. Currently he is also serving as section head.

John D(ouglas) Bissett (B.Sc., 1968, Ph.D., 1975, Calgary) joined the section in 1975 to work primarily with the coelomycetous fungi, and with some groups of Hyphomycetes. He is also experienced in the ecology of soil fungi.

Yolande Dalpé (B.Sc. biology, 1972, M.Sc. mycology, 1975, Montréal; D.Sc., 1981, University of Paul Sabatier, Toulouse, France) joined the section late in 1981 to work primarily on taxonomic aspects of mycorrhizal research. These important plant-fungus symbioses have, belatedly, received greatly expanded attention in recent years. However, the taxonomy of the fungi concerned has received much less attention than some other aspects of the associations. Yolanda Dalpé's work is thus helping to fill a potentially dangerous gap. Without more thorough taxonomic studies there is a serious risk of a situation developing similar to one that has stultified much work in plant ecology, wherein sweeping conclusions have often been drawn from studies involving misdetermined plants.

CHAPTER 4

Entomology

Early collectors of insects in Canada

Systematics of Canadian insects began first with contributions made not by Canadians or in Canada but by foreign systematists such as Kirby, Curtis, and Walker of England; LeConte, Horn, Osten Sacken, Cresson, and Edwards of the United States; and many others from these and other countries. These pioneers based their studies on insects obtained on collecting or exploring expeditions to Canada (such as the Second Franklin Expedition in 1825), from paid collectors resident in Canada, or from some of the first Canadian amateur entomologists who submitted specimens to foreign specialists for determination and description.

The scientific results of Sir John Franklin's expedition in 1825 in which he explored the country from Fort William on Lake Superior to the Mackenzie River in lat. 65° were published by Sir John Richardson in four volumes entitled Fauna Boreali-Americana. The fourth volume, which dealt with the insects collected by the expedition, was prepared by the Reverend William Kirby, the well-known joint author of the famous work Introduction to Entomology, and was published at Norwich in 1837. This work contained the description of no less than 447 species of insects (most of which were described for the first time) and several beautiful colored plates.

In 1840, Philip Henry Gosse published The Canadian Naturalist, a Series of Conversations on the Natural History of Lower Canada in England. It was from this book (which named 26 butterflies, 43 moths, and several beetles and insects of other orders) that many Canadian entomologists of note received their first lessons and learned the names of some of our common butterflies and moths.

At this time, there were no insect reference collections and the ties with the established entomological world were confined to overseas correspondence, help from friendly contemporaries in the United States, and a few important books, of which only those written by Reverend William Kirby and P.H. Gosse contained material about actual Canadian species. Nothing of a distinctively Canadian character appears to have been published during the next dozen years, although some fine work was being done by Harris in Massachusetts, Fitch in the State of New York, and other noteworthy entomologists in various parts of the United States.

The first Canadian entomologists

Canadian entomology began about the middle of the 19th century with a small but able group of hobbyists--the first Canadian entomologists. Because of the tremendous economic importance of insects, entomology in Canada developed mainly as an applied science, with the Canada Department of Agriculture playing a leading role.

Early entomological literature, mostly descriptive, was concentrated in two periodicals: The Canadian Journal (Toronto 1852) and The Canadian Naturalist and Geologist (Montreal 1856). William Couper, Thomas Cottle, W.S.M. D'Urban, William Saunders, and C.J.S. Bethune (who published in 1862 his famous List of Entomologists in Canada--the names of 36 people interested in collecting and studying insects) were among the important early contributors to these periodicals.

Alarmed by the devastation of wheat crops estimated in excess of $2 million in Canada West (Ontario) alone, the Bureau of Agriculture for Upper and Lower Canada offered prizes of 40, 25, and 15 pounds for the best three essays on the subject. First prize was awarded to Professor Henry Youle Hind, of Trinity College, Toronto, for his Essay on the Insects and Diseases Injurious to the Wheat Crops, which was printed and distributed to farmers in 1857; second prize went to the Reverend George Hill, rector of Markham; and third prize, to l'Abbé Léon Provancher of St. Joachim for his Essai sur les maladies et les insectes qui affectent le blé (this was his first contribution to the natural sciences). Thus our economic literature began with the first entomological service sponsored by a government in Canada.

On 26 September 1862, the Reverend C.J.S. Bethune (an Anglican clergyman who became the head of the Department of Entomology and Zoology at the Ontario Agricultural College in 1907) and William Saunders (a pharmacist in London, Canada West, who became the first director of the Dominion Experimental Farms Branch in 1896) arranged the first meeting of entomologists in Canada. Ten gentlemen assembled at the home of Professor Henry H. Croft (University of Toronto) to form an entomological society and establish its objectives. On 16 April 1863, the Entomological Society of Canada was born, with headquarters at Toronto, Croft as president, Saunders as secretary-treasurer, the Reverend Professor J. Hubbert as curator, and a membership of 25. The society, encouraged by the increase in the number of articles describing the appearance and habits of insects since it was founded, established in 1868 its own journal--The Canadian Entomologist.

The first French periodical on natural history published in America, Le Naturaliste Canadien (December 1868), was founded by the priest Léon Provancher who remained its editor and chief contributor until he died. The father of natural history in Lower Canada is most famous for his extensive collections of most groups of insects and his taxonomic publications in Petite faune entomologique du Canada et particulièrement de la province de Québec. Between 1877 and 1890, his Petite faune, which appeared in three volumes plus several supplements totaling nearly 3000 pages, contained the descriptions or redescriptions in French of all the species of Coleoptera, Orthoptera, Neuroptera, Hymenoptera, and Hemiptera known in Quebec at the time. Provancher's collection of insects including types (except a few in the Canadian National Collection and the United States National Museum) are held in the Quebec Provincial Museum.

In 1869, the Board of the Agricultural and Arts Association of Ontario voted a grant of $400 to the Entomological Society on condition that it provided an annual report, formed a cabinet of insects useful and prejudicial to agriculture and horticulture, and continued to publish The Canadian Entomologist. These conditions were agreed upon and in 1871 the Annual Report

for 1870, featuring insects injurious to apple (by Reverend C.J.S. Bethune), grape (by William Saunders), and plum (by E. Baynes Reed), was the first of a continuing series to be issued. In 1871, in return for an annual government grant of $500 and an offer to publish the Annual Report, the society incorporated itself under the name of The Entomological Society of Ontario and from this time on entomology took its place as one of the recognized departments of science in Canada. Important contributors to these annual reports (in addition to Reverend C.J.S. Bethune, William Saunders, and E. Baynes Reed) included: G.J. Bowles of Quebec, W. Brodie of Toronto, F.B. Caulfield of Montreal, W. Couper of Montreal, J. Dearness of London, James Fletcher of Ottawa, Reverend T.W. Fyles of South Quebec, Capitain G. Geddes of Toronto, W.H. Harrington of Ottawa, J.G. Jack of Chateauguay Basin, H.H. Lyman of Montreal, J.A. Moffat of London, R.V. Rogers of Kingston, and Reverend G.W. Taylor of Victoria, B.C.

Two events made 1883 a memorable year. William Saunders published a notable work on Insects Injurious to Fruits, which remained the principal North American reference in this field for several decades, and James Fletcher was appointed as honorary entomologist to the Dominion Department of Agriculture.

James Fletcher and entomology

The following year, as a result of the findings of a committee charged by Parliament to consider what steps were necessary to place the department in a better position to promote agriculture in Canada, James Fletcher was named to the post of Dominion entomologist. While still continuing his duties as accountant in the Library of Parliament, Fletcher found the time that first year to organize an insect intelligence service, the first of its kind in Canada, composed of 400 observers who were to take notes under his direction and report periodically on destructive insects and their remedies. This remarkable correspondence with farmers, fruit growers, gardeners, etc., in all provinces, was continuously enlarged and allowed him to "survey" distant areas, build up a useful reference collection (the beginnings of a national collection), keep himself informed on the pest situations that arose in new settlements throughout the country, and identify the pests and give recommendations for their control. (Fletcher also wrote to American and English entomologists concerning insect control and identification of species).

With the establishment of the Experimental Farms System of the Dominion Department of Agriculture in 1886, James Fletcher was transferred from his post in the Library to that of Dominion entomologist and botanist in the new organization. During the next 5 years he worked alone, traveling throughout Canada, investigating insect and plant problems, addressing meetings of farmers, fruit growers, and other groups, enlarging his reporting service, and making strong the links between him and the people concerned with entomology in this country. Strong ties were also established between Canadian and American entomologists as evidenced by the foundation in 1889 of the American Association of Economic Entomologists, which resulted from a meeting in Toronto sponsored by Fletcher and L.O. Howard, his American counterpart and friend. The one-man era of entomology in agriculture ended in 1892 when J.A. Guignard became his first assistant to help primarily in the botanical work. (Herbert Groh was appointed assistant botanist when Guignard retired in 1908.)

The first federal legislation on noxious insects, the San Jose Scale Act of 1898, was drawn up by Fletcher when the San Jose scale, an insect known as a serious and rapidly spreading pest of fruit trees, was detected in a few orchards in Ontario in 1897. Fletcher then had the authority to inspect nursery stock and orchards and to order the treatment or destruction of infested material to stop the spread of the insect. Fumigation stations were erected at various ports of entry so that infested stock could be treated on importation. Since enforcing the act added to the Dominion entomologist's already heavy duties, Arthur Gibson, a young naturalist from Toronto, was appointed assistant entomologist on 1 April 1899. Together they intensified the work on noxious insects and wherever they traveled they collected insects for the reference collection and encouraged others to send specimens as well. James Fletcher possessed remarkable ability as a public speaker and did much to develop an appreciation for studies relating to injurious insects among the people he addressed during his travels throughout Canada.

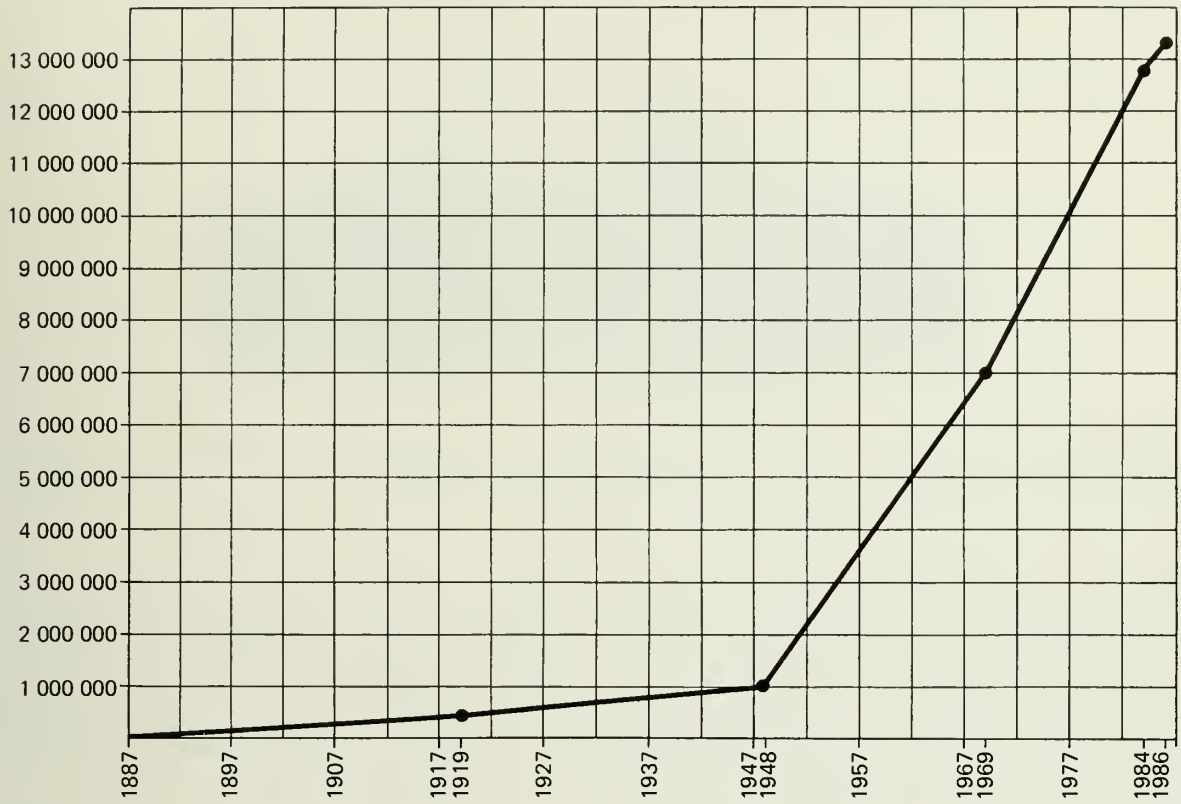
Fletcher's 24 annual reports on the injurious insects of Canada (published by the Dominion Department of Agriculture) provide a monumental record of our developing economic entomology. He was also the author of several pamphlets and bulletins. Although the bulk of his work dealt with economic insects, he discovered many new species which were named in his honor. He described many Lepidoptera larvae and studied the life cycles of many species. He was considered by American entomologists to be an expert on Canadian butterflies and described some new species and varieties. Among other things, he was a fellow of the Royal Society of Canada, a fellow of the Linnean Society of London, president of the Entomological Society of Ontario and later of the Royal Society of Canada, and a member of the Entomological Society of America. Many organizations honored him and, in 1896, Queen's University in Kingston conferred on him an honorary degree of LL.D. in recognition of the valuable service he had given to agriculture science.

