A HISTORY OF NEMATOLOGY IN CALIFORNIA
(as of April, 2008)

by

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PREFACE

Over the past several years it has become increasingly apparent that the nematologists who were the founding members of this science in California were missing a unique opportunity to reflect on and record the events of their careers that were part of the substance and achievements of nematology. Virtually all of the early researchers are already retired but may yet serve as direct contacts with the few even earlier pioneer nematologists and are still in communication with the current faculty and staff.

Perhaps it would be appropriate here to point out and emphasize some facts pertinent to an account of the development and growth of nematology. Nematodes were mostly unknown as threats to agriculture until the early 1900s. Root-knot nematodes of the genus *Meloidogyne* were most frequently studied partly because they produced galls or swellings on the plant roots. This permitted observers to wash the roots clean, preserve them in fixative and collect specimens when convenient. The same was true for cyst forming nematodes, such as *Heterodera schachtii,* where the females formed durable cysts easily visible to the unaided eye. Only much later, beginning about the end of World War II, various collection techniques, especially wet-sieving and Baermann funnel methods brought to light myriad new and fascinating species in great numbers. But until then the administrators of universities and government agencies were literally uninformed about nematodes. The succeeding generations of students had no way to learn about them because there were no courses on nematology in all of U.S.A.

For the next 50 years there was a sustained and remarkable surge in the attention given to nematodes affecting the agricultural industry. Major advancements were achieved in the taxonomy and classification of nematodes revealing many more species and genera of endoparasitic types (which penetrate the roots). To these were added a vast array of ectoparasitic types (which feed on the surface of roots).

In addition, world-wide collections have added immensely to our knowledge of the diverse life histories and feeding mechanisms of nematodes, their great abundance and ubiquitous distribution in literally every imaginable biological niche. Nematodes represent far more than simply pathogens affecting agricultural crops. In fact they are one of the most successful forms of life on this planet surviving the hottest, driest soils; in the ice caps of the antarctic; in every water system, from fresh-water to marine. A single species, *Caenorhabditis elegans*, has emerged as an immensely important model organism for studying fundamental biological processes by scientists worldwide.

All this is evidence that nematodes warrant far more attention and support to more fully understand all the potential values to be gained from studying such a rich fauna. Instead, Nematology at University of California, Davis (U.C.D.) was at one time subjected to pressures aimed at merger into other departments or elimination entirely from U.C.D. These pressures came as a consequence of local interpretations of policy changes set by the Office of Vice President of the University of California to reduce the proliferation of small departments or research centers, etc.

To date Nematology at U.C.D. and the University of California, Riverside (U.C.R.) has resisted and survived these pressures, perhaps an understanding of the historical impetus and development of U.C. departments of Nematology will lead to renewed support and encouragement.

INTRODUCTION

Nematodes are remarkable creatures for many reasons. They are found in virtually every imaginable habitat or biological niche. They are truly ubiquitous and worldwide in distribution and have developed a great range of unique life habits, feeding mechanisms, host ranges when parasitic, different means of surviving through unfavorable conditions and special adaptations for differing habitats.

There are only a few records of nematodes dating as far back as biblical times and most of those were concerning parasites of humans and animals. There was good reason for this - other than a few animal parasites and a few marine species most nematodes are very small, slender and opaque in appearance and special techniques and equipment are required to separate them into clear water in order to find them. More importantly, nematodes are for the most part too small and slender to permit study of them in detail without benefit of magnification.

It was the invention of the light microscope that finally enabled scientists to study microorganisms, including nematodes, in much greater detail than was possible earlier. Collectors found them to be numerous in a vast array of soil types, in freshwater and marine habitats, and in plant tissues both above and below ground. They are virtually everywhere in nature, including agricultural soils and crop plants. There was no information about life cycles of nematodes, their feeding mechanisms, or host ranges. However, the association of certain types or species with crop damage and/or poor yields soon became apparent to agriculturists. Nevertheless it wasn't until the late 1800s that their importance as a possible threat to agriculture began to be recognized in publications.

I. EARLY PERIOD; LATTER HALF OF THE 19TH CENTURY.

One of the first records of nematodes parasitic on plants was that of Kuhn (1858) reporting on the stem and bulb nematode, *Ditylenchus dipsaci*. Other notable publications included Schacht's work (1859) on sugar beet nematode, *Heterodera schachtii*, followed by Schmidt (1871) and Strubell (1888) on the same nematode. Cornu (1879) recorded work on root-knot nematode, *Meloidogyne* spp.; and De Man (1881) (Plate 1) on the lesion nematode, *Pratylenchus* spp.

All of the above came from studies in Europe; awareness of nematode problems did not reach U.S. until after the turn of the century with one exception, a bulletin on root-knot nematode published by J. G. Neal in 1889.

II. MID PERIOD; FIRST HALF OF THE 20TH CENTURY.

These fifty years brought many advances to Nematology in the U.S. the most significant being the appointment of Nathan Augustus Cobb (Plate 2) in 1907 as Nematologist in the Bureau of Plant Industry of the U.S.D.A. Soon afterward a new Division of Nematology was established with Cobb as its first Director. Dr. Cobb was eminently successful in staffing his Division with many outstanding individuals who set high standards of excellence for research which has carried forward to the present time. Cobb himself was exceptionally prolific in a broad spectrum of nematode research including taxonomy, morphology, life habits and their effects on plants. In recognition of his leadership and many achievements, Cobb has been celebrated as the father of Nematology in the U.S.

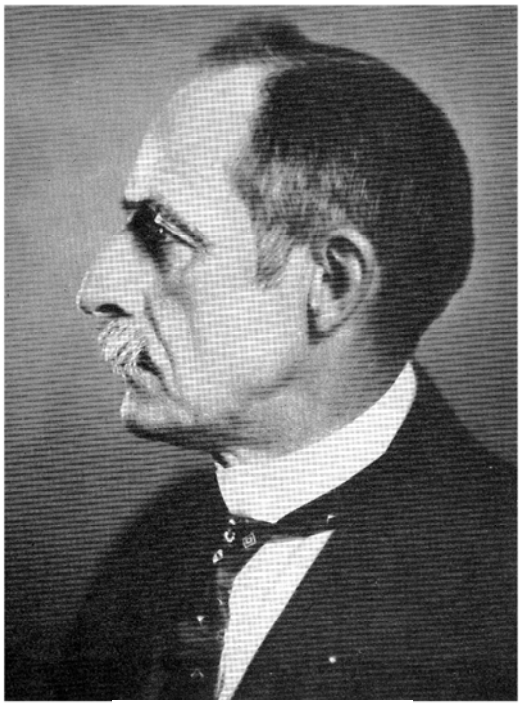
Plate 1

J. G. De Man

Initially the work was concentrated in the east coastal regions but eventually spread throughout the U. S. E. A. Bessey made the first report of root-knot and sugar-beet nematodes in California in 1911. Another early record of nematodes in California involved the citrus nematode. That species was discovered by a Los Angeles County Agricultural Inspector who sent specimens to Cobb. Cobb described it as a new species and named it *Tylenchulus semipenetrans* in 1913. E. E. Thomas of the U.C. Citrus Experimental Station at Riverside, California demonstrated it to be injurious to citrus in 1928.

