

PART I
INTRODUCTION

CHAPTER 1

STUDENTS OF WESTERN AMERICAN FLEAS, THEIR CONTRIBUTIONS

THE PIONEERS

In a sense, the pioneers in the study of western American fleas were those three men who studied these insects because of their love of them as pure science, during the period before the great American public was informed that a serious epidemic of bubonic plague was raging in San Francisco. These three men were Carl F. Baker, the American, and N. Charles Rothschild and Karl Jordan, the inseparable English duo. With the outbreak of plague in California, both the state of California and the federal government sent expert entomologists to the scene; the study of fleas then passed from a study in pure science to one of economic entomology.

CARL F. BAKER (1872-1927)

It seems that first concentrated attention was given western American fleas by Dr. Carl F. Baker. During the year 1895 in the various issues of the *Canadian Entomologist*, Baker published a series of 7 short papers covering about 20 pages under the title of "Preliminary Studies of Siphonaptera." Of the some 50 species of world fleas listed in these papers, 9 were western American. These 9 are known today as *Cediopsylla inaequalis*, *Diamanus montanus*, *Foxella ignota*, *Orchopeas howardi*, *Opisocrostis bruneri*, *Opisocrostis hirsutus*, *Rectofrontia fraterna*, *Stenistomera alpina*, and *Tarsopsylla coloradensis*. At the time this series of papers was written, Baker was a member of the staff of Colorado Agricultural College, Fort Collins, Colorado. During 1896 Baker released the description of *Opisodasys keeni*; 1898, *Catallagia charlottensis*, *Thrassis arizonensis*, and *Anomiopsyllus nudatus*; 1899, *Stenoponia americana*.

A period of 5 years then passed during which Baker was doubtless preparing his 2 monumental works. The first, which appeared in 1904, was entitled "A Revision of the American Siphonaptera." It appeared in the *Proceedings of the United States National Museum* 27, pp. 365-469, and was well illustrated. In this work Baker added the descriptions of 22 new species which were then known to be found in western North America. This gave Baker a total of 36 species of western fleas described. During 1905, Baker's "Classification of the American

Siphonaptera" appeared in *Proceedings of the United States National Museum* 29, pp. 121-170.

The year 1905 brought to an abrupt end Baker's work on fleas. It is not definitely known what caused this change of interest, but never again did Baker appear in print on the Siphonaptera.

Carl (Charles) Fuller Baker was born at Lansing, Michigan, on March 22, 1872. He received his bachelor's degree from Michigan Agricultural College during 1892. During this year he became attached to the Colorado Agricultural College, Fort Collins, Colorado, as assistant to C. P. Gillette. It was while here that he began publishing his first important contributions to entomology. He published articles on Hemiptera, Homoptera, the beet leafhopper, and as the pioneer of American flea men, released his *Preliminary Studies of Siphonaptera*. During 1893 he was in charge of the Colorado forestry and zoological exhibit of the Columbian Exposition at Chicago. Baker acted as zoologist in the Alabama Biological Survey during 1897-1899. The year 1898-1899 found him in the Santa Marta Mountains of Colombia as biologist of the H. H. Smith exploring expedition. Upon his return to the United States Baker became a member of the staff at Central High School at St. Louis, Missouri. During 1901 he left this position to go to Stanford University, where he studied under Vernon L. Kellog. From this institution he received his master of science degree in 1903. While at Stanford, Baker prepared his 2 large papers on American fleas which appeared in 1904 and 1905. During 1903 A. J. Cook, Professor of Biology at Pomona College persuaded Baker to become his assistant, but he remained in this position only 1 year. While at Pomona College, Baker began the publication of *Invertebrata Pacifica*. Baker left the United States in 1904 to become chief of the Department of Botany of the Cuban Experiment Station. With him went Baker, the flea student. Baker returned to the United States and Pomona College in 1908, but somewhere the flea student was lost, for Baker never again published work on fleas.

From this point on, the highlights in Baker's life were many. During 1909 with the assistance of Cook, Baker started the *Journal of Entomology* and in 1911 the *Journal of Economic Botany*.

In October, 1911, Cook became Horticultural Commissioner of California. The effect of this upon Baker was his withdrawal from the college to accept a position of professor of agronomy at the University of the Philippines. Here he worked under his friend E. B. Copeland, then dean, whom he succeeded in 1918.

During his long stay in the Philippines, which terminated with his death in Manila on July 22, 1927, Baker left the Islands only during a year's leave of absence (1917-1918) which time was spent as assistant director of the Botanical Gardens at Singapore.

Essig says, "Although he died comparatively young, he did the life work of many men."

The records state that Baker died from chronic dysentery and was buried on the campus of the University of the Philippines.