The development of the Canadian National Collection of Insects (including arachnids and nematodes)

Following the burning of the Houses of Parliament in 1916, the National Museum building was taken over by Parliament and, because of the resulting congestion, the collection of insects in the museum (12 steel cabinets with 600 drawers) was transferred in 1917 to the Department of Agriculture. Hence the Canadian National Collection was formed by the union of the collection of the Entomology Branch, Department of Agriculture, and that of the Biological Division of the Geological Survey, Department of Mines, and has remained the responsibility of the Department of Agriculture since that time.

The collection of the Entomology Branch was by far the greatest and dated back to 1886 when James Fletcher was appointed Dominion entomologist and botanist and donated his own personal collection, which formed a nucleus on which to build. Important additions were soon made to it through Gibson's personal collection and donations from many well-known collectors and entomologists throughout the country. The collection of the Biological Division of the Geological Survey consisted of specimens collected by officers of the Geological Survey, insects collected during the Canadian Arctic Expedition of 1913-1918, and insects contained in private collections that had

CANADIAN NATIONAL COLLECTION OF INSECTS



been purchased. The latter included the Geddes collection of diurnal Lepidoptera, the Evans collection of Coleoptera, and the Young collection of Microlepidoptera. Following 1917, large numbers of insects were received from various sources but chiefly from field officers connected with the various branch laboratories. The Harrington collection of Hymenoptera was purchased in 1918.

In 1919, "owing to the increasing magnitude of the collection and the growing demands for assistance in the determination of small collections of insects submitted by individuals and institutions" Gordon Hewitt, chief of the Entomology Branch, appointed James H. McDunnough as chief of the Division of Systematic Entomology and charged him with the responsibility of developing the Canadian National Collection of Insects. He was also given the responsibility of developing a taxonomic library. Faunal surveys made by McDunnough and other officers of the division, chiefly W.J. Brown (Coleoptera), C.H. Curran (Diptera), H.L. Viereck (Hymenoptera), G.S. Walley (Hemiptera and Hymenoptera), and T.N. Freeman (general), in various provinces in Canada resulted in much material being added to the collection. A number of enthusiastic systematists, i.e., Arthur Gibson (Lepidoptera), R.C. Treherne (thrips), E.R. Buckell (Orthoptera), W.A. Ross and R. Glendenning (aphids), W. Downes (Hemiptera), J.J. de Gryse (coccids), C.R. Twinn (black flies), and J.M. Swaine, Ralph Hopping, and Norman Criddle (Coleoptera), elsewhere in the branch assisted the divisional staff in revising the collections. Members of

The south wing of the K.W. Neatby Building, the home of the Canadian National Collection of Insects

the Geological Survey, the Topographical Survey, and other government departments also contributed to the Canadian National Collection of Insects. In addition, the following collections were acquired: the Wolley-Dod collection of Lepidoptera (1920), the Sladen collection of Hymenoptera (1921), the Cockle collection (1923), the Swaine collection of bark beetles, the Treherne collection of Thysanoptera (1924), and the Curran collection of Diptera. By 1930, McDunnough and his staff were identifying up to 6000 specimens annually. They had built up by far the best insect collection in Canada and one of the most important in North America. The collection at that time was housed in 2100 steel drawers and 42 steel cabinets. The taxonomic library that he developed was also the largest in the country. When McDunnough retired in 1946 he had a professional staff of six in addition to himself.

The appointment in 1948 of George P. Holland as head of the Systematic Entomology Unit marked the beginning of a period of great expansion in taxonomy. While he was in charge, the Canadian National Collection of Insects grew from a probable 1 million specimens in 1948 to an estimated 7 million in 1969. When he retired as director of the Entomology Research Institute, he left a professional staff of 45, 30 of which were taxonomists.

The Canadian National Collection of Insects grows by gifts, purchases, exchanges, bequests of specimens, and retentions of material submitted for identification, but mostly by insect surveys conducted by members of the institute and others. An invaluable source of material has been the Forest Insect Survey, which began in 1936. The Northern Insect Survey (1947-1961), a cooperative project with the Defence Research Board (Canada Department of National Defence), permitted the investigation of no less than 64 localities in the Arctic and Subarctic by 66 field parties following its inception by T.N. Freeman. Approximately three-quarters of a million specimens were obtained, making the Canadian National Collection the largest and most representative collection of insects ever assembled from the northern parts of the New World. Other institute expeditions were made to Florida (1952),

Mojave Desert (1955), New Guinea (1957), North Carolina (1957), southern Manitoba (1958), southern Texas (1959), Terrace (British Columbia)(1960), Colorado (1961), Mexico (1962, 1969), Nepal (1967), the St. Lawrence Islands National Park, Ontario (1975-1976), Kouchibouguac National Park, New Brunswick (1977-1978), Riding Mountain National Park, Manitoba (1979), Kluane National Park, Yukon (1980), Waterton National Park, Alberta (1980), Gatineau Park, Quebec (1982), and the Cape Breton Highlands National Park in Nova Scotia (1983-1984).

Important collections acquired by the Canadian National Collection of Insects either as a whole or in parts at various times by professional collectors include: the Schmid collection of Trichoptera (ca. 1963), the Bottimer collection of Bruchidae (ca. 1964), the Campbell collection of Coleoptera (1966), the Moore collection of staphilinids (1967), the Schmidt collection of European Parasitica, the Reinhard collection of tachinids (1968), the Thompson collection of Trinidad tachinids (1969), the Leech collection of tundra spiders (late 1960s), the William C. Cook collection of Lepidoptera (ca. 1970), the Mesnil collection of tachinids (1970), the Belleville collection of spiders and harvestmen (1972), the Hull collection of Diptera (1973, 1981), the Brimley collection of Hemiptera and Coleoptera (1976), the Renault collection of forest spiders from New Brunswick (ca. 1976), the Smetana collection of Palaearctic staphilinids (1979), the Woollatt collection of British Coleoptera (1983), Fritz Plaumann's collections of Hymenoptera from Brazil (early 1960s to 1980), L.E. Pena's collections of Hymenoptera from Chile (1960s and 1970s), Moacir Alvarenga's collections of Hymenoptera from Brazil (1960s and 1970s), Susan Nathan's collections of Hymenoptera from India (1960s), J. Klapperich's Hymenoptera collections from Iran, Afghanistan, and the Caribbean (1960s), Fred Bennett's collections of Hymenoptera from Trinidad (1960s and 1970s), and Stewart Peck's collections of Hymenoptera from South America, Australia, New Zealand, and Africa (1960s on).

At the end of 1984, the Canadian National Collection of Insects was estimated to contain 12 817 384 specimens, of which 8 828 239 were curated. These numbers were broken down as follows:

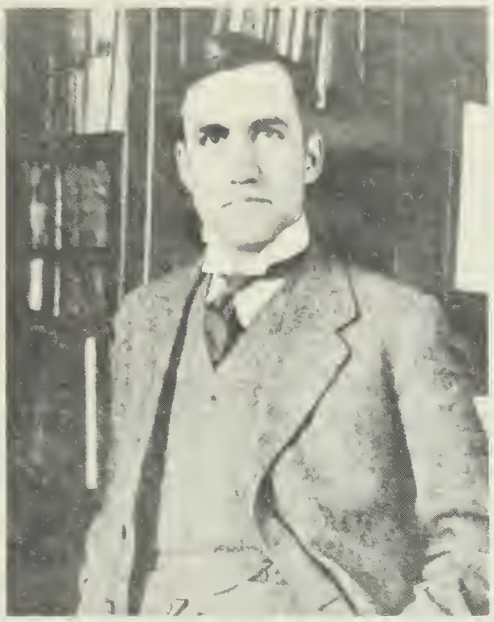
	Curated	Noncurated
Coleoptera	1 724 000	800 000
Diptera	1 771 500	
Hymenoptera	1 668 105	672 500
Lepidoptera/Trichoptera	1 434 612	151 900
Hemiptera	365 555	42 745
Miscellaneous orders	1 001 000	1 500
Nematodes	155 447	1 060 000
Arachnids (minus Acari)	122 520	4 000
Acari	585 500	1 256 500
	8 828 239	3 989 145

It is estimated that by the beginning of the year 1986, the Canadian National Collection of Insects will house 13 296 442 specimens, of which 9 050 597 will be curated.

Entomological (arachnological and nematological) contributions by staff members

Arthur Gibson (1875-1959) was born on 23 December 1875, in Toronto, Ont. He joined the department at Ottawa in 1899 as entomological assistant to James Fletcher, the first Dominion entomologist. He served for 10 years under Fletcher and for 11 years under Gordon Hewitt, who became Dominion entomologist in 1909. Arthur Gibson was appointed chief of the Division of Field Crop and Garden Insects when the Entomological Branch was established in 1914. When Gordon Hewitt died in 1920, he succeeded as Dominion entomologist and, when the Entomological Branch became a division of the newly formed Science Service in 1938, he was appointed associate director of the service and chief of the Division of Entomology. Arthur Gibson devoted considerable time to the development of the collection prior to James McDunnough coming on staff. As Dominion entomologist and chief of the Division of Entomology he continued his support and interest, which greatly assisted McDunnough in procuring equipment and books and increasing the divisional staff. Gibson published over 200 scientific and popular articles on entomology and described a number of new species of Lepidoptera. He belonged to a great many organizations during his career (e.g., he was president of the American Association of Economic Entomologists, the Entomological Society of America, and the Entomological Society of Ontario). In recognition for his outstanding service in Canada, Queen's University conferred on him the honorary degree of LL.D. in 1935. In 1942, Arthur Gibson, one of the pioneers in Canadian entomology, retired after 42 years of service.