Gotthold Steiner (Plate 3) was one of the first Nematologists to join Cobb in the Division and later became Director following the death of Dr. Cobb in 1932. A. L. Taylor (Plate 3) succeeded Steiner as Director of Division in 1956. B. G. Chitwood (Plate 3), renowned for his major contributions to nematode systematics and morphology, began his career with the U.S.D.A. in Washington, D. C. in 1928; later moved to Beltsville; still later joined the U.S.D.A Potato Cyst Nematode Laboratory in Hicksville, Long Island, N.Y. After leaving the U.S.D.A. he worked in Florida and finally in California.

Plate 2



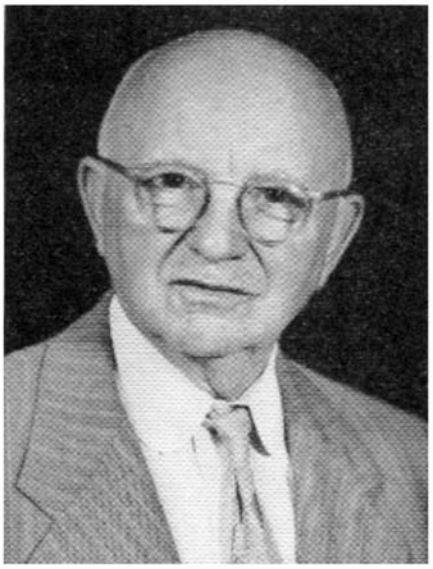
N. A. Cobb

Jesse Christie (Plate 3) was stationed in Beltsville for part of his career but completed some of his most significant research while working in Florida. Gerald Thorne (Plates 4, 5) spent most of his career in Utah, his native state, where sugar beet cyst nematodes were a major agricultural pest. He made a number of visits to California assessing the importance of nematodes here and recommended various methods of control. After retirement from the U.S.D.A. in 1956, he joined the faculty in the Department of Plant Pathology at Madison, Wisconsin where, in 1961, he completed his textbook, Principles of Nematology, the first ever for Nematology.

Plate 3

B. G. Chitwood

J. R. Christie



G. Steiner

A. L. Taylor

Two other members of the Division of Nematology in the U.S.D.A. spent considerable time in California carrying out surveys and detailed studies on certain plant parasitic species. G. H. Godfrey studied the stem and bulb nematode in California as early as 1923; the burrowing nematode, *Radopholus similis* in Hawaii in 1931; distribution of *Anguina amsinckiae* in northern California and reported use of DD for soil fumigation in 1947.

Plate 4

G. Thorne

G. Thorne

D. J. Raski,
G. Thorne,
C. W. McBeth

M. Fielding,
S. A. Sher

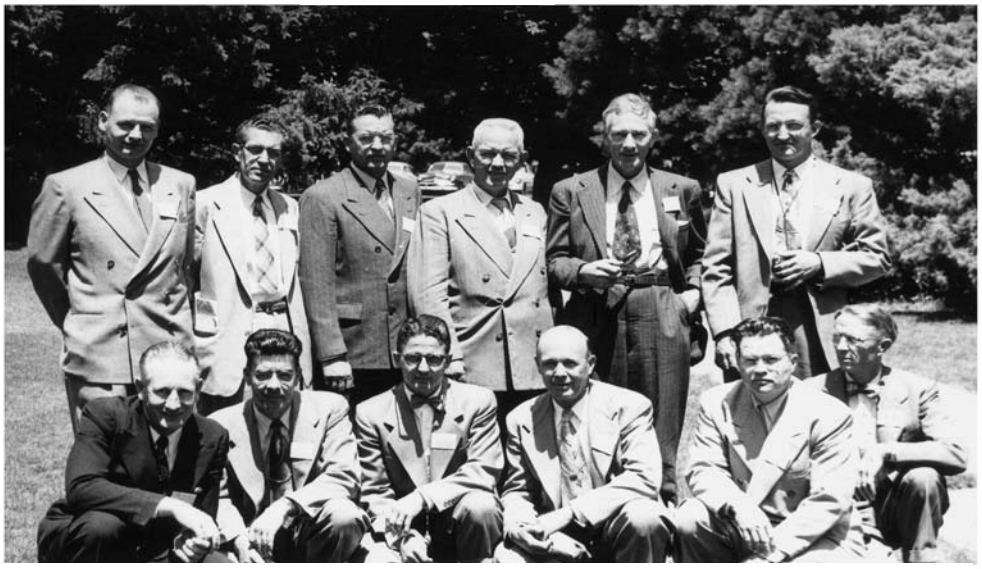
Jocelyn Tyler published six papers on root knot nematode between 1929 and 1942 on research in California and Oregon. She served as Research Assistant in the Department of Entomology and Parasitology, University of California, Berkeley, (U.C.B.) in 1933, later was Junior Nematologist in the Division of Nematology, U.S.D.A. stationed at U.C. Berkeley. She made no further published contributions to Nematology after 1945.

MERLIN WALTERS ALLEN

Merlin Walters Allen (Plates 5, 8), destined to initiate nematology in a major fashion in the University of California, was born December 1, 1912 in Wellsville, Utah a small community south of Logan. He graduated from Logan High School in 1931 and entered Utah State University the same year, majoring in Entomology. Merlin earned his B.Sc. degree in 1935, continued into graduate school and completed requirements for the M.Sc. degree in 1937. That year he joined the Bureau of Entomology and Plant Quarantine of the U.S.D.A. in Logan, Utah and transferred to the Bureau's office in Salt Lake City in 1939. There he came under the guidance and teaching of Gerald Thorne, joined the U.S.D.A. Bureau of Plant Industry and was promoted to Junior Nematologist in 1942. In 1943 he was promoted to Assistant Nematologist and transferred to Bakersfield, California.

These early combined efforts and contributions of Thorne, Allen, Godfrey and Tyler, among others, increased significantly the awareness of the nematode threat to California agriculture. It is not clear if any one individual can be identified as the leader of significant direct influence promoting nematological research and study in California. However, Gerald Thorne does stand out as having been

Plate 5



Back Row: H.J. Jensen, H. Reynolds, C.W. McBeth, W.D. Courtney, J.E. Bosher, W.H. Hart.
Front Row: E.J. Anderson, M.W. Allen, D.J. Raski, G. Thorne, E. Dallimore, C.E. Scott.

APS Meeting, Corvallis, Oregon, 1952

an especially effective voice for promoting growth and support for nematology by virtue of his strong convictions and energetic personality. He and Godfrey were both greatly aided and abetted by C. Emlen "Scottie" Scott (Plates 5, 6), who served as Plant Pathologist in the California Department of Agriculture for nine years before joining the University of California Extension Service as a Specialist in the Department of Plant Pathology at U.C.B. Scott published jointly with Godfrey on the stem and bulb nematode in 1935. He also helped arrange for Thorne's visits to California and accompanied him on field trips to assess the problem of nematodes in this state.