JORDAN AND ROTHSCHILD

The Tring Museum, with the Rothschild collection of fleas, located at Tring, Hertfordshire, England, has become the flea center of the world. Here from the pen of Rothschild, Jordan and Rothschild, and Jordan, flea descriptions have been radiating for over half a century. Dr. Jordan, writing to the author in 1943, described the beginning of flea work at Tring as follows:

"When I (Jordan) came to Tring in 1893 he (Rothschild) was at Harrow, the great Public School; his greatest pleasure was going out and collecting insects, at that time almost exclusively butterflies and moths. From Harrow he went to Cambridge, his chief interest being Natural History. Here he saw some slides of foreign fleas which aroused his interest so much that he wished to acquire more. In 1896 Heller described *Ctenophthalmus agyrtes* from one of German Islands of the North Sea and as the host mouse was quite common at Tring we put out some traps one day in the hedges on the hill-side opposite the Museum and went late in the evening to inspect them; to our great joy there was a mouse and there were fleas, which seemed to be identical with Heller's *agyrtes*. That was the beginning here at Tring, which gradually led to the study of fleas from all regions."

In our records we find that as early as 1900 Dippie and Brooks already were sending specimens of fleas to Rothschild from western Canada. One of the first of these was an American mouse flea which Rothschild described as *Hystrihopsylla dippiei* from materials taken off a weasel by Dippie in Alberta on September 21, 1900, and off a mink by Brooks at Chilliwack, British Columbia, on January 2, 1900.

Since this beginning, Rothschild has issued the descriptions of 33 western North American fleas, Jordan and Rothschild 12, and Jordan an all-time high of well over 50 species.

As far as the writer is able to ascertain, neither Rothschild nor Jordan ever collected in western North America. They relied for their specimens upon the collecting activities of various field collectors.

THE ROTHSCHILD COLLECTION OF FLEAS

Dr. Jordan explains further:

"The collection grew rapidly and Charles decided to make it the property of the British Museum by deed of gift, with the condition that the collection remain his own as long as he wanted to keep it. On his death in 1923 it became definitely the property of the British Museum. The trustees agreed to leave it at Tring, as I was working at the material contained in the collection.

"In 1899 F. J. Cox was engaged as technical assistant to attend to the mounting and labeling of the specimens, which he has done ever

since, his salary being paid from the interest on the capital which Charles had given to the British Museum for that purpose and for the purchase of specimens."

Early in the development of this collection Dr. Alfonso Dampf was asked to join the museum staff as specialist in fleas, but Dampf declined the invitation.

It is difficult to separate the Tring Museum, in which the N. C. Rothschild Collection of Fleas had its inception and in which it was nurtured, from the House of Rothschild. In 1805 Nathan Meyer Rothschild established the famous London banking house of N. M. Rothschild and Sons. It seems that there are no authentic records of this man and his family, but upon his death in 1836 his oldest son, Lionel Nathan Rothschild, succeeded to the chief management of the great banking house. His mother was the daughter of Levi Barnet Cohen. Lionel was born in London on November 22, 1808. In 1836 he married his first cousin, the daughter of Baron Charles de Rothschild of Naples. This couple raised five children, three sons and two daughters. The first son was born in London on November 8, 1840, and was named Nathan Meyer after his grandfather. In 1872, 7 years before his death, Lionel purchased the Tring Park estate in Hertfordshire. Today all flea students recognize this as the address of Dr. Karl Jordan. Lionel is characterized as a genius of finance and a philanthropist.

Nathan Meyer Rothschild, the first baron Rothschild of Tring, established himself in the great banking firm upon the death of his father in 1879. During his life he also proved to be a financial wizard and is credited as the greatest leader of Jews of the time. He was married to Emma Louisa, daughter of Baron Karl von Rothschild of Frankfurt. This couple had two sons and a daughter. The oldest son, named Lionel Walter, was born in London on February 8, 1868, and the second son was Nathaniel Charles, born 9 years later on May 9, 1877.

THE HONORABLE NATHANIEL CHARLES ROTHSCHILD (1877-1923)

Unlike his associate Jordan, who was a research entomologist, Rothschild was a businessman, a financier, who at the time of his death in 1923 was Chairman of Alliance Assurance Company, Ltd. and during life was a partner of the firm of N. M. Rothschild and Sons, established by his great grandfather in 1805. Rothschild became interested in fleas about 1897 and as relaxation and recreation studied and published articles on these insects from 1900 until his death, a period of some 23 years.

Nathaniel Charles Rothschild was born May 9, 1877, at London, England. His older brother was Lionel Walter Rothschild (first Lord Rothschild), who became a Trustee of the British Museum in 1899, was joint editor of *Novitates Zooligicae* which was published at Tring Mu-

seum. The Museum at Tring which is referred to by Jordan as Walter Rothschild's Museum was doubtless established, maintained, and endowed by him. Like N. Charles, his brother, L. Walter was interested in natural history and published articles on various biological subjects.

Dr. Jordan has written the author as follows, "Born in 1877 he (Rothschild) was 9 years younger than his brother and 8 years younger than his sister; he felt much alone and in the way. There was the difficulty of his trend to melancholia aggravated by the wrong treatment of the very sensitive child. He became what a strict governess calls a difficult child, to be corrected and its natural tendencies to be suppressed. Psychology was not understood at that time."