C(harles) Gordon Hewitt (1885-1920) (B.Sc., M.Sc., D.Sc. from 1902 to 1909, Manchester) was born near Macclesfield, England, in 1885. He came to Canada in 1909 as the newly appointed Dominion entomologist, succeeding James Fletcher. With the appointment of a university-trained doctor of science in zoology and entomology as Dominion entomologist, the era of naturalists and hobbyists in entomology in Canada came to an end and a new phase began. Under Gordon Hewitt's leadership, the important Destructive Insect and Pest Act was passed in 1910 to prevent the introduction and spread of noxious insects, plant diseases, and other agricultural pests in Canada. The act was also of great historical importance because its administration required more funds and staff, allowing for the development of the Canadian Entomological Service. During his short term in office (11 years), Gordon Hewitt developed the Canadian Entomological Service from a very small unit of the Experimental Farms Service to an important, separate branch of the Department of Agriculture. The Entomology Branch (1914) was soon organized into four functional divisions: the Division of Field Crop and Garden Insects (1914), the Division of Forest Insects (1914), the Division of Foreign Pests Suppression (1919), and lastly but not least importantly, the Divison of Systematic Entomology (1919). Gordon also established field laboratories at Annapolis Royal, N.S.; Fredericton, N.B.; Hemmingford and Fort Coulonge, Que.; Vineland Station and Strathroy, Ont.; Treesbank, Man.; Saskatoon, Sask.; Lethbridge, Alta.; and Vernon, Victoria, and Agassiz, B.C. Gordon Hewitt showed remarkable ability as an organizer and in picking the right people for responsible positions. He had very broad interests and was keenly interested in medical entomology, accomplishing much on problems relating to the housefly, mosquitoes, ticks, and other animals that spread disease, and in the conservation of wildlife in Canada. It was because of his concerns with conservation of wildlife that his official title was changed to Dominion



C. Gordon Hewitt

entomologist and consulting zoologist in 1916. He was president of the American Association of Economic Entomologists in 1916. He was a Canadian representative on the International Commission for the Protection of Nature and drafted the very important Migratory Bird Treaty, which later came into force. Unfortunately, Gordon Hewitt died on 29 February 1920, of pleural pneumonia, without being able to develop to the fullest extent his broad plans for advancement.

James H(alliday) McDunnough (1877-1962) (M.A., 1909, Queen's; Ph.D., 1909, Berlin) was born on 10 May 1877, in Toronto, Ont. After graduation, he worked for several months at the Marine Biological Laboratory, Wood's Hole, Mass., and in 1910 he became curator of the Barnes collection of Lepidoptera. During the next 9 years, he published jointly with Barnes many outstanding taxonomic papers, of which the first four volumes of the Contributions to the Natural History of North American Lepidoptera and Illustrations of American Species of the Genus Catocala are outstanding examples. In 1918, at the request of A. Gibson, chief of the Division of Field Crop and Garden Insects, James McDunnough spent the summer in Ottawa arranging the Macrolepidoptera of the Canadian National Collection. In 1919, James McDunnough, a lepidopterist, was appointed chief of the newly created Division of Systematic Entomology. He was the first officer appointed to devote full time to the Canadian National Collection of Insects and for 3 years he worked without technical assistance. During his 28 years of service, McDunnough built up one of the best insect collections in North America, acquired a large reference library, built up a small supporting staff, established the practice of faunal surveys, initiated an identification service, carried on research on several orders of insects, and published 199 papers, of which 153 were on Lepidoptera, 38 on Ephemeroptera, 5 on Odonata, 2 on Diptera, and 1 on Hemiptera. Among his outstanding papers are studies on the geometrids of the tribe Cleorini (1920);

revisions of the North American genera and species of agrotid moths (1928) and of the phalaenid subfamily Plusiinae (1944); studies on adults and nymphs of the mayfly genus Ephemerella (1931); a revision of the species of the tortricid genus Peronea (1934); and a checklist of the Lepidoptera of Canada (1938, 1939). During his entire publishing career (1909-1962), however, 282 papers were produced, most of which were taxonomic with descriptions of many new species of Lepidoptera, Ephemeroptera, and Diptera. In November 1946, he was superannuated and was appointed a research associate in the American Museum of Natural History, New York. In February 1950, he went to the Nova Scotia Museum of Science at Halifax where he devoted his time mainly to Microlepidoptera. On 23 February 1962, he passed away in a hospital in Halifax. James McDunnough was a fellow of the Royal Society of Canada and of the Entomological Society of America; he was an honorary member of the New York Entomological Society and of the Lepidopterists' Society; and he was editor of The Canadian Entomologist from 1921 until 1938. James McDunnough set high standards for the preparation of material and the curation of the Canadian National Collection, a tradition that carries on today.

C(harles) Howard Curran (1894-1972) (B.S.A., 1922, Ontario Agricultural College; M.Sc., 1923, Kansas; D.Sc., 1933, Montreal) was born in Orillia, Ont., on 20 March 1894. Curran worked as an assistant in the Dominion Entomology Branch, Vineland Station, in 1915 and 1919-1921. In September 1922 he was appointed to the Division of Systematic Entomology and was in charge of the Diptera until he left in 1928. During this period, our first dipterist published numerous articles on flies in The Canadian Entomologist.

Henry L(orenz) Viereck (1881-1931) was born in Philadelphia on 28 March 1881. Henry worked at several places prior to becoming an assistant entomologist with the Entomology Branch (1923-1926). He was a specialist in wild bees and ichneumonids and has the distinction of being our first hymenopterist. By 1928, Henry was the author of 92 papers on the Hymenoptera, including his A Preliminary Revision of the Campoplegiinae in the Canadian National Collection, Ottawa.

G(eorge) Stuart Walley (B.S.A., 1926, Toronto; M.S., 1928, Iowa State College) was born in 1904 in Ingersoll, Ont. Stuart Walley joined the staff of the Entomology Branch on 25 May 1926 as an insect pest investigator and spent most of his research career in taxonomic research. An authority on the Ichneumonidae (Hymenoptera), he published over 70 scientific papers including A Revision of the Ichneumon-Flies of the Genus Campoplegidea Occurring in America North of Mexico (1940), The Genus Casinaria Holmgren in America North of Mexico (Hymen., Ichneumonidae) (1947), and The Nearctic species of Scambus Hartig in Townes and Townes' Ichneumon-Flies of America North of Mexico: 2. Subfamilies Ephialtinae Xoridinae Acaenitinae (1960). Stuart retired from the department on 23 April 1969, after 43 years of service.

Williamson J(ames) Brown (1902-1977) (B.A., 1923, Kansas; M.Sc., 1924, Oklahoma Agricultural and Mechanical College) was born on 23 August 1902, near Preston, Nebr., on the Sac and Fox Indian Reservation. Bill was an instructor at Oklahoma Agriculture and Mechanical College for 3 years prior to coming to the Division of Systematic Entomology in January 1927. Our first coleopterist was widely known for his work on the systematics of scarabaeids, elaterids, and chrysomelids; on problems of sibling species; on composition and distribution of Arctic beetles; and on accidental introduction of European

beetles into North America. Bill was the author of 87 scientific papers (80 of which were on beetles). He described as new 11 genera, 2 subgenera, 268 species, and 25 subspecies, and most of these taxa are still valid. Apart from collecting in many areas across Canada, he made several extended expeditions (i.e., to the north shore of the Gulf of St. Lawrence and along the Labrador Coast, to Churchill, Man., to the Mackenzie Delta, N.W.T., to the Kenai Peninsula, Alaska, and to Greenland) and was the first professional entomologist to investigate the fauna at points in the eastern Arctic. Among many other things, Bill was editor of The Canadian Entomologist from 1939 to 1946 and was elected second vice-president of the Entomological Society of America in 1944. After 40 years of service, Bill Brown retired in August 1967.

Alexander D(ouglas) Baker (1894-1974) (B.S.A., 1923, M.Sc., 1925, McGill; Ph.D., 1933, Toronto) was born on 18 March 1894 in Winnipeg, Man. He held teaching positions at both McGill and Toronto universities prior to joining the Department of Agriculture on 30 May 1935. From 1927 to 1937 his research was mainly concerned with helminthology and entomology and he published over 30 important papers. Alex's interests soon shifted to nematodes following the discovery of the sugar beet nematode in southern Ontario in the late 1930s. He conducted surveys for this pest and established extensive chemical control trials and host range studies. His publications on the potato rot nematode and the oat cyst nematode provided valuable information to growers. In 1945 Alex became chief of the Nematode Investigations Unit of the Science Service (which became incorporated into the Entomology Research Institute in 1959). He then began to establish a badly needed library and card index file of taxonomic literature which, by the time he retired, ranked as one of the most complete in the world. His Check Lists of the Nematode Superfamilies Dorylaimoidea, Rhabditoidea, Tylenchoidea and Aphelenchoidea was widely acclaimed. Alexander Baker's contributions in nematode systematics earned him an international reputation as one of the top authorities in nomenclature. He retired on 16 March 1962.

Oswald Peck (B.Sc., 1931, Alberta; M.Sc., 1933, Ph.D., 1935, McGill) was born in 1903 in Bolton, England. Oswald joined the Entomology Branch on 7 November 1935, as an insect pest investigator and carried out taxonomic research throughout his career. He was a specialist in the taxonomy of the Chalcidoidea (Hymenoptera). His Catalogue of the Nearctic Chalcidoidea, a monumental publication of almost 1100 pages, is considered to be a most important contribution to the scientific literature. After 33 years of service, Oswald Peck retired on 25 April 1969.

Thomas N(esbitt) Freeman (1911-1975) (B.S.A., 1934, Ontario Agriculture College; M.Sc., 1936, Colorado; Ph.D., 1946, Toronto) was born in 1911 in Saskatoon, Sask. Tom joined the Division of Systematic Entomology in 1936 to assist with the Lepidoptera. He had previously assisted J.A. Hall in the Simcoe Laboratory during the summer of 1934 and G.S. Walley in the Division of Systematic Entomology during the summer of 1935. Tom concentrated his efforts mainly on the Microlepidoptera and published a large number of papers including the two memoirs: The Archipinae of North America (Lepidoptera: Tortricidae) (1958) and Needle-Mining Lepidoptera of Pine in North America (1960). His most outstanding achievement, however, was coordinating the Northern Insect Survey. From this survey, the Canadian National Collection gathered the largest and finest collection of Arctic insects in the world. Tom received many honors during his career, including being elected president

of the Lepidopterists' Society in 1956. Tom Freeman retired on 16 October 1971 and later passed away on 15 May 1975.

Guy E(aden) Shewell (B.Sc., 1935, M.Sc., 1937, McGill at Macdonald College) was born on 16 July 1913, at Newcastle-on-Tyne, England. Guy began with the Entomological Branch in October 1937 (although he worked here as a summer student in 1936). A series of six papers was published by him on Nearctic Simuliidae with descriptions of new Canadian species and a general discussion of classification, with special reference to the Boreal and Arctic fauna. He also published a paper correctly identifying the main black fly pests of domestic ducks and geese in North America, establishing the fact that a large group of simuliids with specially adapted claws are exclusively or primarily ectoparasites of birds. Guy has contributed many collections to the Canadian National Collection from different parts of Canada, from both the eastern and western Canadian Arctic, and from England.

William Grenfell Matthewman (B.S.A., 1934, Toronto; M.Sc., 1939, McGill) was born on 10 February 1909. He joined the Department of Agriculture (Field Crop and Garden Insects Unit) on 1 March 1938. He became a part of the Entomology Research Institute (Experimental Biology Section) when it was formed in 1959 and worked on experimental ecology until he retired on 31 December 1970.

Arthur R(obinson) Brooks (1917-1962) (B.A., 1938, Saskatchewan; M.Sc., 1947, Iowa State College) was born in 1917 at Indian Head, Sask. Art began his professional career as a seasonal assistant at the Entomology Laboratory at Saskatoon in 1937. It was in 1938 that he accepted a position in the Systematic Entomology Unit at Ottawa. Several quite extensive papers were published by this expert in the Tachinidae. During the war, Art played a vital role in the identification of mosquitoes and other biting Diptera for the armed forces. He was also much involved with the development of the Forest Insect Survey. In 1948, Art was transferred back to Saskatoon.

Herbert H(ugh) J(ohn) Nesbitt (B.A., Queen's; M.A., Ph.D., Toronto) was born in Ottawa, on 7 February 1913. Bert joined the Systematic Entomology Unit in 1939. An expert in the field of acarology, he published six papers including A Revision of the Family Acaridae Based on Comparative Morphological Studies (1945) before leaving in 1948 to become a professor at Carleton University.

Alfred Wilkes (B.S.A., M.Sc., Ph.D., Toronto) was born on 7 January 1909. Alfred joined the Department of Agriculture on 3 May 1940 and transferred to the Entomology Research Institute (Experimental Biology Section) in 1959 to work on the genetics (sex ratio of Hymenoptera) of insects. About six papers were published by him prior to his retirement in December 1973.