Plate 6

C. E. Scott

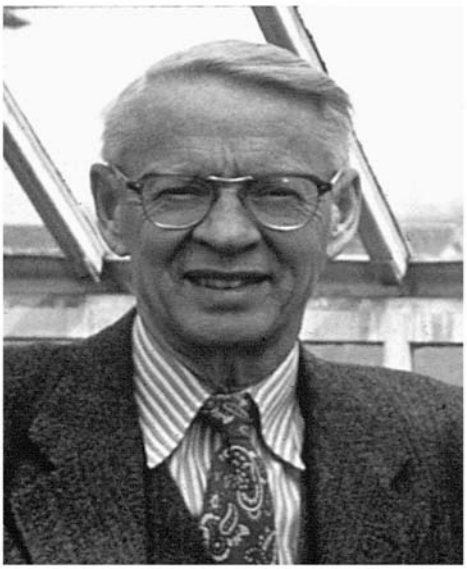
D. J. Raski,
H. Jensen

There were also annual meetings of Farm Advisors and farm leaders that were convened to discuss their activities and findings. One report prepared by the Agricultural Extension Service dated July 1, 1941 included information given by County Agricultural Economic Conferences as well as Extensive and Intensive Land Use Problem Surveys. Every year from 1937 these reports urged the establishment of more in-depth, on-going research in the U.C. College of Agriculture and in the U.S.D.A. to control nematodes which they perceived to be a serious threat to agriculture in California. Those efforts apparently were successful when the State Legislature in 1947 included funds in the University of California budget to provide for new faculty positions for nematological research at U.C. Berkeley and U.C. Riverside.

Documents or directives apparently no longer exist that would provide an official version of these actions that resulted in the University of California obtaining funds to initiate and expand research and teaching of nematology. Aware of these events Gerald Thorne informed Merlin Allen and Clyde W. McBeth (Plates 4, 5, 30) that one position was being established at U.C. Berkeley and another by the Shell Chemical Co. at their laboratory in Salida, CA. At that time McBeth, who like Thorne and Allen came from Utah originally, was stationed at Tifton, Georgia and was an employee of the U.S.D.A. He and Allen discussed various aspects of both and came to the mutual agreement Merlin would best apply for the position at Berkeley and McBeth for the Shell position helping to develop new nematicides. Clyde Warren (Mac) McBeth retired in 1969 and died in Payson, Utah, January 2005.

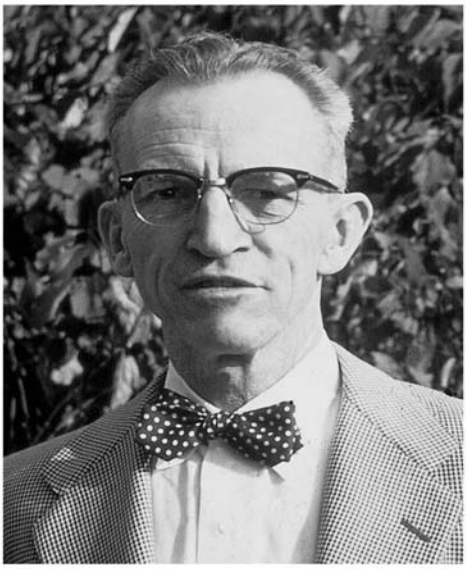
During his career, Dr. Allen taught formal courses in Nematology at both U.C. Berkeley and U.C. Davis. At U.C. Berkeley he taught Plant Nematology (Appendix Table 9) and at U.C. Davis, General Plant Nematology, Introduction to Nematology, Nematode Taxonomy and Comparative Morphology, Principles and Techniques of Nematode Taxonomy and Morphology (Appendix Table 10).

Plate 7

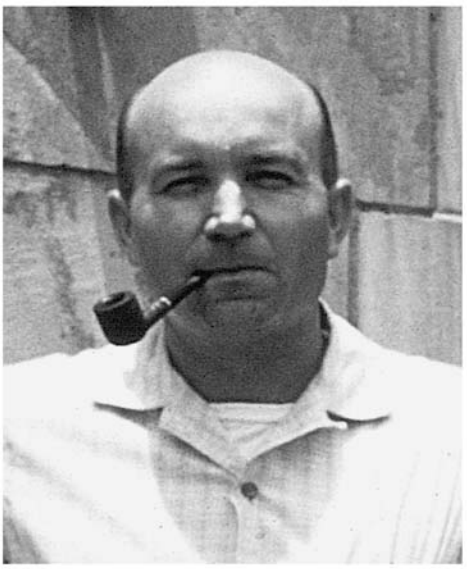


A. G. Newhall

W. F. Mai



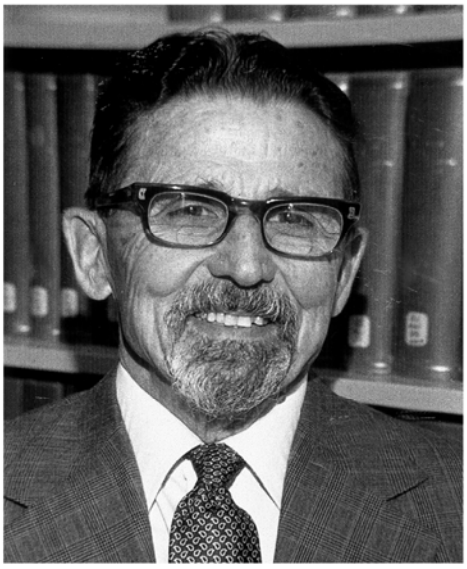
M. Linford



J. N. Sasser

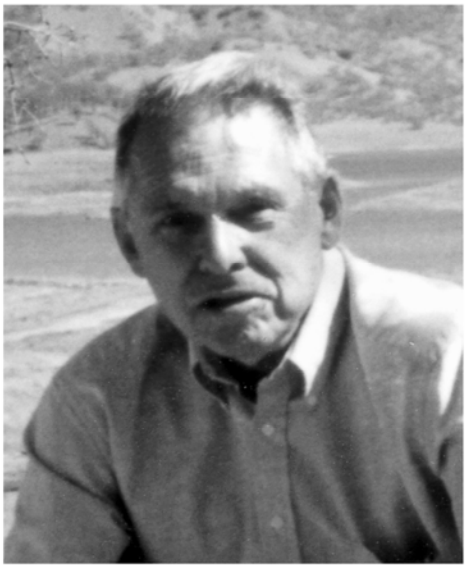
Plate 8

M. W. Allen



D. J. Raski

B. Lear



B. F. Lownsbery

III. PRESENT PERIOD: LATTER HALF OF 20TH CENTURY. UNIVERSITY OF CALIFORNIA BERKELEY/UNIVERSITY OF CALIFORNIA DAVIS

The transfer of Merlin Allen to U. C. Berkeley in Feb. 1944 as an Associate in the Experiment Station was the initial step in establishing the first full time Nematologist in the University of California system. The next question to arise was which department would accept responsibility for administration. At a joint meeting of leaders from Plant Pathology (including Dept. Chair Max Gardner) and Entomology and Parasitology (with Dept. Chair E.O. Essig) this issue was discussed. In the absence of any official minutes of that meeting hearsay reports that Prof. Gardner advised the meeting of serious reservations about assigning nematology to his department. The meeting was summarily concluded when Prof. Essig abruptly announced "I'll take them!" (to which those who knew him can imagine Prof. Essig clearing all the chips from the table with a sweep of both hands).