Rothschild received his early education at Harrow, then earned a bachelor of arts degree in 1898 and a master of science degree in 1901 in Natural Science at Trinity College, Cambridge. He was married in 1907 to the third daughter of Captain Alfred Edler von Wertheimstein of Nagy-Varal, Hungary. The Rothschilds were the parents of a son and three daughters.

Jordan has written the author that "He (Rothschild) was a most liberal-minded man, but very anxious that nobody should know how often he helped people over difficulties without their knowing from whom the help came, and he liked nothing better than a good joke."

From 1900 through 1923 Rothschild published 27 papers on fleas as sole author. From 1906 through 1923 he published 16 papers with Jordan as co-author. Most of these papers appear in *Novitates Zoologicae*, the organ of the Tring Museum, edited by Rothschild's brother Walter. During December of 1915 there appeared the first issue of *Ectoparasites*. This periodical also issued from the Tring Museum. It was edited by Jordan and Rothschild and dealt almost entirely with fleas. This paper ran through only one volume of 370 pages, made up of five parts and an index. Its publication was suspended after the death of Rothschild in 1923. Of the 27 papers appearing in *Ectoparasites* on fleas, 10 are of importance to North American investigators.

After the death of Rothschild, Jordan carried on alone as siphonapterist at Tring. From 1925 through 1938 he published 21 papers on fleas, 15 of which are in *Novitates Zoologicae*.

DR. KARL JORDAN (1861-)

In the following lines, the Dean of world siphonapterists, Dr. Karl Jordan, has given his biography to the author:

"In a letter sent off to you last night I forgot to say that I was born on the 7th of December 1861 as a subject of George V, by the Grace of God, King of England and Hannover, as he styled himself. The village where I was born belonged to the old Bishopric of Hildesheim, which was independent until Napoleon's time, became Prussian in 1805, Westphalian in 1807, and after Napoleon's downfall was handed over by

the Vienna Congress to Hannover, although the Bishop had been fighting hard during the Middle Ages against the aggression by the Guelphs of Hannover and Brunswick and succeeded to beat them off. In 1866 we became Prussian again. My Grandfather, who died in 1867, used to say that life was best under the Bishop: hardly any taxes and no soldiers. Hildesheim is about two-thirds Lutheran and one-third Roman; the town had the great fortune to escape destruction in the 30 years war and contains a large number of houses built shortly after 1600 and some much before that time, the woodwork carved or painted, the pictures illustrating some biblical stories in most cases, quite a show place. It was founded by the son of Charlemagne in 818. The hills are covered with large forests, an ideal country for a budding entomologist like myself.

"My own life has been varied and interesting and still gives me much enjoyment. As the youngest of seven children of a farmer I received the usual village education and went to school for six years in the nearest town, Hildesheim, where the North German plain begins, and then studied for four and a half years at the University of Göttingen, received the degree doctor of philosophy in 1885 and passed the examination *pro facultate docendi* in 1886. Then I served for a year in the army at Hannover. Education was very cheap, all these years did not cost more than two years at one of the great public schools in England. As I wished to become a school master (higher grade) I was sent to Hannoversch Münden, where I remained five years, incidentally assisting the professor of Zoology at the Academy of Forestry and in the autumn of 1892 became master for mathematics, physics and natural history of the school of Agriculture at Hildesheim. Here I received a letter from Tring asking me whether I would accept a post as assistant at Walter Rothschild's Museum. I accepted after having consulted the professor of Zoology at Münden, the idea being that I should come back when the professor was due to retire. All those years I had collected Coleoptera and was much impressed by the mass of unclassified material I found at Tring, the classification of which was my first task. Soon after I was put on to the Lepidoptera, which have occupied most of my time until the death of Lord Rothschild (1923), when the Museum became the property of the British Museum. Time, however, was found chiefly in the evenings for the study of fleas and Anthribid beetles, which are now the only insects to which I devote my time."

PLAGUE STIMULATES STUDY IN WEST

After bubonic plague was discovered in San Francisco, an entirely new set of names appeared in western flea literature. Baker apparently took no part in the plague investigations, and Jordan and Rothschild were interested in fleas only as fleas. The new names were Doane, Carroll Fox, McCoy, and Mitzmain. Although plague was officially recognized in 1900 in San Francisco, the first paper on fleas and their rela-

tion to plague did not appear until 1907 when M. B. Mitzmain issued such a paper while he was attached to the Entomological Laboratory of the University of California. This very short paper was published in *California State Board of Health, Monthly Bulletin* 3:38.

During the early part of 1908 Professor R. W. Doane, of the Department of Biology of Stanford University, received a large number of fleas from various public health sources in and around San Francisco. He found 6 species in the lot and published the results in August, 1908, in the *Canadian Entomologist*. In this 2-page paper the most interesting statement, to the author, was ". . . and 477 specimens of *Ctenocephalus canis* collected from a single Dachshund pup." The writer knows of no record which anywhere near approaches this infestation on a single animal.