David F(rancis) Hardwick (B.A., 1946, Saskatchewan; M.Sc., 1948, McGill; Ph.D., 1955, California) was born in Edmunston, N.B., on 22 March 1924. David joined the staff of the Systematic Entomology Unit on 4 June 1945. In the spring of 1973, he was appointed director of the Entomology Research Institute (which later that year was amalgamated with the Mycology and Vascular Plant sections of the Plant Research Institute to become the Biosystematics Research

George Holland (left) and Frank McAlpine (right)

Institute). Approximately 40 papers were published by him, most of which dealt with the earworm and cutworm moths. His most extensive work was a world revision of the corn earworm complex (for which he won the Karl Jordan Award in 1984). After over 34 years of service, David Hardwick retired as director of the Biosystematics Research Institute on 29 December 1978.

V.E. Henderson (B.S., Toronto) joined the Nematode Investigations Unit of the Science Service (which became incorporated into the Entomology Research Institute in 1959) in 1946. He worked on the association between nematodes and microorganisms in relation to plant diseases. Henderson was transferred to the Plant Protection Division in 1964.

John W(alter) Arnold (B.A., M.Sc., Ph.D., Western Ontario) was born on 10 January 1921. He joined the Department of Agriculture (Stored Product Insect Unit) on 29 May 1947. John transferred to the Entomology Research Institute (Experimental Biology Section) in 1959 to work on hematology, hemocytology, and morphology of insects. He served as head of the Experimental Taxonomy Section from 1974 to 1975. John Arnold retired on 31 March 1982.

George P(earson) Holland (1911-1985) (B.A., 1933, M.A., 1937, British Columbia; D.Sc.,1963, Carleton) was born on 27 August 1911, in Vancouver, B.C. From 1936 to 1948, George Holland worked at the Livestock Insect

Laboratory at Kamloops, B.C., where he established the basis for his continuing study of the Siphonaptera. In 1948, he replaced the retired James McDunnough as chief of the Systematic Entomology Unit in Ottawa. At this time, the unit had a complement of six scientists and the Canadian National Collection of Insects contained approximately 1 million specimens. A leading authority on the Siphonaptera, George published numerous papers on this group including the widely acclaimed monograph The Siphonaptera of Canada (1949). In 1955 he took over responsibility for a biological control laboratory in Belleville and the unit was retitled the Insect Systematics and Biological Control Unit. With the amalgamation in 1959 of the Experimental Farms Service and the Science Service, the establishment in Ottawa with George Holland as director was retitled the Entomology Research Institute. At this time, the Systematic Entomology Unit was joined by the Nematology Unit, the Veterinary and Medical Entomology Unit, the Apiculture Unit, and part of the former Field Crop and Garden Insects Unit. As director, George was responsible for the Canadian National Collection and for an extensive program of research in systematics, ecology, physiology, genetics, and apiculture. In 1969, health reasons forced George to step down as director but he continued at our institute as a specialist in the Siphonaptera. Under George Holland's leadership, taxonomy had undergone a period of great expansions. In 1969, the institute had a professional staff of 45, 30 of whom were taxonomists, and the Canadian National Collection of Insects had grown to an estimated 7 million specimens. George participated in many organizations. He was president of the Entomological Society of Canada in 1957-1958, chairman of the centennial of entomology in Canada, and chairman of the Advisory Committee on Entomological Research, Defence Research Board, from 1963 to 1967. In 1963, Carleton University conferred upon him the degree of Doctor of Science, honoris causa and in 1967 he was elected a fellow of the Royal Society of Canada. George Holland retired from the Biosystematics Research Institute on 26 August 1976 but continued to work on fleas as a research associate. In July 1985, an extensive memoir on the fleas of Canada, Alaska, and Greenland was published. He died in November 1985 following an unfortunate accident while walking in the woods that he loved.

C(harles) Douglas F(airbanks) Miller (B.S.A., 1948, Toronto; M.Sc., 1951, British Columbia; Ph.D., 1967, McGill) was born on 20 March 1925, in Alabama, N.Y. He joined the Systematic Entomology Unit on 29 May 1948 and worked on the taxonomy of ants, wasps, and parasitic Hymenoptera. Doug has since published 12 papers, including Taxonomy and Distribution of Nearctic Vespula (1961) and The Nearctic Species of Pnigalio and Sympiesis (Hymenoptera: Eulophidae) (1970). On 14 July 1978, he transferred to the Pacific Forest Research Center.

William R(ichardson) M(iles) Mason (B.Sc., 1942, Alberta; Ph.D., 1952, Cornell) was born in Lucknow, India, on 29 November 1921. He joined the Systematic Entomology Unit on 16 November 1948. An expert in the Braconidae, Bill has 40 or so scientific publications to his credit, which include revisions of Nearctic Cteniscini (1955, 1956, 1959), Chrysopothorus (1964), Muesebeckiini (1969), Brachistini (1974), Coeloides and Braconini (1978), and the world genera of Microgastrinae (1981). He is currently working on a Phylogenetic Revision of Hymenoptera and is contributing to the Manual of Hymenoptera of Canada. Bill led 17 collecting expeditions to the Arctic, Canada, Alaska, the United States, Europe, Mexico, and Nepal. About 9% of the

Hymenoptera in the Canadian National Collection has been collected by him. Bill Mason served as section head for most of the 1960s and was editor of The Canadian Entomologist for 3 years (1961-1963).

J(ohn) Richard Vockeroth (B.A., 1948, M.A., 1949, University of Saskatchewan; D. Phil., 1954, Oxford) was born on 2 May 1928, in Broderick, Sask. Dick joined the Systematic Entomology Unit on 1 June 1949. His discovery that the claws of female mosquitoes show specific differences led indirectly to extensive change in the mosquito control program at Fort Churchill. Dick made the first official collecting trip outside Canada (England, Scandinavia) in 1951. He has collected and pinned about 113 000 Diptera since 1948 (about 1/15 of the Canadian National Collection of Diptera). Important publications include A Revision of the Genera of the Syrphini (1969) and A Review of the World Genera of Mydaeinae, With a Revision of the Species of New Guinea and Oceania (1972).

Bryan P(atrick) Beirne (B.Sc., 1938, Ph.D., 1940, M.Sc., 1941, M.A., 1942, Trinity College in Dublin) was born in County Wexford, Ireland, in 1918. In 1949, Bryan came to Canada and joined the Systematic Entomology Unit. Here he specialized in Homoptera and was in charge of the Hemiptera-Homoptera Section. His studies ultimately resulted in the publication of the well-illustrated monographs The Leafhoppers of Canada and Alaska (1956) and The Cicadas and Treehoppers of Canada (1959). Bryan left the unit in 1955 to become director of the Entomology Research Institute in Belleville. In 1967, he was appointed director of the Pestology Center at Simon Fraser University. Among his many accomplishments, Bryan has authored over 140 papers and several books. In 1976, he was awarded the Entomological Society of Canada Gold Medal for his outstanding contributions in entomological research, teaching, and extension, not only in Canada but throughout the world.

Eugene G(ordon) Munroe (B.Sc., 1940, M.Sc., 1941, McGill; Ph.D., 1948, Cornell) was born on 8 September 1919, in Detroit, Mich. Eugene joined the Systematic Entomology Unit on 1 February 1950. He specialized in the systematics of the moth family Pyralidae but he also worked on the Geometridae, Saturniidae, Sphingidae, and Rhopalocera, and also on the orders Megaloptera and Trichoptera. A long series of taxonomic papers were published by him (about 150 research papers and 60 related works), including monographs of the North American Odontiinae, the North American species of Udea, the European corn borer and allies (with A. Mutuura), Epicorsia and related genera, the subfamily Midilinae, and the genera Vitessa, Cosmethella, and Vitessidia (with Michael Schaffer). He wrote five fascicles in The Moths of America North of Mexico monographing the subfamilies Scopariinae, Nymphulinae, Odontiinae, and part of the Pyraustinae, describing many new genera and species and giving an overall classification of the subfamilies and higher divisions of the Pyraloidea. Other important contributions included a conspectus of the Canadian Lepidoptera in Danks' Canada and its Insect Fauna, the Pyraloidea and Pterophoridae in the Wedge Foundation's Check List of the Lepidoptera of America North of Mexico, and a long section on Lepidoptera in the McGraw-Hill Synopsis and Classification of Living Organisms. Eugene has collected throughout North America, as well in Europe, Africa, Asia, the Pacific Islands, and tropical America. Thanks to Eugene Munroe, the Canadian National Collection of organized North American Pyralidae has grown from 40 drawers to some 300 drawers and that of the organized exotic Pyralidae from 1.5 Schmidt boxes to about 1000 drawers. Eugene was chief of the Insect

Taxonomy Section from 1959 to 1965. He was editor of The Canadian Entomologist from 1958 to 1961 and was president of the Entomological Society of Canada in 1964. He is a member of several entomological and biological societies. Eugene Munroe retired from the Biosystematics Research Institute on 7 September 1979. Many honors were bestowed upon him, including the Queen's Silver Jubilee Medal and the Entomological Society of Canada's Gold Medal for outstanding achievement in Canadian entomology (1982).

John E(llis) H(amer) Martin was born on 19 December 1920, in Ancaster, Ont. Jack joined the Systematic Entomology Unit on 6 March 1950. He became curator of the Canadian National Collection of insects in 1953 and, later, manager of the Identification Service. Jack was much involved in the Northern Insect Survey as well as many other institute surveys. Twelve papers were published by Jack including his handbook on Collecting, Preparing, and Preserving Insects (1977). After 35 years of service Jack retired on 19 April 1985.

Leonard A(lexander) Kelton (B.S.A., 1950, Saskatchewan; M.Sc., 1954, Ph.D., 1957, Iowa State University) was born on 22 February 1923, in the Ukraine. His Ph.D. thesis was entitled "An investigation of the male genitalia as taxonomic characters in the Miridae." Len joined the Systematic Entomology Unit on 29 April 1950, to work on the Heteroptera. Seventy-one papers were published by him, including Male Genitalia as Taxonomic Characters in the Miridae (Hemiptera) (1959), Review of Lygocoris Species Found in Canada and Alaska (1971), and The Lygus Bugs (Genus Lygus Hahn) of North America (1975); the two handbooks The Anthocoridae of Canada and Alaska-Heteroptera: Anthocoridae (1978) and The Plant Bugs of the Prairie Provinces of Canada-Heteroptera: Miridae (1980); and the monograph The Plant Bugs on Fruit Crops in Canada (1982). Len Kelton retired on 13 December 1984.

J(ames) Francis McAlpine (B.S.A., 1950, Ontario Agricultural College; M.Sc., 1954, Ph.D., 1962, Illinois) was born in Maynooth, Ont., on 25 September 1922. Frank joined the Systematic Entomology Unit on 1 June 1950 and began work on the classification, evolution, and biogeography of the higher Diptera, especially the Acalyptratae. Although his main emphasis was on North American fauna, he treated a number of families (e.g., Lonchaeidae, Pallopteridae, and Piophilidae) on a world basis. Frank published about 85 scientific papers (including 18 chapters of the Manual of Nearctic Diptera) and is internationally recognized as an authority on the morphology and biosystematics of the Diptera. His scientific investigations have also included studies on fossil Diptera, insect dispersal, and mating behavior. Frank has participated in about 20 collection expeditions (10 of which he led) in Canada, the United States, Mexico, Australia, and New Caledonia. He served as head of the Diptera Section from 1966 to 1975 and was a member of many entomology related organizations. After 35 years of service, Frank McAlpine retired in July 1985; he is, however, continuing his research activities as a research associate.