Allen then enrolled in a Ph.D. program and completed his Ph.D. in the Department of Entomology and Parasitology at U.C.Berkeley. He completed his Ph.D. requirements in Feb. 1947 including a research thesis on the Big Vein of Lettuce. It was known to be a soil-borne virus the vector of which was unknown. Those conditions suggested nematodes might be the answer. The carefully planned and executed study by Allen conclusively established that nematodes were not involved. Not much later the virologists/plant pathologists at U.C.B. proved the vector is a species of fungus, *Olpidium brassicae.* Infected spores of the fungus delivered the virus to host plants when the roots were invaded. That same year Dr. Allen was appointed Assistant Professor of Entomology and Assistant Nematologist at U.C. Berkeley.

Throughout his career at U.C.B. and U.C.D. Dr. Allen worked on the nematode species attacking cotton and other field crops and their control. Fundamentally he established that root- knot was the predominant problem on cotton. However, a complex of species and races increased the difficulty of control especially in development of plants resistant to the nematode.

DEWEY JOHN RASKI

Dewey John Raski (Plates 5, 6, 8) was the next to join the ranks of nematology in the U. C. system. He was born December 12, 1917 in Kenilworth, Utah and at the age of three came to California when his family moved to Los Angeles. He attended public schools in Los Angeles including Manual Art High School. He elected to major in academic studies preparatory to higher education and graduated in 1935. The next two years he was hired as a bookkeeper in The House of Farrell, a small family office in the insurance business, including W.G. Farrell, father, and his two sons, Caine and James Farrell.

By 1937 Dewey was admitted to the University of California at Berkeley having chosen a major in Entomology in the College of Agriculture. Completion of all requirements for the degree Bachelor of Science was achieved in 1941. Graduation in June did not offer employment opportunities so studies toward a Master's Degree were initiated but interrupted in December by the start of World War II. Dewey along with two fellow students in Entomology drove to Sacramento to enlist in the then Army Air Force: Dewey for pilot training, Phil Crane for gunnery training and Harold Reynolds for navigator training. All three returned to Berkeley and Entomology after the war ended in 1945.

There were few or no job opportunities at first and most returning students were advised by Prof. E.O. Essig, then Chair of the Dept. of Entomology and Parasitology, to continue their education toward a Doctorate of Philosophy. Dewey chose to do that and began a study program under the direction of Arthur "Dick" Borden who was a specialist on insects affecting pome fruit production in California, however midway into that project Dewey met Prof. Merlin Allen and changed direction to work on nematode problems. His thesis covered detailed descriptions on the morphology and biology of *Heterodera schachtii*, a serious pathogen of sugar beets in California. Dewey joined the faculty as

Instructor and Junior Nematologist in 1948 in the Dept. of Entomology in Berkeley. In 1954 he was transferred to U.C. Davis to establish teaching and research on that campus in the newly created Department of Plant Nematology. At U.C. Berkeley he taught a formal course in Plant Nematology (Appendix Table 9). On moving to U.C. Davis he taught formal courses in General Plant Nematology , Principles and Techniques of Nematode Taxonomy and Morphology, Nematode Taxonomy and Comparative Morphology (Appendix Table 10).

Something that is not well known is that Entomology at U.C.B. had taken one step further in trying to strengthen nematological research by budgeting a third faculty position to work with Merlin Allen. This was considered briefly by another student (Kenneth Frick?) who was just then completing his Ph.D. in Entomology. Unfortunately, after a brief trial period, he declined the offer; the position was never filled and ultimately was lost to nematology.

Teaching

From 1948 onward Nematology under the leadership of Dr. Allen began to flourish and made great strides towards its ultimate recognition as a distinct and separate science as well as administratively meriting separate departmental status. Progress was particularly outstanding in the teaching program. Dr. Allen presented the first organized introductory course ever given on plant-parasitic nematodes. Then a succession of students was attracted to this field and trained in his laboratory. Three of them completed doctoral studies and later accepted positions in the University of California, S.A. Sher (Plates 4, 10, 19), Nematologist at U.C.R.; Winfield H. Hart (Plates 5, 16), Extension Specialist at U.C.D.; Armand R. Maggenti (Plate 16) served as Nematologist also at U.C.D. Another of the early students, Harold J. Jensen (Plates 5, 6), after receiving his Ph.D. in 1950 served as Nematologist and Professor at Oregon State University, Corvallis. All four made outstanding contributions to Nematology; three lived to normal age of retirement.

For more than 50 years Nematology has succeeded in attracting a steady and dependable corps of graduate students (Appendix Tables 2 and 3). Students usually applied for admission after completion of undergraduate studies towards a B.Sc. in Entomology or Plant Pathology. To serve the students of Nematology, separate programs were established in Entomology and Plant Pathology as agreed upon by those departments and leading to the M.Sc. or Ph.D. degrees. A few exceptions were students who majored in zoology, ecology, or environmental studies but by far the majority came through Entomology or Plant Pathology. At U.C. Riverside several students completed their Ph.D.s in Biology.

Over an extended period of time several proposals were submitted to the Graduate Divisions and Academic Senate at U.C.B. and U.C.D. requesting recognition of a separate program of graduate study for Nematology but these never succeeded in gaining approval. One faculty member at U.C.B. expressed concern and 'would feel better' if there were other examples to refer to

Plate 9

I. N. Filipjev

L. A. P. DeConinck

T. Goodey

F. G. W. Jones

M. Oostenbrink

P. A. Loof

Plate 10

J.W. Seinhorst, H. Goffart, M. Luc, A.V. Palo, S.A. Sher, A.M. Omidvar
European Society of Nematologists Meeting, Uppsala, Sweden, 1959.

Plate 11

Back Row: H. Jensen, W. Hart, M.A. McClure, D.J. Raski, A. Ayala, A.R. Maggenti, F. Lamberti, R.A. Kinloch, N. Abdalla, G.R. Noel, J. Chitambar
Front Row: W.R. Nickle, S. Paracer, G.S. Santo, N. Marban M., H. Mojtahedi, S.L. Hafez

Plate 12

U.S.D.A. Western Regional Project Meeting ca 1959, Prosser, Washington.
Back Row: E. Jorgenson, V. White, L. Faulkner, W. Orchard, H. Jensen
Middle Row: O. Holtzman, Dr. G. Shaw (admin. advisor), J. Altman
Front Row: B.F. Lownsbery, E. Nigh, E. Dallimore

as models. A bitter disappointment considering U.C.B. was noted for its reputation as a leader on the cutting edge of science.