During this year Mitzmain published in *Entomological News* a synopsis and biography of California fleas in which he added 3 newly listed species. Carroll Fox the same year described the western chicken flea *Ceratophyllus niger*, the western mole flea *Corypsylla ornata*, published a note on squirrel fleas taken off rats and a 1-page report entitled "Identification of Fleas at San Francisco, Cal." in which 8 species are mentioned. This paper appeared from page 1371, *Public Health Reports*, September 25, 1908. It is interesting to note that there appears on the following page, prepared by Dr. Blue, whose name Fox attached the next year to the giant California gopher flea, the following:

"REPORT FROM SAN FRANCISCO, CALIF.—PLAGUE-PREVENTION WORK
WEEK ENDED SEPTEMBER 12.

Date of last case	Sickened, January 30, 1908
Sick inspected	11
Dead inspected	89
Premises inspected	12,486
Houses disinfected	97
Buildings condemned	9
Houses destroyed	2
Nuisances abated	1,480
Rats found dead	311
Rats trapped	3,428
Total rats taken	3,739
Rats identified:	
<i>Mus norvegicus</i>	2,729
<i>Mus rattus</i>	82
<i>Mus musculus</i>	739
Total	3,550
Rats examined bacteriologically	1,975
Poisons placed	89,833"

In the meantime, during October of 1907, 7 cases of human plague were discovered at Seattle, Washington. The plague work carried on there appears directly under the report of Assistant Surgeon Blue:

"REPORT FROM SEATTLE, WASH.—PLAGUE-PREVENTION WORK.

ASSISTANT SURGEON GLOVER REPORTS:

WEEK ENDED SEPTEMBER 12.

Date of finding of last plague rat, July 9, 1908.

Rats received	1,075
Rats necropsied	949
Plague-infected rats to date	20
Vessels inspected	8
Vessels fumigated	6"

Through the year of 1909 the pen of Carroll Fox was very busy. He reported from the County of San Francisco 14 species of fleas and 3 undetermined forms, and described the new fleas *Atyphloceras multi-dentatus*, *Dactylopsylla bluei*, and *Catallagia wymani*. During this year Mitzmain, who had now become technical assistant to the Plague Suppressive Measures Laboratory at San Francisco, published in *Canadian Entomologist* a review of the fleas of California in which he named 29 species and included a host index. Mitzmain and G. W. McCoy published 3 papers during this year, one on the regional distribution of fleas on rodents, another upon fleas observed in plague campaign in California and the third on rat and squirrel fleas biting man. During 1910 Mitzmain published his last papers on fleas. Two of these were upon the bionomics of human and rodent fleas, and a third written with McCoy was on fleas of California squirrels. McCoy released a note during this year on squirrel fleas as plague carriers. The big paper of the year was Fox's "The Flea and Its Relation to Plague," a 20-page issue in *Public Health and Marine Hospital Service Bulletin* No. 30.

During 1911 only 1 American paper appeared on Western fleas. This was McCoy's description of *Actenophthalmus heiseri* in *Entomological News*. This was McCoy's last paper on fleas. At the present time McCoy is professor of preventive medicine at the Medical School of Louisiana State University. He was born at Cumberland Valley, Pennsylvania, June 4, 1876. He received his doctor of medicine degree at Pennsylvania during 1898. For a great many years McCoy has been attached to the Public Health Service in one capacity or another.

From 1911 to 1919 only 1 American paper appeared on western fleas. This was *Hygienic Laboratory Bulletin* No. 97, 1914, in which Fox described several new western fleas, and advanced for the first time the taxonomic value of the female copulatory organs of the flea. The paper is beautifully illustrated.

The name of Dr. E. A. Chapin came into flea literature in 1919. Since 1934 Chapin has been curator of insects at the National Museum.