Roland H(ugh) Mulvey (B.Sc., 1951, Macdonald College; M.Sc., 1954, Oregon State) was born on 16 October 1917, at Timmins, Ont. Rollie joined the Nematode Investigations Unit of the Science Service on 4 May 1951. In 1962, he became chief of a section of up to eight nematologists, a position he held until retirement. His many research accomplishments concentrate mainly on the systematics of the root-knot and cyst-forming nematodes, and on the predaceous

groups of Mononchoidea, having published 44 papers on these groups alone. Rollie was the first to find and characterize chromosomes in root-knot and cyst nematodes and to establish their value in the taxonomy of the species. He is perhaps best known for his comprehensive, systematic treatments on the genus Heterodera. His innovative studies on cone-top morphology of cysts and on white females and their extended application to taxonomy and identification of the many species have had major impact. This work permitted an orderly classification of species groupings and established important diagnostic characters for their identification. After retiring on 28 December 1979, Rollie Mulvey completed as coauthor a major publication on the cyst-forming genera and species of the Heteroderidae of the western world.

James G(ordon) T(homas) Chillcott (1929-1967) (B.Sc., 1951, Ontario Agricultural College; Ph.D., 1958, Kansas) was born in Penetanguishine, Ont., on 19 June 1929. Jim joined the Diptera Section of the Systematic Entomology Unit on 10 May 1951. For his Ph.D., he undertook a revision of the muscoid subfamily Fanniinae. Jim was officially responsible for the Muscidae but he also developed a special interest for the Empididae. Field work was always an essential part of his program and he organized and participated in several institute surveys, his first love being the Arctic. Unfortunately he died while on a field trip in Nepal. During his short life-span, he published an exceptional number of solid taxonomic treatments.

Herbert J(oseph) Teskey (B.Sc., 1951, Alberta; M.S.A., 1955, Toronto; Ph.D., 1967, Cornell) was born 9 June 1928, in Grand Prairie, Alta. Herb began his government career at Guelph in veterinary entomology where he published papers on the warble fly and the face fly and a paper on a survey of livestock insects in southwestern Ontario. It was here that he began his studies on immature stages of Tabanidae (Diptera). The Entomology Research Institute hired Herb on 1 October 1964. He has since completed a monograph on the immature stages of 81 species of Tabanidae as well as several papers on immature Tabanidae. He has prepared a most comprehensive treatment of morphology and terminology of Diptera and a family key to Diptera larvae for the Manual of Nearctic Diptera. Several new species of Tabanidae in all life stages have been described by Herb, including a very difficult revision of the North American genus Atylotus.

Robert Lambert (1912-1957) (B.S., B. Surv., F.E., Laval; M.S., Ph.D., Cornell) was born in Nova Scotia in 1912. Bob transferred to the Systematic Entomology Unit to specialize on sawflies and bees around 1951. Formerly he was in charge of the Quebec Forest Insect Survey for 13 years. He had almost completed a comprehensive revision of the Sparganothidinae (Lepidoptera: Tortricidae) of the world when he died suddenly of a heart attack on 21 October 1957.

Charles D(enton) Dondale (B.Sc., 1952, Macdonald College at McGill); M.Sc., 1955, Ohio State; Ph.D., 1959, McGill) was born in Princedale, N.S. on 28 November 1927. Charlie was first employed at the Belleville Research Institute (Agriculture Canada). In June 1972, he came to the Biosystematics Research Institute as an expert on spiders. Since then he has made major taxonomic revisions of 20 genera of crab spiders and wolf spiders, involving more than 200 species. He has also produced identification manuals for seven families of Canadian spiders totaling more than 250 species. Two of his handbooks are The Crab Spiders of Canada and Alaska Araneae: Philodromidae and

Thomisidae (1978) and The Sac Spiders of Canada and Alaska Araneae: Clubionidae and Anyphaenidae (1982). The Canadian National Collection of spiders has grown by an average of 5000 specimens a year since his arrival here in 1972. Charlie belongs to many organizations and was president of the American Arachnological Society from 1978 to 1979.

Edward C(oulton) Becker (B.S., 1944, Missouri; M.S., 1950, Ph.D., 1952, Illinois) was born on 15 March 1923, in St. Louis, Miss. Ed did his Ph.D. thesis on the "Revision of the Nearctic species of Agriotes (Coleoptera: Elateridae)." In 1948-1949, he was an entomologist with the Standard Fruit Co. at La Ceiba in Honduras. In 1953 he published a paper on the Pselaphidae of Honduras. Ed joined the Entomology Division on 21 June 1952. Several papers were published by him including Revision of the Nearctic Species of Agriotes (Coleoptera: Elateridae) (1956), The North American Elaterid Types of Otto Schwarz With a Revision of Ctenicera bivittata (Melsheimer) and Allies (Coleoptera) (1961), Five New Species of Megapenthes From the Southwestern United States, With a Key to the Nearctic Species (Coleoptera: Elateridae) (1971), Revision of the Nearctic Species of Athous (Coleoptera: Elateridae) East of the Rocky Mountains (1974), and Review of the Western Species of Athous (Coleoptera: Elateridae) With a Key to the Species North of Panama (1979). Ed Becker is currently treasurer of the Entomological Society of Canada (since 1961), president of the CanaColl Foundation (since 1972), and editor of the Coleopterists Bulletin (since 1983); he was president of the Coleopterists Society from 1971 to 1972. In 1978, he was awarded the Queen's Silver Jubilee Medal; in 1976 he became a fellow of the Entomological Society of Canada; and in 1984 he received the Canada Commemorative Award. Ed Becker officially retired on 30 December 1980 but has continued working here as a research associate.

Margaret R(ae) MacKay (B.Sc., 1934, M.Sc., 1938, Saskatchewan) was born in Vonda, Sask., on 18 October 1914. From 1938 to 1940, she worked as a scientific illustrator for the British Museum in London. Margaret joined the Division of Forest Biology in 1940 and the Systematic Entomology Unit in 1952. Forty publications were produced by her, most of which were the results of highly specialized taxonomic studies of Lepidopterous larvae (four were monographs of microlepidopterous larvae). She discovered the first fossil evidence of Lepidoptera before the Tertiary period. This was a partial head capsule in Canadian amber of the Cretaceous period. Thanks to Margaret MacKay the Canadian National Collection of Lepidopterous larvae grew from a few dozen inflated larvae to its present numbers. From 1963 to 1965 she served as editor of The Canadian Entomologist. Margaret MacKay retired on 28 April 1972.

Robert S. Bigelow was born in 1919 in Nova Scotia. He joined the Systematic Entomology Unit in 1952 to work on Orthoptera and Thysanoptera. Although Bob resigned his position early in 1953, he arranged the Orthoptera collection and added material.

Georgiana L(ouise) Roberts (Nee Brown) (M.Sc., 1951, Macdonald College) was part of the Nematode Investigations Unit of the Science Service from 1952 to 1958. She has the distinction of having named and described the first plant nematode in Canada, which initiated the type collection of the Canadian National Collection of Nematodes. During her career in nematology, she made substantial contributions to the nematode collection, which has greatly extended our knowledge of the kinds and distribution of nematodes in Canada.

Stephen L(ane) Wood (B.S., 1946, M.S., 1948, Utah State; Ph.D., 1953, Kansas) was born on 2 July 1924, at Providence, Utah. Steve joined the Systematic Entomology Unit in November 1953 as a specialist on bark beetles. Steve Wood published on the bark beetles of the genus Carphoborus in North America (1954), on new species of bark beetles mostly from Mexico (1956), on the Ambrosia beetles of the tribe Xyloterini in North America (1957), and on the Platypodidae and Scolydidiae of Micronesia (1960). Steve left the institute in August 1956.

Gerd H. Heinrich was temporarily with the Entomology Research Institute from 1959 to 1960. Gerd specialized in the Ichneumonidae. From 1960 to 1962, he published in seven parts his Synopsis of Nearctic Ichneumoninae Stenopneusticae With Particular Reference to the Northeastern Region (Hymenoptera).

J(ohn) Antony Downes (B.Sc., 1935, Imperial College of Science and Technology in London) was born on 14 February 1914, at Wimbledon, England. From 1940 to 1953 Antony was a lecturer in entomology at the University of Glasgow. The Veterinary and Medical Entomology Unit (part of which joined the Entomology Research Institute in 1959) acquired the services of Antony Downes on 22 June 1953. He published approximately 50 scientific papers on the feeding and mating behavior of biting midges and mosquitoes, and on Arctic insects. He also studied the feeding habits of Lepidoptera. In 1956 Antony was general secretary at the 10th International Congress of Entomology; from 1958 to 1959 he was head of the Medical and Veterinary Entomology Unit; and from 1960 to 1971, he was head of the Experimental Biology Section of the Entomology Research Institute. The Entomology Society of Canada awarded Antony the Gold Medal for outstanding achievement in entomology in 1977. Antony retired on 28 December 1978.

Samuel A. Sher (-1976) (Ph.D., California) worked for the Nematodes Investigation Unit of the Science Service in 1953. Skip left Canada in the same year to take up a newly created position in nematology at the Riverside Campus, University of California. During his illustrious career in nematode systematics, he remained an avid supporter of the Canadian National Collection of Nematodes, to which he contributed many important types of plant nematodes.

Helen E(dith) Salkeld (M.S.A., Toronto; Ph.D., London) was born on 22 July 1926. She joined the Department of Agriculture (Field Crop and Garden Insects Unit) on 1 April 1954. Helen became a part of the Experimental Biology Section of the Entomology Research Institute in 1959 and worked on the histochemistry and physiology of insects. For a time she was head of the Comparative Morphology Section (1969-1971) and head of the Experimental Taxonomy Section (1972-1973). Helen also worked on the comparative micromorphology of insect eggs. Helen Salkeld published several papers before retiring on 31 December 1980.

W(illiam) Robin Richards (B.Sc., 1949, Alberta; M.Sc., 1951, Ph.D., Illinois) was born on 13 November 1926, in Regina, Sask. Rob joined the Systematic Entomology Unit on 16 February 1954, to work primarily on aphids but also on scale insects and psyllids. Approximately 80 papers were published by him, including memoirs on A Synopsis of the Genus Rhopalosiphum in Canada (Homoptera: Aphididae) (1960), The Callaphidini of Canada

(Homoptera: Aphididae) (1965), Systematics of Fossil Aphids From Canadian Amber (Homoptera: Aphididae) (1966), A Synopsis of the World Fauna of Myzocallis (Homoptera: Aphididae) (1968), and A Synopsis of the World Fauna of the Saltusaphidinae, or Sedge Aphids (Homoptera: Aphididae) (1971). Rob Richards retired on 30 November 1981.

James Grant Robertson (1921-1967) (B.Sc., 1948, Manitoba; M.A., 1951, Ph.D., 1954, British Columbia) was born on 17 October 1921, in Winnipeg, Man. He joined the Department of Agriculture on 19 July 1954 and came to the Entomology Research Institute (Experimental Biology Section) in 1959. He worked on the genetics (cytotaxonomy) of insects and published about six papers. James Robertson passed away on 14 June 1967.

Brian E(llman) Brown worked for the Nematode Investigations Unit of the Science Service from 1955 to 1956. During this brief period, Brian initiated the first physiological studies of plant nematodes in Canada. He later moved to a position in insect toxicology in Saskatoon.

Mushtaq A(hmed) Khan (degree in veterinary medicine, M.S., 1948, Michigan State) joined the Nematode Investigations Unit of the Science Service in 1955 and worked on the nematode parasites and associates of insects. From his studies important new species were named and described. Mushtaq left the Nematology Section in 1957 to pursue a career in animal parasitology and toxicology at Lethbridge, Alta.

Liang-Yu Wu (B.S., M.S., Lingnan; Ph.D., 1952, Macdonald College) was born on 19 December 1910. Liang-Yu Wu joined the Nematode Investigations Unit of the Science Service on 1 October 1956, as an expert on nematodes. During her career she made substantial contributions in the morphology and taxonomy of plant nematodes and was internationally recognized as a taxonomic authority on Tylenchidae and Criconematidae. Liang-Yu Wu was cited by the Society of Nematologists in 1967 for her outstanding contributions to nematology. She retired on 8 August 1975.