Students came from all parts of the world and the U.S.A., and were consistently successful in completion of their studies to gain their degrees. A very high percentage of graduates went on to establish their own careers and have made outstanding contributions to the science. The appendix tables include most if not all the graduates of U.C.B. and U.C.D. with notes regarding their subsequent careers where known (see Appendix Tables 2 and 3 for U.C.B. U.C.D.; also Appendix Table 4 for graduates of U.C.R.).

Another service of teaching by Nematology in the 1950s was a series of 10 Short Courses ranging from 2-3 days to 2-3 weeks (mostly one week or less). These were designed for all interested individuals to acquaint them with the rudiments of Nematology, techniques of collection and identification, plant symptoms and various control measures. These were joint programs involving the Department of Nematology, U.C. Agricultural Extension Service, Calif. Department of Food and Agriculture and the Shell Chemical Co. Two representatives were especially prominent in the organization and presentation of the courses; C.W. McBeth and Dr. L.C. Glover.

Research

The first years 1947-1954 were spent on travels throughout California meeting Farm Advisors, County Commissioners, growers and representatives of chemical companies in an attempt to broaden our data base of nematode incidence and distribution. In the process, a record-keeping system was established to document nematode identifications to species, associated cropping, symptomatology and soil types. This culminated in a book under the authorship of I. A. Siddiqui (Plate 31), S.A. Sher and A.M. French published in 1973 by the California Department of Food and Agriculture entitled "Distribution of Plant Parasitic Nematodes in California". At the same time a permanent nematode collection was established on slides catalogued in a system very similar to the slide collection devised by Gerald Thorne in Salt Lake City. The extensive collection assembled at U.C. Berkeley by Merlin Allen and associates was later integrated into the U.C. Davis Collection. The collection at U.C. Riverside has remained separate.

A number of soil nematicide trials were established to assess the value of several soil fumigants as preplant treatments for cotton, tomato, sugar beets and other annual or perennial crops. These were carried out in commercial fields cooperatively with the growers, local farm advisors and chemical company representatives.

Foundations were established for a departmental library of published material on a world-wide scale. These were cross-indexed according to title, author and major subjects and/or nematode species studied.

The very fundamental importance of wider current literature references was apparent from the paucity of books and articles available to Nematology. There simply was little knowledge generated on this subject. And for good reason: there was no demand for it. The threat to agricultural production by nematodes was not yet established. A single reference (Plant Parasitic Nematodes and the Diseases They Cause) by Tom Goodey (Plate 9) was published in Great Britain in 1933 and was the major source of information for over two decades. It was followed by :

- J.B. Goodey Soil and Freshwater Nematodes 1933 rev. 1963.
- I.N. Filipjev (Plate 9) and J.H. Schuurmans-Stekhoven, Jr. A Manual of Agricultural Helminthology 1941
- J.R. Christie (Plate 3) Plant Nematodes Their Bionomics and Control 1959

- Gerald Thorne Principles of Nematology 1961

The last book, by Thorne, was a coverage of nematodes in a depth, breadth and up-to-date character that qualified it as a textbook, the first for Nematology. In the years to follow many more publications have covered a wide range of aspects of Nematology as befitting the evolution of research and knowledge documenting the significance of nematodes to agriculture. Some books focused on special topics such as nematode physiology, ecology or control.

Over the following half century (1948-9/1999), the collections (library references; slide collections of permanent mounts as well as wet collections of mass preservations and/or plant material; plus catalogued records of soil samples taken on surveys) proved equal or better than those found elsewhere in the world. They were especially important for graduate student teaching and research and brought many visiting scholars to U.C. for study.

U. C. Administrative Reorganizations

Shortly after 1950 two events had a profound influence on the development of Nematology. The first was a decision taken by U. C. administrators to strengthen research and teaching in the College of Agriculture by reassigning many faculty positions and their resources from U.C.B. and University of California, Los Angeles (U.C.L.A.) to U.C.D. and/or U.C.R.

The objectives as set out by that decision were brought to my (Dr. Raski's) attention in a very casual and informal manner by Dr. E.G. Linsley then chair of the Department of Entomology and Parasitology. It was on a Saturday morning and I was alone in the laboratory when Dr. Linsley came into the lab and talked about the administrative objectives leading into a direct question if I would consider a move to U.C.D.

The prospect of a move to U.C.D. seemed clearly advantageous to Nematology itself extending its presence to another campus. Furthermore it was needed at U.C. Davis for teaching as well as research purposes since Davis had never been included previously in the plans for expanding Nematology in the U.C. system.

My response was to acknowledge the proposal had merit and agreed to consider it. Here again, lack of knowledge and experience in University affairs led to premature decisions and before long the move was set in motion. In retrospect the proposal could well have profited by a more thorough examination of the conditions of the move, comparison of short-term gains vs. long term implications for Nematology. When it was made known to Merlin Allen it is certain in retrospect that he was very disappointed, would not consider moving for himself but would not stand in the way of my move. By July 1954 it was so implemented, I transferred to Davis and never regretted the change.

The other event occurred in 1952 when a Report of a Nematode Study Committee was made to the Statewide Agriculture Committee of the California State Chamber of Commerce. Special recognition is due that committee including its Chair James E. Armstrong (a cotton grower whose farm was in Tulare County but his primary residence was in Los Angeles); Prof. Harry S. Smith, an Entomologist at U.C.R.; D.G. Milbrath, California Dept. of Agriculture; and Ralph H. Taylor, (affiliation unknown). Their recommendations urged recognition of Nematology as a separate and distinct science, major additions to funding including more new faculty positions, staff support personnel, equipment and facilities besides operating expenses. Similarly additional support was urged for the U.C. Agricultural Extension Services. Virtually everything requested was provided by the state legislature in campus budgets for 1954-55.

THE DEVELOPMENT OF NEMATOLOGY AT U.C. DAVIS

The evolution of Nematology at Davis was slow but sure, gaining wider acceptance every year and ultimately succeeded as a full-fledged Department for research and teaching. By 1959 Dr. Allen saw the merits of unifying at Davis, agreed to closing down the program in Berkeley and his transfer to Davis.

Administration

From the Daily Record Book of Dr. S.A. Sher it is reported that a conference was convened by Dr. Harry Wellman, Vice-President for Agricultural Sciences held at U.C. Berkeley on Jan. 8 – 9, 1954. Purpose of the meeting was to consider the State Chamber of Commerce report and the administrative status of Nematology. The following were in attendance:

M. W. Allen, U.C.B.	L. Klotz, U.C.R., Chair Dept Plant Pathology
D. J. Raski, U.C.D.	A. Boyce, U.C.R., Dean
B.F. Lownsbery, U.C.D.	D. Aldrich, U.C.D., Dean
B. Lear, U.C.D.	P.F. Sharp, Director of Agric. Exp. Sta.
E.G. Linsley, U.C.B. Dean	H. Wellman, Vice Pres.for Agric., U.C.