WASHINGTON, D. C., SIPHONAPTERISTS



Edward A. Chapin



H. E. Ewing

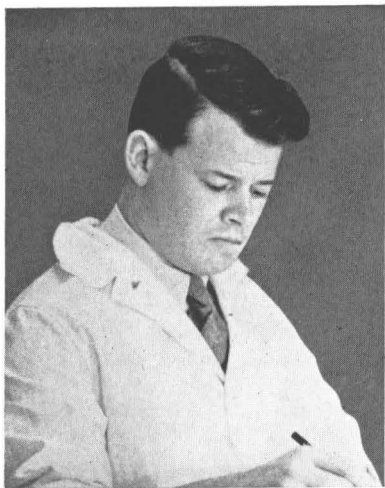


Irving Fox

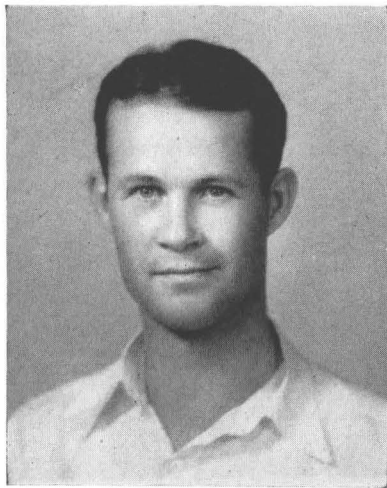


Carroll Fox

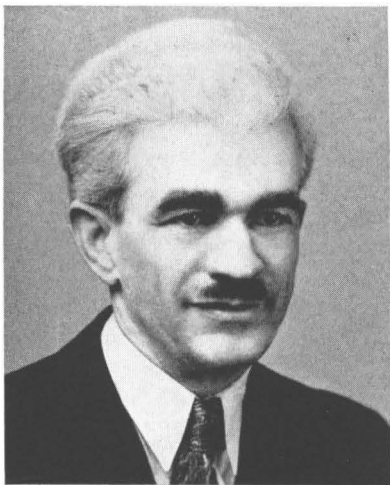
PACIFIC COAST SIPHONAPTERISTS



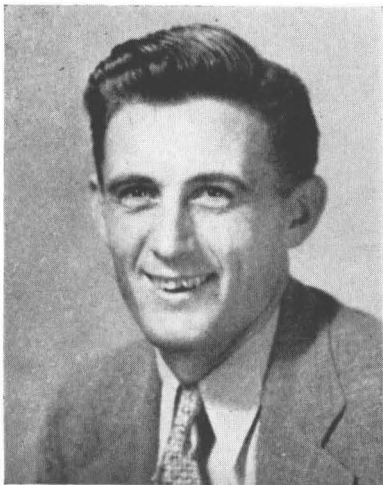
George Holland



Gus Augustson



C. Andresen Hubbard



Frank Prince

Prior to this time he was attached in one capacity or another to the Department of Agriculture. Chapin received his doctor of philosophy degree from George Washington University in 1923. He was born in Springfield, Massachusetts, January 4, 1894. During 1919 Chapin released the description of the giant northwest Mountain Beaver flea *Hystrichopsylla schefferi* and in 1921 the description of the giant Sierra-Nevada Mountain Beaver flea *H. mammoth*. Chapin did not again publish on fleas.

During 1923 the name of L. H. Dunn became associated with fleas in "Fleas Found on Wild Animals in the Bitterroot Valley, Montana." This was published with R. R. Parker in *Public Health Reports* 38. In this paper 25 species are mentioned, a new genus and several new species are erected. Dunn did not again publish on fleas.

It was in this year that N. A. Rothschild died and left his huge collection of fleas to the British Museum. From 1900 until 1923 Rothschild had published 27 papers and with Jordan 16; described 34 fleas found in the west and with Jordan, 12 others.

Another new name to appear about this time was that of H. E. Ewing. In 1924 he described the smaller wild rabbit flea of California as *Hoplopsylla foxi*.

After an absence from the western flea field of 9 years, Carroll Fox again began publishing. During 1925 in *Entomological News* he erected the genus *Actenophthalmus* to hold the species *heiseri*. In 1926 he described *Anomiopsyllus falsicalifornicus*, *Peromyscopsylla ebrighti*, and *Meringis cummingi*, all from California; in 1927 *Carteretta carteri* from California and *Thrassis francisi* from Utah; and in 1929 *Orchopeas dieteri* from California. Carroll Fox did not again publish on western fleas.

About this time another pair of names appeared in western flea bibliography. M. A. Stewart who had been publishing on eastern fleas since 1926, issued a paper "Two New Siphonaptera from Colorado" in *Canadian Entomologist* 60, 1928. The following year (1929) Dr. Julius Wagner, who had been publishing on fleas since 1889, released the description of *Doratopsylla c. obtusata*, his first description of a western flea, the materials having come from British Columbia.

During 1930 while Stewart was still at Rice Institute, Houston, Texas, he released the descriptions of *Conorhinopsylla stanfordi*, *Rhopalopsyllus sigmodoni*, and *Neopsylla texana*.

Professor J. S. Stanford released, during 1931, "A Preliminary List of Utah Siphonaptera" in which was listed 9 genera and 18 species.

The year 1936 was a banner year for Wagner, as far as western fleas were concerned. From material supplied him by Professor G. J. Spencer he described 8 species from western Canada, and from materials from Professor Stanford of Utah State College he described 5 species from Utah. It was during this year that Wagner's "The Fleas of British Co-

lumbia" appeared in the *Canadian Entomologist*. Fifty-three species were listed in this checklist.

In this year Professor Spencer, of the University of British Columbia, published his checklist of the fleas of British Columbia, and Collins released the description of *Anomiopsyllus montanus*.

JELLISON AND KOHLS
OF THE ROCKY MOUNTAIN SPOTTED FEVER LABORATORY

Jellison and Kohls became associated with western fleas about 1930. Jellison was appointed to the staff of the Rocky Mountain Spotted Fever Laboratory at Hamilton, Montana, during 1929, Kohls during 1931. Both remained at this federal laboratory until called into the armed forces of World War II.