Henry F(uller) Howden (B.S., 1946, M.S., 1949, Maryland; Ph.D., 1953, North Carolina State) was born on 19 August 1925, in the United States. Henry joined the Systematic Entomology Unit on 2 August 1957, as an expert on the Scarabaeidae (Coleoptera). He published several papers, including the following three memoirs: A Revision of the New World Species of Thalycra Erichson, With a Description of a New Genus and Notes on Generic Synonomy (Coleoptera: Nitidulidae) (1961), The Geotrupinae of North and Central America (1964), and A Review of the Trichiinae of North and Central America (Coleoptera: Scarabaeidae) (1968). An excellent collector, Henry participated in several institute expeditions. Henry Howden resigned on 31 August 1970, to became a professor at Carleton University.

W(illiam) Robin Thompson (1887-1972) (B.S.A., 1909, Ontario Agricultural College; M.Sc., 1912, Cornell; Ph.D., St. Maximin; D.Sc., Paris, Car.) was born in 1887 in London, Ont. Robin Thompson made outstanding contributions to entomology (see Bull. Ent. Soc. Can. 4:3). Shortly after retiring as director of the Commonwealth Institute of Biological Control in 1958, Robin Thompson was appointed an honorary fellow of the Entomological Research Institute. Here he began a long series of taxonomic studies on the Tachinidae of Trinidad, in which he published eight parts (the last in 1968) comprising over

800 pages and 600 figures. Many honors came to him in the course of his career, including serving as president of the 10th International Congress of Entomology (1956) and serving as editor of The Canadian Entomologist (1949-1958).

Kailash C(handra) Sanwal (B.Sc., M.Sc., Ph.D., Lucknow) first joined the Nematode Investigations Unit of the Science Service as a postdoctorate fellow, a position he held until his appointment as a full-time nematode systematist in 1958. His many excellent research papers established him internationally as a leading taxonomic authority on several major plant nematode groups. On 31 March 1971, Kailash transferred to Charlottetown to work as a plant nematologist and, the following year, he returned to India to work as a nematode systematist at the Indian Agricultural Research Institute, New Delhi.

Lois K(athleen) Smith (B.Sc., 1950, Alberta; M.Sc., Ph.D., 1958, Wisconsin) was born on 13 September 1927. She joined the Civil Service on 28 February 1958 and transferred to the Entomology Research Institute on 1 April 1959, to work on the Icheumonidae. Lois Smith resigned on 31 May 1970.

Jack C(laydon) Guppy (B.S.A., 1951, M.S., 1956, Cornell) was born on 29 October 1925. Jack joined the Entomology Research Institute (Experimental Biology Section) in April 1959. He published 12 scientific papers on various problems concerning the life history, behavior, and ecology of four major forage crop pests. Jack Guppy transferred to the Ottawa Research Station in April 1970.

Bruce E(van) Hopper (B.S., 1954, Rhode Island; M.Sc., 1957, Auburn) was born on 11 August 1932, at Norwalk, Conn. Bruce joined the Entomology Research Institute on 9 November 1959, as a specialist in nematology. Approximately 30 papers were produced by him, including a large manuscript he coauthored on the marine nematodes of the east coast of North America (1967). Bruce resigned on 31 March 1972.

Conrad E. Yunker (M.S., Ph.D., Maryland) joined the Entomology Research Institute in December 1959, as an expert in acarology. He published one or two papers before resigning in 1960.

G.H. Hammond (B.S.A., M.Sc., McGill) transferred to the Entomology Research Institute (Experimental Biology Section) when it was formed in 1959. He worked on white grubs until he retired in 1961.

Douglas G. Harcourt (B.S.A., Toronto; Ph.D., Cornell) joined the Entomology Research Institute (Experimental Biology Section) when it was founded in 1959. Doug worked on the population dynamics of crop insects and published several papers before transferring to the Ottawa Research Station in 1970.

John R.R. McLintock (B.Sc., Manitoba; Ph.D., McGill) worked for the Veterinary and Medical Entomology Unit, part of which joined the Entomology Research Institute (Experimental Biology Section) in 1959. John worked on the bionomics of mosquitoes and published a few papers. He transferred to the Saskatchewan Research Station on 1 May 1965.

A.E.R. Downe (B.Sc., Alberta; M.A., Ph.D., Queen's) was transferred from the Veterinary and Medical Entomology Unit to the Entomology Research

Institute (Experimental Biology Section) when it was formed in 1959. Downe worked on serology and published a few papers before resigning in 1961 to join the Department of Entomology at Kansas State University.

Lewis Davies (B.Sc., Wales; Ph.D., Durham) was hired by the Department of Agriculture around 1957. He joined the Entomology Research Institute (Experimental Biology Section) when it was formed in 1959 and worked on the ecology of black flies. Lewis Davies published a few papers and then resigned in 1960 to return to Britain.

B(eatrix) N(ina) Anne Hudson (B.Sc., 1952, London, England; Ph.D., 1955, London School of Hygiene and Tropical Medicine) was born on 10 December 1923, in London, England. Anne joined the Entomology Research Institute (Experimental Biology Section) in August 1960. She worked on oviposition attractants and anticoagulants in the salivary secretions of mosquitoes. Anne Hudson has also done chemotaxonomic studies (isozymes) of the Tabanidae and Noctuidae. Her collection of Tabanidae from Newfoundland was contributed to the Canadian National Collection of Insects.

H.M. Thomson (M.Sc., Ph.D., McGill) transferred from the Department of Forestry to the Entomology Research Institute (Experimental Biology Section) in 1960. He died the same year.

Herbert E(dward) Milliron (B.S., 1936, West Virginia; M.S., 1938, Michigan State; Ph.D., 1942, Minnesota) was born on 25 February 1923, at Dubois, Pa. Herb worked at several places in the United States prior to joining the Entomology Research Institute, on 10 March 1961. He was concerned with the systematics and biology of Apoidea, Symphyta, and Chalcidoidea. During his long career, Herb wrote 42 scientific papers including a five-part monograph on the bumble bees of the Western Hemisphere. He retired after 12 years with the Biosystematics Research Institute on 1 September 1973.

Evert E(splin) Lindquist (B.Sc., 1957, M.Sc., 1959, Ph.D., 1963, Berkeley) was born on 26 June 1935, at Susanville, Calif. Evert's Ph.D. thesis was entitled "Systematic revision of the subfamily Blattisocinae (Acarina: Blattisocidae) in America north of Mexico." The Entomology Research Institute acquired the services of Evert Lindquist on 29 December 1961. He has since published approximately 40 papers, many of which are substantial contributions to systematics, phylogeny, bionomics, ecology, symbiosis, structure morphology and homology, and nomenclature of mites. His most notable papers include Taxonomic Concepts in the Ascidae, With a Modified Setal Nomenclature for the Idiosoma of the Gamasina (Acarina: Mesostigmata) (1965), Revision of Holarctic Tarsonemid Mites (Acarina: Prostigmata) Parasitizing Eggs of Spine Bark Beetles (1969), and Evolution of Phytophagous Mites (Acari) (1979). The Canadian National Collection of Mites has grown substantially as a result of Evert's many collecting trips across Canada, the United States, and Mexico. Evert served as head of the Coleoptera, Siphonaptera, and Arachnida Section (1970-1973) and the Hymenoptera and Arachnida Section (1981-1983). He was an adjunct professor in biology at Carleton (1971-1976, 1978-1983) and continues (since 1972) to give an intensive course in agricultural acarology during the summer at Ohio State University.

Philip S(teven) Corbet (B.Sc., 1950, Reading, England; Ph.D., 1953, Cambridge; D.Sc., 1962, Reading) was born in Kuala Lumpur, Malaya, in 1929.

From 1954 to 1962, Philip served as an invertebrate zoologist and an entomologist with the East African High Commission in Uganda. He joined the Experimental Biology Section of the Entomology Research Institute on 2 May 1962 and worked on the experimental ecology of aquatic insects. Philip Corbet's taxonomic works included the description of a new species of mosquito and two Ephemeroptera and descriptions of larvae of Ephemeroptera, Trichoptera, and Odonata. He left on 31 July 1967 to become director of the Research Institute at Belleville.

Donald R(aymond) Oliver (B.A., 1953, M.A., 1955, Saskatchewan; Ph.D., 1960, McGill) was born on 20 August 1930, in Saskatchewan. The Entomology Research Institute acquired the services of Don Oliver on 29 June 1962. Since that time he has concentrated his efforts on the biosystematics of Canadian Chironomidae with emphasis on Arctic species. Approximately 50 papers have been published by him, of which about 35 deal with the Chironomidae. Thanks to Don's collecting and curation, the Canadian National Collection of Chironomids is one of the best in North America with a strong representation of reared specimens.

W(illiam) Clayton McGuffin (B.A., 1936, M.A., 1937, Western Ontario; Ph.D., 1954, Minnesota) was born on 14 February 1913, in Thorndale, Ont. Clayton's Ph.D. thesis was entitled "Larvae of the Nearctic Larentiinae (Lepidoptera: Geometridae)," which was later published in 1958. He started work in the Forest Insect Survey (Forest Insect Investigations) of Agriculture Canada on 31 May 1938 and was seconded to the Entomology Research Institute in 1962. Important papers published by Clayton include his guides to the Geometridae of Canada (Subfamily Sterrhinae in 1967 and subfamily Ennominae number 1 (1972), 2 (1977), 3 (1981), and 4 (in press).

Fernand Schmid (Licence Sciences, 1951, D.Sc., 1953, Lausanne, Switzerland) was born in Sion, Switzerland, on 12 May 1924. His Ph.D. thesis was entitled "Contribution de l'étude des Limnophilides." Prior to coming to the Biosystematics Research Institute on 16 October 1963, Fernand did entomological surveys in Iran, Pakistan, Sri Lanka (Ceylon), and India. Since coming to the Biosystematics Research Institute he has published world revisions on the families Arctopsychidae (1968), Stenopsychidae (1969), Rhyacophilidae (1970), and Xiphocentronidae (1982), as well as papers on many genera. He has also published a handbook on the genera of Trichoptera in Canada and adjacent states (1980) and memoirs on the families Rhyacophilidae (1981); Glossosomatidae and Philopotamidae (1982); and Hyalopsychidae and nine other small families (1983).

Robert V(ern) Peterson (B.Sc., M.Sc., Ph.D., Utah) was born on 16 December 1928. Robert began his professional career in 1958 at the Entomology Laboratory in Guelph. In 1963, he was transferred to the Entomology Research Institute where he began working on the Simuliidae and Nycteribiidae (Diptera). Several papers were published by him, including The Prosimulium of Canada and Alaska (Diptera: Simuliidae). For a period he served as head of the Diptera Section. He resigned to accept a position at the United States Department of Agriculture on 25 February 1983.

D.P. Pielou (B.Sc., Ph.D., Birmingham) was transferred from the Summerland Research Station to the Entomology Research Institute in 1963. With the

Experimental Biology Section, Pat worked on experimental and faunistic ecology. He transferred to the Ottawa Research Station in 1970 and retired in 1971.

Akira Mutuura (B.S., 1945, College of Agriculture, Taihohu; Ph.D., 1961, Kyushu, Japan) was born on 1 June 1923, in Japan. He worked for the Department of Agriculture on a postdoctoral fellowship during the year 1963-1964. On 28 July 1964, the Entomology Research Institute hired Akira as an expert in the Pyralidae (Lepidoptera). Akira Mutuura has published several papers, including Taxonomy and Distribution of the European Corn Borer and Allied Species: Genus Ostrinia (Lepidoptera: Pyralidae) (1970).

D(onald) Monty Wood (B.A., 1956, M.A., 1959, Toronto; Ph.D., 1963, McMaster) was born in London, Ont., on 22 December 1933. Monty was appointed to the Entomology Research Institute on 1 October 1964, as a specialist on the Simuliidae and Tachinidae. He published several papers including two (with others) on the black flies of Ontario (1962, 1963), a handbook (with others) on the mosquitoes of Canada (1979), and a chapter on the Tachinidae in the second volume of the Manual of Nearctic Diptera (in press). Monty participated on several field trips and collected extensively in the North. He was the first to discover the female and larva of Parasimulium in the Pacific northwest. For a period, Monty Wood served as head of the Diptera Section.