On Jan. 9 Dr. Wellman announced that a new Department of Nematology would be made. It was designated as the Department of Plant Nematology, a separate state-wide unit, with the Chair to be selected from U.C.D., and a Vice-Chair at each of U.C.B. and U.C.R. Dr. Raski was appointed the first chair, Dr. Allen Vice Chair at U.C.B. and Dr. R.C. Baines Vice-Chair at U.C.R. At U.C.D., Dr. Raski served as chair 1959-1964, Dr. Allen served as chair 1964-1969.

Personnel

BERT LEAR

Two faculty positions each were added to Nematology at U.C.D. and U.C.R. Bert Lear (Plate 8) was recruited for one of the positions at U.C.D. Bert was born in 1917 in Logan, Utah. He entered Utah State University in January 1937 majoring in Botany and Plant Pathology with a minor in Chemistry. He completed studies for his B.Sc. in 1941. During his last two years as an undergraduate he served as an assistant at the Utah Experiment Station aiding in tomato disease research.

In June 1941 he was appointed Agent in the U.S.D.A. at Utah State University continuing his work on tomato diseases. In April 1943 he accepted a Dow Chemical Co. Fellowship in the Department of Plant Pathology, Cornell University, where he received his Ph.D. Degree in 1947 having carried out his thesis research under the direction of Dr. A.G. Newhall (Plate 7). His research was on: The Use of Methyl Bromide and other Volatile Chemicals for Soil Fumigation.

After graduation he was appointed assistant Professor of Plant Pathology at Cornell where he worked on control of the Golden Nematode. In 1952 Bert moved to New Mexico State University to begin research on nematode problems of cotton. In 1953 he joined the faculty of U.C.D. as Assistant Nematologist in the Department of Entomology. At Davis he initiated a course on nematode control, taught formal courses in Principles of Nematode Control and Nematode Pathogenicity (Appendix Table 10), supervised twelve graduate students and conducted research on nematode problems of vegetable and ornamental crops. He retired from U.C.D. in January 1985 and died in Palo Alto, California on November 8, 2005.

BENJAMIN FERRIS LOWNSBERY

Benjamin Ferris Lownsbery (Plates 8, 11), known to everyone as “Ben”, was chosen for the second new position established at U.C. Davis. Ben was born July 28, 1920 in Wilmington, Delaware. He began his academic career in 1938 at the University of Delaware majoring in Biology and was awarded his B.A. Degree in 1942. During the next three World War years he worked in a DuPont

munitions plant. In 1945 after the war ended he enrolled in the Graduate School of Cornell University where he came under the tutelage of Dr. William Mai (Plate 7).

There Dr. Mai introduced Ben to the Golden Nematode and the fascinating science of Nematology which set Ben's career interests for the rest of his life. He received the Doctor of Philosophy degree in 1950 then served briefly at Cornell as an Assistant Professor. That same year he joined the U.S.D.A. in Beltsville, Maryland where he worked on the Golden Nematode Project on Long Island.

The next two and one-half years Ben served as an Assistant Plant Pathologist at the Connecticut Agricultural Experiment Station in New Haven. Ben's research interest focused on the cyst forming nematodes and among other reports he described a new species he named *Heterodera tabacum* which he co-authored with his wife, Joyce. In December 1953 he was recruited to join the newly established faculty of nematologists. At that time the nematologists were administratively in the Dept of Entomology in the University of California, Davis. Ben began as Lecturer in 1953, and retired as Professor of Nematology in 1983.

Dr. Lownsbery assumed responsibility for studying nematodes affecting tree fruit and nut crops in California with special attention to developing procedures for establishing proof of pathogenic effects on plants suffering nematode attacks. He had an inquiring spirit in his research which impressed colleagues and fellow workers in addition to his positive attitude in his career as well as toward life generally. Ben was a prolific researcher and author or co-author of more than 140 scientific publications.

One of his most noteworthy contributions was a solution for the Bacterial Canker Disease of peaches caused by *Pseudomonas syringae*. Ben joined with Drs. James DeVay and Harley English in a cooperative project proving the ring nematode *Criconemoides xenoplax*, feeding on the roots of peach predisposed the trees to the bacterium which ultimately killed the trees. In 1971 the American Society of Horticulture Science honored him for helping to develop nematode-resistant peach trees.

Dr. Lownsbery also taught courses in Nematology giving a formal courses in General Plant Nematology, Nematode Pathogenicity and Nematode Pathogenicity to Plants (Appendix Table 10) and directed graduate students in M.Sc. and/or Ph.D. programs. In all his contacts with students he held for the highest standards of thorough and well designed research. He earned the appreciation and respect of all his students which was still clearly sustained more than thirty years after their graduations.

Ben contributed in many other ways to the success of the Department: willingly serving on committees and participating generously in departmental affairs: also to the Society of Nematologists when he was Editor-in-Chief of the Journal of Nematology from 1978-1980.

Ben retired Aug. 1, 1983 and died on Friday, July 14, 2000 after many years of struggle against the effects of Parkinson's disease.

Funds enough for three Laboratory Technicians at U.C.D. were part of the new budget; Starr Miyagawa (Plate 13), Dave Lawfer and Norman O. Jones (Plate 13) were hired for those positions. At first it seemed that the best organization of their talents and time would be to function as a pool of help. This plan proved difficult to manage and was soon replaced with assignments individually to faculty, Jones with Raski, Miyagawa with Lownsbery and Lawfer with Lear.

NORMAN O. JONES

Norman Jones was born in British Columbia, Canada on Jan. 30, 1926 and from 1944-46 studied Agriculture at the University of British Columbia in Vancouver. From 1947-49 he enrolled in Plant Science at U.C. Davis earning the degree of BSA in 1949. Service in the U.S. Army took him to

Germany from 1950-52. Returning to U.S. in 1952 he studied in the Graduate Division majoring in Plant Science then worked in the Pomology Dept. then the Viticulture Dept. from 1953-54 as laboratory assistant. He served highly effectively as Staff Research Associate with Dr. Raski throughout his entire career until retirement in 1985. His participation in nematological research covered virtually every aspect and he had a deep interest and involvement in every new direction the studies covered. He was anxious to learn the use of all new equipment and soon mastered every one: field trials with chemical nematicides; preparation of specimens for the taxonomic studies; virus cultivations and the search for virus-vectors proved especially rewarding. He also learned and became expert in the preparation of nematode specimens for ultra-thin sectioning and examination of tissues on the electron microscope; also successfully fixed, mounted and prepared specimens for study of external structures on the scanning electron microscope. In sum Norman's career was particularly outstanding in the many contributions made in the progress and success of the many varied lines of research attempted.