William L. Jellison was born in Kalispell, Flathead County, Montana, on February 28, 1906. Kalispell is about 100 miles north of Hamilton, in the northwestern part of the state. Jellison received his bachelor of science degree at Montana State College during 1929. While here he acted as laboratory assistant in botany for the Experiment Station through the summers of 1926 and 1927. During 1928 Jellison acted as field agent for the Department of Agriculture. Early in 1929 Jellison became associated with the Hamilton Laboratory as laboratory assistant and in November of the same year was elevated to the rank of junior bacteriologist. Jellison received his master of science degree in 1931 from the University of Minnesota and while working for the degree acted as teaching assistant in the Department of Zoology. During May of 1931 Jellison returned to Hamilton as assistant bacteriologist. In 1935 Jellison's title was changed to assistant parasitologist. In 1941 Jellison was appointed to the Malaria Commission to China with the rank of major. On April 27, 1942, he was transferred to the United States Army Service of Supply and as late as November, 1943, was serving in India.

In 1936 Jellison, with Kohls, released a paper upon the western distribution of the human flea; 1937 the description of *Thrassis pandorae*; 1939 a review of the prairie dog fleas with a new subspecies of *Opisocrostitis tuberculatus*, a paper on the relation of predatory and scavenger birds to spread of sylvatic plague, a third paper which is a review of the flea genus *Opisodasys*, a fourth with Kohls on the fleas of Alaska; 1940 a paper completing the description of *Carteretta carteri* by describing the female, the description of *Monopsyllus fornacis* by describing the male; 1941 a review of the flea genera *Amphalius* and *Ctenophyllus*; 1943 with Kohls and Mills, Montana fleas and their hosts.

It was during 1942 that Jellison's greatest contribution appeared. This was "Index to the Literature of Siphonaptera of North America" written with Newell E. Good of the Plague Suppressive Measure Laboratory of San Francisco. This work is *National Institute of Health Bulletin* No. 178.

Glen M. Kohls was born at Vesta, Minnesota, on October 23, 1905. He received his bachelor of science degree from Montana State College in 1929. In 1937 he was granted a master of science degree by the University of Minnesota. From 1925 to 1927 Kohls was student assistant in entomology and zoology at Montana State. He acted as laboratory assistant, in local charge of tick parasite studies at Hamilton for the Montana State Board of Entomology during 1927–1928; 1929–1931 as assistant entomologist for the State Board. From 1931 to 1943 he was assistant entomologist at the Rocky Mountain Laboratory and in 1943 was elevated to associate entomologist. On April 9, 1943, he was commissioned as captain in the United States Army Sanitary Corps.

Kohls' first paper on western fleas appeared in 1937. In *Journal of Parasitology* he described *M. collinsi*, a bat flea from Arizona. This was followed in 1938 by the description of 2 new Meringis, *dipodomys* from southern California, *hubbardi* from Idaho. In 1939 he published on synonymy found in western rabbit fleas. Kohls' largest paper appeared in 1940 in *National Institute of Health Bulletin* No. 175. This was a beautifully illustrated paper on the rabbit and hare fleas of North America north of Mexico. With Jellison he published on the distribution of the human flea in 1936 and on fleas of Alaska in 1939, fleas of Montana in 1943.

In the meantime, Ewing in 1938 released the description of the Mountain Beaver flea, *Trichopsylloides oregonensis*, and the surgeon in charge of the Plague Suppressive Measures Laboratory at San Francisco, Dr. C. R. Eskey, published 3 papers, 1 on plague transmission, another on flea infestation of San Francisco rats and a third on fleas as vectors of plague. Eskey's largest and last contribution on western fleas appeared in 1940 as *Public Health Bulletin* No. 254 and is entitled "Plague in the Western Part of the United States." The co-author was Dr. V. H. Haas.

In 1939 two members of the staff of this Laboratory, Newell Good and Frank Prince, described 2 new *Opisocrotis*, *oregonensis* from ground squirrels of Oregon and *washingtonensis* from ground squirrels of Washington. During this year Holland and Mail of the Kamloops Laboratory published "Siphonaptera of Western Canada in Relation to Sylvatic Plague."

The year 1940 marks the beginning of a new era in flea study on the West Coast. In the north George Holland, collecting around Vancouver, B. C., began assembling material for publication out of the Kamloops Laboratory. Mrs. Ruth Svilha of the University of Washington, Seattle, began collecting in that state. Hubbard at Pacific University, Forest Grove, Oregon, had amassed a huge number of fleas, collected in Oregon, Washington, northern California, and northern Nevada. M. A. Stewart of the University of California at Davis was working central California materials and in southern California at the

Allan Hancock Foundation of the University of Southern California, Gus Augustson was working materials from central and southern California. Irving Fox began working Rocky Mountain fleas from materials found in the National Museum.