Roger V(incent) Anderson (B.A., 1953, Augsburg College; M.S., 1958, Minnesota; Ph.D., 1962, Wisconsin) was born in St. Paul, Minn., on 13 July 1930. Roger did his Ph.D. thesis on the feeding, reproduction, and embryology of the potato rot nematode. From 1962 to 1965, he worked as an assistant professor at the University of Minnesota. The Entomology Research Institute acquired the services of Roger Anderson on 15 June 1965. An expert on nematodes, Roger has published 52 papers, including the first illustrated key to the genera of plant parasitic nematodes in Canada. Roger has served as section head since 1979.

Donald E(dward) Bright (B.S., 1957, Colorado State; M.S., 1959, Brigham Young; Ph.D., 1961, California) was born on 10 February 1934, at Columbus, Ohio. From 1964 to 1965, Don was an assistant research entomologist with the University of California. The Entomology Research Institute hired Don to work on the Scolytidae on 7 March 1966. Don Bright is author of nearly 50 research papers, including handbooks on The Bark Beetles of Canada and Alaska Coleoptera: Scolytidae (1976), The Metallic Wood Boring Beetles of Canada and Alaska (in press), and The Weevils of Canada and Alaska (Coleoptera: Curculionoidea, Except Curculionidae and Scolytidae) (in press). He also published a large memoir on a Taxonomic Monograph of the Genus Pityophthorus Eichhoff in North and Central America (Coleoptera: Scolytidae) (1981) and coauthored a chapter in the book Bark Beetles in North American Conifers (1982). Don served as section head from 1973 to 1977 and was selected to serve as chairman of the annual meeting of the Entomological Society of Canada, 1985.

J(ohn) Milton Campbell (B.Sc., 1957, Western Kentucky State; M.S., 1959, Kentucky; Ph.D., 1964, Illinois) was born on 19 December 1935, in Hopkinsville, Ky. Milt's Ph.D. thesis was "A revision of the genus Lobopoda (Coleoptera: Alleculidae) in North America and the West Indies." From 1964 to

1966, he worked as a research entomologist for the University of Kentucky and was stationed in Guatemala, where he studied the ecology and control of the coffee leaf miner. Eight papers were published by him during this period. Milt joined the Biosystematics Research Institute on 2 August 1966. He has since published 55 research papers, including six memoirs. Most of his papers are on the systematics of the staphylinid subfamilies Tachyporinae, Omaliinae, and Oxyporinae and the families Alleculidae and Micropeplidae. He served as section head for 6 years and coordinated and wrote major parts of the Coleoptera Section's contribution to the insect surveys of national parks. Milt is now president of the Coleopterists Society.

Ryuichi Matsuda (B.S., 1952, Taihoku Imperial University; D.Sc., Kyushu, Ph.D., 1956, Stanford) was born in Kagoshima City, Japan, on 8 July 1920. Ryuichi joined the Entomology Research Institute on 31 June 1968. Ryuichi Matsuda has published several papers, including Morphology and Evolution of the Insect Thorax (1970), The Morphology and Evolution of the Insect Abdomen (1976), the handbook The Aradidae of Canada Hemiptera: Aradidae (1977), and Abnormal Metamorphosis and Arthropod Evolution (1979).

John Robert Byers (B.S.A., 1962, M.A., 1963, Ph.D., 1966, Saskatchewan) was born in 1937 in Stoughton, Sask. His Ph.D. thesis was on the histochemistry and ultrastructure of the cryptorephridium (rectal complex) in the larva and pupa of the mealworm, Tenebrio molitor. John Byers joined the Entomology Research Institute (Experimental Biology Section) on 2 July 1968, as a specialist in physiology and electron microscopy. He published several papers including a few on the biosystematics of Euxoa (Lepidoptera: Noctuidae). From 1976 to 1978 he was head of the Experimental Taxonomy and Nematology Section. John Byers transferred to the Lethbridge Research Station on 29 June 1981.

Christopher F(rederick) Hinks (B.Sc., 1964, M.Sc., 1966, Ph.D., 1968, London, England) was born in 1939 in Hayle, England. Chris did his Ph.D. thesis on a histological and experimental study of neurosecretion in relation to development and to the circadian flight rhythm in Lepidoptera. The Entomology Research Institute (Experimental Biology Section) acquired the services of Chris Hinks on 1 October 1968. He specialized in physiology and endocrinology and published a number of papers. Chris Hinks resigned on 19 October 1978.

Mukal K. Mukerji (B.Sc., 1957, M.Sc., 1959, Calcutta; Ph.D., 1965, Macdonald College) was born in Dacca, India, in 1938. He was appointed to the Entomological Research Institute (Experimental Biology Section) in 1968. Mukal Mukerji worked on populations and energetics and published a few papers before transferring to the Ottawa Research Station in 1970.

John R(obert) Barron (B.Sc., 1961, Macdonald College; M.Sc., 1962, McGill; Ph.D., 1969, Alberta) was born on 23 December 1932, in Niagara Falls, Ont. From 1962 to 1969, John worked as an extension entomologist for the Province of Alberta. He joined the Entomology Research Institute in March 1969. John is responsible for the Ichneumonidae and has published several papers, including the monographs Provancher's Collections of Insects, Particularly Those of Hymenoptera, and a Study of the Types of his Species of Ichneumonidae (1975), Systematics of Nearctic Euceros (Hymenoptera: Ichneumonidae: Eucerotinae) (1976), Systematics of the World Eucerotinae (Hymenoptera,

Ichneumonidae). Part II. Non-nearctic Species (1978), and The Nearctic Species of Ctenopelma (Hymenoptera, Ichneumonidae, Ctenopelmatinae) (1981). For a period John served as section head.

Carl M(asaru) Yoshimoto (B.A., 1950, Iowa Wesleyan College; M.Sc., 1952, Kansas State; Ph.D., 1955, Cornell) was born on 27 April 1922, in Honolulu, Hawaii. Carl did his Ph.D. thesis on the nesting behavior of Pompilidae. From 1955 to 1957, he worked on insect attractants at the entomology lab of the Agricultural Research Service, United States Department of Agriculture, in Mexico City, Mexico. From 1958 to 1968 Carl was employed at the Bernice P. Bishop Museum in Honolulu, where he was curator of the Hymenoptera collection, studied insect dispersal, and published an impressive number of papers. In 1967, Carl took a 1-year sabbatical to study the systematics of Chalcidoidea at the British Museum of Natural History in London, England. He joined the Canadian Forestry Service in March 1969, at which time he was seconded to the Biosystematics Research Institute as a taxonomist in Chalcidoidea. Forty papers were produced by Carl, mainly on chalcidoids and cynipoids, including A New Subfamily of Cynipoidea from Nepal (1970), New Subfamily of Mymaridae (Hymenoptera, Chalcidoidea, Mymaridae (1972), and Cretaceous Chalcidoid Fossils From Canadian Amber (1975). Carl also published a handbook on the families and subfamilies of Canadian chalcidoid wasps (1984). Current projects include a monograph of the genera of New World Eulophidae, a paper on the genera of Mymaridae of the New World, and a book on the Hawaiian Chalcidoidea (in press).

Lubomir Masner (B.Sc., 1954, M.Sc., 1957, Charles University, Prague; Ph.D., 1962, Czechoslovakia Academy Science) was born on 18 April 1934, in Prague, Czechoslovakia. Prior to coming to Canada on a National Research Council postdoctorate fellowship at Simon Fraser University in 1968, Lubomir worked for the O.I.L.B. Identification Center in Prague (1957-1967), during which time he produced 44 scientific papers. Due to a change in government in Czechoslovakia during his absence (and certain unpleasant complications which arose as a result), Lubomir applied for and was immediately granted landed immigrant status. The Biosystematics Research Institute hired Lubomir Masner on 8 September 1969, as a specialist in the Proctotrupoidea and since then 36 papers and 2 memoirs were published by him. He served as section head for 5 years (1969-1974) and as curator of the Hymenoptera collection since 1980. An avid collector, Lubomir (with major contributions from the Dominican Republic in 1978, Venezuela in 1981, Ecuador in 1983, New Zealand and Australia in 1984, and Costa Rica in 1985) is mostly responsible for the Canadian National Collection of Proctotrupoid Wasps becoming the largest and best in the world today. Since 1980, Lubomir has been one of the teachers of the parasitic Hymenoptera course, University of Maryland; he is now one of the coordinators of our first Hymenoptera workshop (August 1985). He has also coordinated the Gatineau Park and Cape Breton National Park surveys. Lubomir Masner has, for the past 2 years (1983-1984, 1984-1985), been president of the International Hymenoptera Society.

Ales Smetana (B.Sc., 1952, M.D., 1956, Charles, Prague; Ph.D., 1960, Czechoslovakia Academy of Sciences) was born on 6 April 1931, in Hradec Kraloe, Czechoslovakia. Ales was an employee of the Institute of Parasitology at the Czechoslovakia Academy of Sciences from 1960 to 1970. He also worked at the Entomology Research Institute on a postdoctoral fellowship (1967-1969) and at the National Museum in Czechoslovakia (1970). Ales joined the

Entomology Research Institute on 23 September 1971. Since that time he has published about 80 papers on taxonomy, zoogeography, and phylogeny of the Coleoptera, including five memoirs on the taxonomy of various groups of Hydrophilidae and Staphylinidae (1971, 1974, 1978, 1980, 1982). He is currently curator of the Coleoptera.

M(arie) Y(olande) Suzanne Allyson (B.Sc., 1972, Quebec; M.Sc., 1979, Carleton) was born on 4 June 1950, in Trois-Rivières, Que. Suzanne joined the Entomology Research Institute on 1 May 1972, as a specialist in Lepidoptera (and particularly the family Pyralidae). Since then she has published several papers and completed her master's degree. Her M.Sc. thesis was "Last instar larvae of Pyraustini of America north of Mexico (Lepidoptera: Pyralidae)." Suzanne is now the manager of the National Identification Service and Canadian National Collection (Zoology) (having replaced Jack Martin who retired on 19 April 1985).

J(ames) Donald Lafontaine (B.A., 1972, Carleton; Ph.D., 1979, Alberta) was born on 8 December 1948, in Ottawa, Ont. Don did his Ph.D. thesis on the systematics of cutworms (Noctuidae). The Entomology Research Institute acquired the services of Don Lafontaine on 1 May 1972. Twenty-eight scientific papers (mostly on the Noctuidae) have been published by him. He has collected Lepidoptera in western Canada, the western United States, and, during the last 5 years, in the Yukon and Alaska. Don has been serving as section head of the Lepidoptera-Trichoptera Section since 1984.

K(enneth) G(avin) Andrew Hamilton (B.S.A., 1968, Manitoba; M.Sc., 1970, Ph.D., 1972, Georgia) was born in Nottingham, England, on 13 March 1946. His Ph.D. thesis was "The classification, morphology, and phylogeny of the family Cicadellidae (Homoptera)." Prior to graduation, Andy worked for the Department of Agriculture in Summerland, B.C., and produced 17 papers. On 4 October 1972, the Biosystematics Research Institute hired him as a Homoptera-Auchenorrhyncha expert. He has since published 44 papers, including Cicadellidae (Rhynchota: Homoptera) Described by Provancher, With Notes on his Publications (1976), Morphology and Evolution of Rhynchotan Head (Insecta: Hemiptera, Homoptera) (1981), Introduced and Native Leafhoppers Common to the Old and New Worlds (Rhynchota: Homoptera: Cicadellidae) (1983), a handbook on The Spittlebugs of Canada (Homoptera: Cercopidae) (1982), and Revision of the Macropsini and Neopsini of the New World (Rhynchota: Homoptera), With Notes on Intersex Morphology (1983). For a period of time Andy served as section head and unit curator. He is currently working on a handbook of the leafhoppers of Canada and papers on the leafhoppers of Alaska, Newfoundland, and Cape Breton Island. A paper on Leafhoppers of Ornamental and Fruit Trees in Canada is in press.