STARR MIYAGAWA

Starr Miyagawa was born in Jan. 6, 1926 and earned his AA degree in Sacramento Junior College in 1950. He went on to complete requirements for his B.Sc. degree in 1953 in the Department of Entomology at U.C. Davis. He was hired as Laboratory Assistant in Nematology that same year and soon after was assigned to assist Dr. Lownsbery. In 1962 he earned his M.Sc. degree in part by a study on "Longevity of Stem and Bulb Nematode, *Ditylenchus dipsaci*". When David Lawfer resigned his position and left U.C.D. Starr assumed responsibility to assist Dr. Lear. This Starr fulfilled very effectively on a wide range of nematode control studies on vegetable crops and ornamental plants including chemicals, hot water treatments, and cultural management schemes. Starr retired in 1986 after 33 years service at U.C. Davis; he died April 3, 2008. After Starr Miyagawa was reassigned to assist Dr. Lear, Lownsbery hired John Mitchell as associate who served with a high degree of enthusiasm and energy for many years until he resigned to return to his native country, Greece.

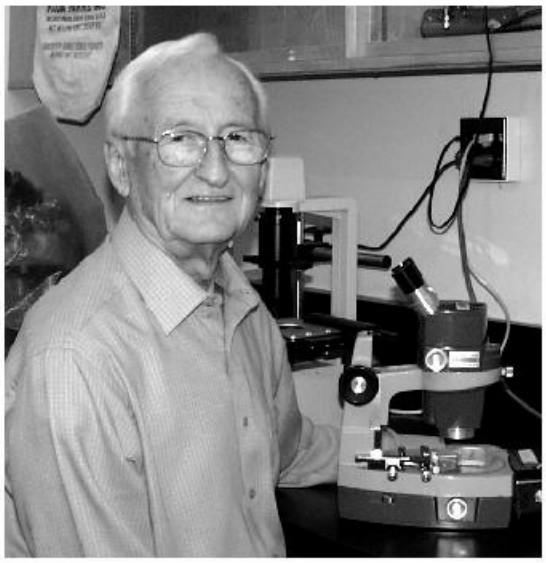
RICHARD SCHMIDT

Richard Schmidt (Plate 14) proved to be another valuable assistant when he joined the Department of Nematology as a laboratory technician which was made possible by grant funds from the Wine Advisory Board. His mission was to assist Dr. Raski in assessing the efficacacy of various nematicides for control of nematodes causing severe damage to grapevines. His duties included field testing as well as laboratory and greenhouse trials. When the grant money ran out Mr. Schmidt was assigned to assist Dr. Viglierchio. Throughout his career at U.C.D., Dick Schmidt was a dedicated, dependable and talented assistant. Upon retirement, he moved to Washington State where he currently resides.

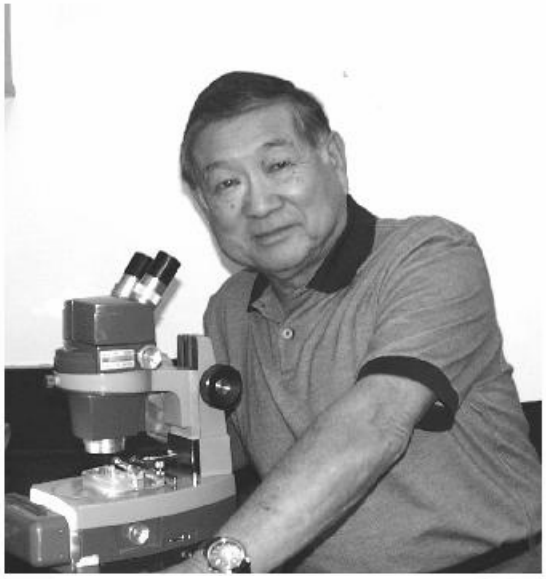
THOMAS M. BURLANDO

Mr. Thomas Burlando (Plate 15) began his association in the Division of Nematology in 1975 as a Research Assistant working towards a Masters Degree with Dr. Armand Maggenti. After obtaining his Masters in 1978, he was hired as a staff research associate working with Dr. Benjamin Lownsbery on various projects including nematode parasites of alfalfa and walnuts. After Dr. Lownsbery retired in 1984, Mr. Burlando was assigned to work with Dr. Kaya. He worked 80% time in insect nematology and 20% to maintain the greenhouse and headhouse facilities at Orchard Park. He provided great technical support to Dr. Kaya's research program including setting up field plots for entomopathogenic nematode trials, providing laboratory support in numerous greenhouse and laboratory experiments, and making sure that graduate students, visiting scientists, and postdoctoral fellows had the proper supplies and equipment. He had overall supervision of the facilities at the greenhouse and headhouse and made sure that everyone that used the facilities was properly trained. Due to budgetary constraints faced by the Department in the early 1990s, Mr. Burlando found a position with Diamond Walnut in 1995.

Plate 13



N. O. Jones

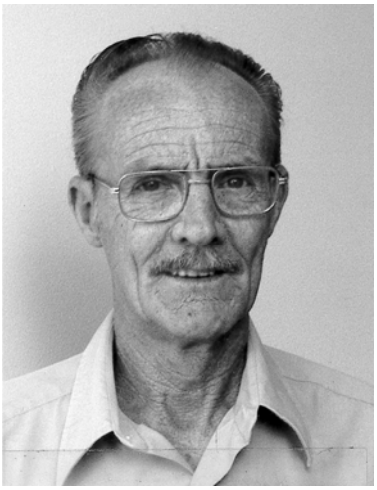


S. T. Miyagawa

Plate 14

E. M. Noffsinger

G. Paxman



R. Schmidt

Space and Equipment

From the beginning in 1954 office space proved to be the most difficult and pressing need. In retrospect the voluntary move of part of Nematology from U.C.B. (where research office quarters were generous and suitable), to U.C.D. without prior provision for office/laboratory space was certainly made from a position of naiveté, inexperience and/or assumed expectations of faculty involved.

With all due respect to Dr. Stanley Bailey, then Chair of Entomology at U.C.D., it was true the availability of space was absolutely minimal. His faculty occupied a building that had previously served as the garage for University cars and trucks. Imposing three more faculty into that tightly crowded facility was an unreasonable burden on that department. The answer was found in a tiny corner room used for storing cans of old insecticide chemicals, diluents, lubricants, etc. That storage room was cleared, then together with a small adjacent area which served mostly for coffee breaks was thoroughly cleaned and painted. Finally a temporary wall and door were added and the resulting space proved barely adequate for three desks and chairs. It served as office quarters for Raski, Lear and Lownsbery for several years in the early humble beginnings of Nematology at U.C. Davis.

Fortunately the special appropriations by the State Legislature provided funds for a full greenhouse and headhouse/laboratory. The site chosen to build these facilities was conveniently in the central part of campus and fully equipped to carry out various research projects. Later, campus plans designated this site as within the 10-minute zone, so-called to define the central part of campus within which students could walk between classes from one to another anywhere within that zone. Greenhouse work was to be located in a more distant area to the west and Nematology's greenhouse itself was moved and reassigned to another department. The original headhouse/laboratory was reassigned to the Department of Botany but Nematology was privileged to redesign completely new, up-to-date facilities and equipment.