The first paper on western fleas to appear during 1940 was "New Siphonaptera From California" by M. A. Stewart. In this paper, which appeared in *Pan-Pacific Entomologist*, Stewart erected 2 new genera and 8 new species. The materials upon which the paper was based were collected on the Hastings Natural History Reservation, Monterey County, California. Stewart was still entomologist at the Davis branch of the University of California at this time but has since moved to Berkeley and become attached to the Department of Parasitology there.

Hubbard followed in March and from this month on during the year published 6 papers in which were erected a new genus and 13 new species. All of Hubbard's papers to this date (1944) appeared in *Pacific University Bulletin*. This student of western fleas became interested in these insects in 1919 while writing a master's thesis on the Mountain Beaver at the University of Washington. Opening a nest of these animals he was amazed at the size of their fleas, *Dolichopsyllus stylosus* measuring over 5 mm., *Hystrichopsylla schefferi* over 7 mm. Hubbard became head of the Department of Biology at Pacific University in 1922 and retained this position for 22 years. Prior to 1934 he collected fleas occasionally, generally during summer outings, but in the summer of that year a shepherd died of plague at Lakeview, Oregon. This event stimulated his interest in fleas, and from that time on he collected fleas by the thousands. Hubbard worked entirely alone, doing all his own collecting, mounting, determining, and labeling. He personally financed all his work on western fleas.

During early 1940 Holland with Stewart erected the genus *Aetheopsylla* and named *septentrionalis* its genotype. During this year Irving Fox described *Opisocrostis ornatus* from a male taken off a Prairie Dog in Colorado, *Dactylopsylla rara* from a male taken off a pocket gopher in Colorado and *Amphipsylla neotomae* from a male taken off a wood rat in California. Ewing during this year described *Paratyphloceras oregonensis* from a female taken off a mink in Oregon and *Sternopsylla carlsbadensis* from specimens taken off bats in New Mexico.

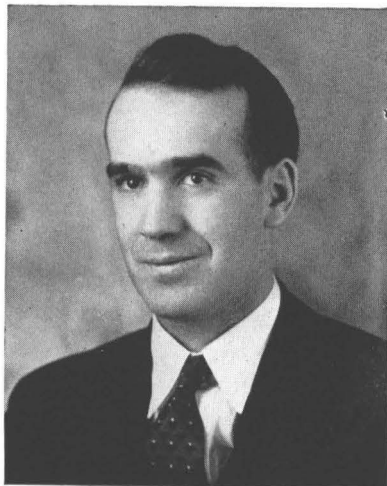
Dr. Henry Ellsworth Ewing is attached to the National Museum as entomologist and is a specialist in arachnida. He was born at Arcola, Illinois, on January 4, 1883. He received his doctor of philosophy degree from Cornell in 1911. He has taught at Knox College, Iowa State College and Oregon State College. After 1919 he was attached to the Department of Agriculture.

The year 1941 brought Gus Augustson of the Allan Hancock Foundation of the University of Southern California into print. During this year he published 2 papers in which were described 4 new species of

ROCKY MOUNTAIN SIPHONAPTERISTS



J. S. Stanford



William L. Jellison



Glen M. Kohls



Robert Traub

TYPICAL BASIC TRAP EQUIPMENT USED
BY PRESENT-DAY SIPHONAPTERISTS IN THEIR RESEARCH

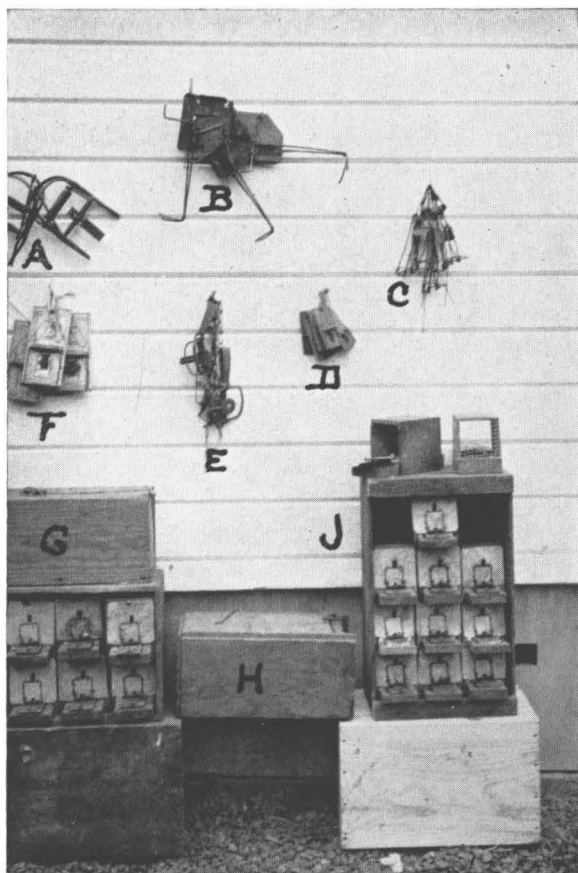


FIG. 1. Traps used by the author:
 A. Out-of-sight mole trap.
 B. Chinch gopher trap.
 C. Macabee gopher trap.
 D. Snap mouse trap.
 E. Steel trap
 F. Snap rat trap.
 G. Hammerhead box trap.
 H. Sliding door box trap.
 J. Author's all-purpose live trap.