Gary (Alfred) P(eter) Gibson (B.Sc., 1972, Simon Fraser; M.Sc., 1978, Carleton) was born on 1 September 1950, in Winnipeg, Man. Gary was first hired by the Entomology Research Institute as a technician in 1972; he resigned from this position in 1978. On 3 May 1982, he was rehired by the Biosystematics Research Institute as a biologist. He is currently working on his Ph.D. at the University of Alberta on the genera of Eupelmidae (Hymenoptera). Gary has a few publications to his credit.

Conrad C. Loan (B.A., M.S., Ph.D.) joined the Entomology Research Institute in 1972 as an expert on the Braconidae (and particularly the

subfamily Euphorinae) and later the Ichneumonidae. After publishing several papers, Conrad Loan transferred to the Ottawa Research Station in 1980.

Ian M(ichael) Smith (B.Sc., 1969, Western Ontario; Ph.D., 1973, Toronto) was born on 18 February 1945, in Toronto, Ont. Ian's Ph.D. thesis was on the systematics of the water mite family, Pionidae. He worked at the Biosystematics Research Institute on a postdoctoral fellowship (1973-1974) prior to officially joining the institute on 23 January 1974, as a specialist on mites. On 1 March 1979, he was appointed head of the Hymenoptera and Arachnida Section and on 9 April 1981, he became assistant director. His major interests lie in the phylogenetic systematics, life histories, and zoogeography of the Canadian fauna of Acari. Over 30 scientific papers on mites have been published by him. Ian has conducted field work throughout North America and developed major research collections in two large groups of Acari, the Hydrachnida (water mites) and the Eriophyoidea. Ian Smith serves on many institute and departmental committees and study groups. He was appointed to the Scientific Committee of the Biological Survey of Canada (1978-); he is associate editor for taxonomy of The Canadian Entomologist (1979-); he co-chaired a major symposium on biosystematic services in entomology at XVII International Congress of Entomology at Hamburg in 1984 (which initiated the International Advisory Committee on Biosystematic Services, with the Biosystematics Research Institute as cofounder and Ian as the first Canadian representative); and he was appointed to the organizing committee for the XVIII International Congress of Entomology in Vancouver (1988).

Michael J(ohn) Sarazin (B.Sc., 1974, Carleton) was born on 15 November 1951, in Sudbury, Ont. Mike joined the Biosystematics Research Institute on 25 October 1976. He is author of several type catalogs as well as coauthor of a handbook on the economically important beetles in Canada. He is involved in cooperative biological control projects and serves as liaison officer between applied entomologists and taxonomists. Mike was also a coordinator of the first Hymenoptera workshop (August 1985).

Barry A(lan) Ebsary (B.Sc., 1970, M.Sc., 1973, Memorial; Ph.D., 1976, Rutgers) was born on 26 June 1949, in St. John's, Nfld. Barry joined the Biosystematics Research Institute on 17 January 1977, as a specialist on nematodes. He has since produced a series of 11 taxonomic publications, including six revisionary papers, on the Criconematidae, an important plant parasitic nematode group. Barry has also contributed to the taxonomic knowledge of the families Heteroderidae, Meloidogynidae, and Longidoridae, which are economically important for quarantine, production, decline, or virus transmission reasons.

Henri Goulet (B.A., 1966, Collège Bourget; B.Sc., 1969, McGill at Macdonald College); M.Sc., 1971, Ph.D., 1978, Alberta) was born on 26 May 1945, in Montreal, Que. His Ph.D. thesis was entitled "Revision of the Elaphrus of the world (Coleoptera, Carabidae)." The Biosystematics Research Institute hired Henri Goulet on 2 January 1978, as an expert on sawflies. He has since published approximately 10 papers, and his Revision of Nearctic Dolerini (Hymenoptera, Tenthredinidae) is now in press.

Phuoc T(rung) Dang (B.S., 1967, University of Saigon; M.Sc., 1970, Ph.D., 1973, Michigan State) was born on 18 January 1941, in Vietnam. Prior to

coming to the Biosystematics Research Institute, Phuoc Dang worked as a research associate at Carleton University on the black flies and mosquitoes of Africa and Canada (1975-1979). He joined the Canadian Forestry Service, Department of Environment, in November 1979, at which time he was seconded to the Biosystematics Research Institute. Several papers were published by him, including (with others) the handbook Mosquitoes of Canada (1979).

Laurent LeSage (B.A., 1974, M.Sc., 1976, Montreal; Ph.D., 1979, Waterloo) was born in Louiseville, Que., on 1 April 1946. Laurent did his Ph.D. on the Taxonomy and Ecology of Cricotopus (Diptera: Chironomidae). The new traps and new techniques, developed by him during his Ph.D., which reduce considerably the labor involved in collecting insects, are now used by many ecologists and entomologists. He was hired on 1 July 1979, as a specialist in Coleoptera (Chrysomelidae) and beetle larvae. Since he joined the institute the collection of beetle larvae has grown exponentially: from a few hundred vials piled up in disorder on shelves, the collection of larvae is represented now by more than 15 000 well-organized samples, and is one of the best collections of beetle larvae in North America; this was made possible through an extensive program of collecting, rearing, exchanges, and curation. About 20 cultures of stored product beetle pests are maintained permanently by him to fill the requests for specimens from individuals or institutions. About 15 papers have already been published by him on the biology of various groups of beetles, on surveys of aquatic beetles, on the descriptions of beetle larvae and pupae, and on the revision of some groups of leaf beetles. He is currently working on a handbook of the leaf beetles of eastern Canada and is continuing his study on the taxonomy of leaf beetle larvae and pupae.

Eldon S. Eveleigh (B.Sc., 1971, M.Sc., 1974, Memorial; Ph.D., 1979, Toronto) joined the Biosystematics Research Institute on 17 June 1980, to work on nematodes and mites. Eldon published a couple of papers describing new species of nematodes and several papers (with D.A. Chant) on acarine predator-prey interactions. He transferred to the Maritimes Forest Research Center on 12 February 1982.

Michael J(oseph) Sharkey (B.Sc., 1977, Guelph; M.Sc., 1980, Ph.D., 1983, McGill at Macdonald College) was born in Kitchener, Ont., on 2 November 1953. Mike joined the Biosystematics Research Institute on 15 June 1981, as a biologist and continued working on his Ph.D. thesis "Revision of the species of Albagrus (Braconidae, Hymenoptera)" at Macdonald College. A year of his time was spent at Cornell University in the United States studying insect systematics. After graduation he returned to Ottawa and soon became head of the Hymenoptera Section. Mike is a specialist in the family Braconidae (and particularly the subfamily Agathidinae) and also works on pseudoscorpions. He has published a few papers and is currently working on a handbook to the families of Canadian Hymenoptera (with others) and a handbook to the Canadian pseudoscorpion species. He is involved in cooperative biological control projects and was involved in the first Hymenoptera workshop (August 1985).

Valerie M(ary) Behan-Pelletier (B.Sc., 1969, University College, Dublin; M.Sc., 1972, Ph.D., 1978, Macdonald College at McGill) was born on 15 February 1948, in Drogheda, Ireland. Val's Ph.D. thesis was entitled "Distribution, diversity and feeding habits of North American Arctic soil Acari." From 1978 to 1981, she taught at the John Abbott College in Ste. Anne de Bellevue. The Biosystematics Research Institute hired Valerie on 6 July 1981, as a

specialist in Acari. She was named chairperson of the Zoological Curatorial Committee in 1982 and it was at her initiation that Biosystematics Research Institute became a designated institute under the Canadian Cultural Property Export and Import Act. Valerie has published on the genus Epidamaeus (Acari: Damaeidae) of Subarctic and Arctic western North America and the extreme northeastern U.S.S.R. (1983 and 1985) and on the genus Ceratozetes (Acari: Ceratozelidae) of Canada and Alaska. Her paper Ceratozetidae of the Western North American Arctic is currently in press.

Jean-François Landry (B.Sc., 1978, Laval; M.Sc., 1981, Alberta) was born at Levis, Que., on 14 May 1955. The Biosystematics Research Institute hired Jean-François as a biologist on 8 September 1981. He is currently working on his Ph.D. thesis ("Taxonomy of Microlepidoptera") at the University of Alberta.

Yves Bousquet (B.Sc., 1975, M.Sc., 1977, Ph.D., 1981, Montreal) was born in Montreal, Que., on 19 November 1951. His Ph.D. thesis was entitled "Taxonomy and biology of Pterostichini (Coleoptera: Carabidae) of northeastern North America." Yves joined the Biosystematics Research Institute on 13 October 1981 and has since contributed to the taxonomy of the Pterostichini of North America and the taxonomy of the larvae of the Carabidae. Current projects include an identification guide to beetles associated with stored products and households in Canada and some work on the taxonomy of small families of Coleoptera.

Art Borkent (B.Sc., 1975, M.Sc., 1978, Alberta; Ph.D., 1982, Carleton) was born on 1 July 1953, in Enschede, Netherlands. Several papers were published by Art while he was a student. Art joined the Biosystematics Research Institute on 28 September 1982, as a specialist in Diptera (particularly the families Ceratopogonidae, Cecidomyiidae, and Chaoboridae). His Ph.D. thesis "The systematics and phylogeny of the Stenochironomus complex (Xestochironomus, Harrisius and Stenochironomus) (Diptera: Chironomidae)" has since (1984) been published. He is currently head of the Diptera Section.

Robert G(eorge) Foottit (B.Sc., 1974, M.Sc., 1979, Ph.D., 1983, Simon Fraser) was born in Vancouver, B.C., on 17 June 1947. His Ph.D. thesis was entitled Morphometric Analysis of Character Variation and Taxonomic Discrimination Among a Complex of Species of the Genus Cinara Curtis (Homoptera: Aphididae) on Western Pines. The Biosystematics Research Institute hired Bob on 3 October 1983, as a specialist in aphids, scales, and thrips. He has since applied morphometric techniques to the analysis of taxonomic problems in the Aphididae of Canada.

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APPENDIX I

Dominion botanists, Dominion entomologists, and directors 1886-1986

1886 James Fletcher donated insect and plant collections to Agriculture Canada; worked with William Saunders but not officially appointed

1887-1908 James Fletcher Dominion Entomologist and Botanist; Chief of Entomology and Botany Division

1908-1914 C.G. Hewitt Dominion Entomologist; Chief of Entomology Division

1909-1944 H.T. Güssow Dominion Botanist; Chief of Botany and Plant Pathology Division

1914-1920 C.G. Hewitt Dominion Entomologist; Chief of Entomology Branch

1920-1924 A. Gibson Dominion Entomologist; Chief of Entomology Branch

1924-1936 H.G.M. Crawford Dominion Entomologist; Chief of Entomology Branch

1936-1950 H.G.M. Crawford Dominion Entomologist; Chief of Entomology Division

1945-1952 J.H. Craigie Dominion Botanist; Chief of Botany and Plant Pathology Division

1950-1957 R. Glen Chief of Entomology Division

1952-1958 W.F. Hanna Chief of Botany and Plant Pathology Division

1957-1959 B.M. Smallman Chief of Entomology Division

1959-1961 H.A. Senn Director, Plant Research Institute

1959-1969 G.P. Holland Director, Entomology Research Institute

1961-1965 R.A. Ludwig Director, Plant Research Institute

1965-1973 A.P. Chan Director, Plant Research Institute

1969-1973 W.B. Mountain Director, Entomology Research Institute

1973 D.F. Hardwick Director, Entomology Research Institute

1973-1978 D.F. Hardwick Director, Biosystematics Research Institute

1978-1986 G.A. Mulligan Director, Biosystematics Research Institute

1986- G.A. Mulligan Director, Biosystematics Research Centre

APPENDIX II

Index to names

All names mentioned in the text are included in this index, except for those names followed by a year and indicating a reference cited in the list at the end of the document.

Systematics in Agriculture Canada at Ottawa

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Agriculture Canada
1886 · 1986
RESEARCH · RECHERCHES

Canada