California fleas. In 1940 Augustson wrote the author that he had been interested in the ectoparasites of southern California for about 6 years. Prior to 1938 he had been working under Dr. G. F. Ferris at Stanford University and while there was writing a master's thesis upon the ticks of his own collection. He moved to the Hancock Foundation as research associate with privilege of working toward his doctor of philosophy degree. During 1943 Augustson was commissioned lieutenant in the Army and became entomologist of the 8th Service Command Laboratory, Fort Sam Houston, Texas. From here Augustson wrote on December 31, 1943, "I have been here for nearly 2 months now, and feel that I will be here for the duration," but during May of 1944 he was shipped to the South Pacific.

Irving Fox released the description of *Opisodasys jellisoni* during 1941 from materials off flying squirrel taken at Boise, Idaho. Fox received his doctor of philosophy degree from Iowa State College in 1940, using for his thesis *Fleas of Eastern United States* which was published by the Iowa State College Press. He joined the staff of the University of Puerto Rico in 1941 as medical entomologist and in 1942 was commissioned lieutenant of the Army Sanitary Corps.

Hubbard published 4 papers during 1941, 3 of which were host indices. A new genus and a new species appeared in these papers. During October of this year Mrs. Ruth Svihla published "A List of Fleas of Washington."

During 1942 Augustson contributed more to the literature of western fleas than anyone else writing in the year. He published 7 papers in which he erected a new genus, a series of new species, and a list of fleas and their hosts from central Sierra-Nevada Mountains of California. Hubbard during this year issued only 1 paper in which he described *Thrassis rockwoodi* and reviewed the northwest ground squirrel fleas. Good, of the Plague Suppressive Measures Laboratory, released his review of *Stenistomera* and described *S. macrodactyla*, and issued a key to the males of the genus *Atyphloceras* together with the description of the male of *A. echis*.

By 1943 World War II had pretty well drained the flea men from the west. Augustson, Fox, Jellison, Kohls were in the service. Good had returned to Washington, D. C. Stewart with offices now in Berkeley seemed to be busy with teaching and administrative duties. The only active flea men were apparently Prince in San Francisco, Hubbard at Forest Grove, and Holland at Kamloops. Augustson, however, released, while in the Army, a paper on the fleas of southern California in which he listed 48 species with their hosts. Prince released a paper on the fleas of rats west of the 102nd Meridian, and another on *Opisocrotis brunneri* and *Thrassis bacchi* as vectors of plague. Hubbard published "Fleas of California" and in a paper entitled "American Pocket Mouse Fleas" described *Meringis jamesoni*. Holland released a paper on syn-

onomy and collected new records for British Columbia. Jellison and Kohls released with Mills "Species and Host List of Montana Fleas" in which were recorded 64 species of fleas.

During January, 1944, in *Pan-Pacific Entomologist*, Prince described 3 new species of Thrassis and Professor J. S. Stanford issued in *Proceedings of the Utah Academy of Science* "More Utah Siphonaptera." Fifty species and subspecies were listed in this Utah checklist, the collections having been made by Stanford, the determinations for the most part by Robert Traub.

Three other papers scheduled for late 1944 delivery were not released until early 1945. Holland issued "The Distribution of Some Plague-Important Rodents and Fleas in Western Canada" in *Proceedings of the Entomological Society of British Columbia*, December 1944. From materials found in the collection of Professor Stanford, Traub described two new western fleas from Utah in *Zoological Series of Field Museum of Natural History*, December 1944. This was Traub's first publication on western fleas and brings him in the category of western flea students. He was born in New York City in October 1916, attended College of the City of New York where he received his B. S. during 1938. Cornell granted his M.S. in 1939. From this time until June 1942 Traub was working for his Ph. D. at the University of Illinois. The Army commissioned him a First Lieutenant in the Sanitary Corps and during most of 1945 he was stationed as a Captain in Burma with the Army Typhus Commission, being associated there with Jellison and Kohls. The third of the papers appeared in *Canadian Entomologist* dated January, 1945 but which failed to reach libraries until late April. In this issue Prince described three new species of *Dactylopsylla* and a new subspecies of *Foxella*. Augustson released a study on Thrassis in *Journal of Parasitology* for August.

The period beginning in 1940 was, then, one of the most prolific eras in the study of western fleas; younger men like Augustson and Traub were showing intense interest, an interest interrupted by the war and the older men like Stanford and Hubbard were still very active in the field, Hubbard having covered 5,000 miles during the summer of 1944, and 12,000 during 1945.