Plate 15

C. E. Anderson

T. M. Burlando

Decisions were also taken on how to divide responsibilities for research based on crop types. At U.C.D. Raski was assigned nematodes of grapes; Lear to conduct research on chemicals for control of nematodes; Lownsbery fruit trees and nut crops. Allen at U.C.B. continued his research on field and vegetable crops with specialization on cotton and alfalfa and the taxonomy of nematodes in general. At U.C.R. Baines was assigned citrus, Sher ornamentals and tree crops of southern California other than citrus; Thomason field and vegetable crops of southern California.

Two more significant changes occurred which helped support and strengthen the department and shape its growth for many years. The first concerned the status of Merlin Allen, the only faculty remaining in Berkeley along with several graduate students. It was his preference to remain there and he cooperated with U.C.D. by traveling to campus twice a week to teach courses for Davis students until other faculty could organize the desired courses. Ultimately Dr. Allen came to recognize the persuasive merits of uniting all Nematology in Northern California on one campus. The strengths of his leadership, excellence in teaching and research and communicating skills with industry representatives, plus the valuable resources of the Berkeleynematode collections and great library references all would be of immense aid if brought together with U.C.D. Finally Merlin acceded to such a proposal being advanced to the administration at Berkeley, stating he would abide by their decision however taken but he would not volunteer to request the transfer. At a meeting of U.C.B. department Chairs called by Chancellor Kerr in 1958 it was proposed that Nematology be discontinued at Berkeley and relocated at Davis. The proposal was approved without comment and was accomplished in May 1959 when Dr. Allen left U.C.B. to join the faculty of Nematologists in U.C.D.

Subsequent Faculty, Staff and Space Additions

Faculty and Staff

DAVID R. VIGLIERCHIO

The next faculty position added at U.C.D. was made possible by a grant from the Beet Sugar Development Foundation in 1955. The Foundation was concerned with the heavy losses in beet sugar production caused by the sugar-beet nematode, *Heterodera schachtii*. Dr. David R. Viglierchio (Plate 16) was selected on the basis of his graduate studies and research at the California Institute of Technology. There he completed his B.Sc. degree in Chemistry in 1950 and his Ph.D. in Bioorganic Chemistry in 1955. His special training as well as his subsequent research and teaching added significantly to our knowledge of nematode behavioral responses and patterns, hatching factors, host plant resistance, and nematode physiology and biochemistry. He offered formal courses in Nematode Behavior and Nematode Biology (Appendix Table 10). About 1960, support for this project was shifted to state funds which also provided tenure status for Dr. Viglierchio. He served as chair of the Department of Nematology during 1978-1985 (Appendix Table 7). He retired from the University 10 Oct. 1990 and died September 28, 2005.

The addition of Dr. Viglierchio to the faculty made critical the need for additional office space. Relief came in the form of two adjacent offices located in a temporary building near the campus library. Two similar Quonset style structures, simple in design, lacking air conditioning were originally constructed to serve temporarily for World War II needs. Uncomfortable, especially in hot Davis summers, they were nevertheless most welcome additions. Raski and Lear moved into two offices in one of the buildings; Lownsbery and Viglierchio continued to occupy those quarters originally assigned in the Entomology building. Years later the two Quonset style buildings were demolished to make room for the campus library expansion.

FRANCES WU (KUO)

Ms. Frances Wu (Kuo) was hired as a staff research associate in 1983 and worked with Dr. David Viglierchio. She provided invaluable technical support for his research program in nematode physiology. After his retirement in 1990, Ms. Wu worked 50% time each for Drs. Edward Caswell-Chen (Plate 17) and Scott Gardner. She provided technical assistant to Dr. Caswell-Chen's population genetics program and Dr. Gardner's systematics program. She also assisted in the Nematode Museum making sure that requests for loans of type slides were sent and properly returned. In 1995, Ms.Wu left the Department to obtain further training in the area of medical technology.

Plate 16

W. Hart

D. R. Viglierchio

A. R. Maggenti

H. K. Kaya

ELLA MAE NOFFSINGER

Ella Mae Noffsinger (Plate 14), who joined the department at U.C.D. in 1962 to serve as Laboratory Technician for Dr. Allen, was born Mar. 15, 1934 and raised on a farm/ranch in Center, Colorado located in the San Luis Valley. She graduated from Center High School in 1952; received a B.Sc. degree in 1956 in Animal Production at Colorado State University, Fort Collins; worked from 1956-58 as an assistant to Fields E. Caveness of the Beet Sugar Development Foundation, Fort Collins; and completed requirements for an M.Sc. degree in Zoology at C.S.U. in 1958. From 1958-62 she worked as an assistant to Gerald Thorne at the University of Wisconsin, Madison, WI. During her service with Dr. Allen she also spent 18 months, 1967-69, in Santiago, Chile as a Post-Graduate agriculture Researcher at the Univ. Calif./ Univ. Chile Convenio in Santiago under the direction of Drs. W.H. Hart (Plates 5, 16) and M. W. Allen. After the death of Dr. Allen in 1974 she was appointed Senior Museum Scientist in charge of the U.C.D. Nematode Collection. She also was active in the Society of Nematologists serving on the Executive Board, Editor Nematology Newsletter and numerous other committees. She retired in 1991.

ARMAND R. MAGGENTI

Also in 1958 a new faculty position was made available to Nematology at U.C. Davis. It was defined with a primary responsibility of studying management of *Aphelenchoides spp*. affecting strawberry production in California. A prime candidate for the position was Armand R. Maggenti (Plate 16) who was at that time a graduate student at U. C. Berkeley. Maggenti was born February 15, 1933 in San Jose, California. He completed his B.Sc. in the Department of Entomology and Parasitology at U.C.B. in June 1954 and was nearing completion of his Ph.D. in the same Department under the guidance of Merlin Allen. There remained only his research thesis to be completed on the biology, morphology and taxonomy of the genus *Plectus.* In March 1958 Dr. Raski contacted Maggenti to see if he would be interested in the position with the understanding his appointment depended on completion, approval and filing of his thesis. Maggenti agreed and his thesis was delivered Sept. 31, 1958. His appointment to the faculty at Davis as Lecturer and Assistant Nematologist was effective in October 1958. Dr. Maggenti was a highly successful selection for he proved to have both excellent verbal and writing skills, was an outstandingly popular and respected teacher and major guide for graduate students. He taught General Plant Nematology and Nematode Taxonomy, Comparative Morphology with Dr. Allen later, by himself, Introduction to Nematology, Principles of Nematode Control with Dr. Lear, Principles and Techniques of Nematode Taxonomy and Morphology (Appendix Table 10) at U.C. Davis.

GAYLEN PAXMAN

Dr. Maggenti was provided assistance for his research and teaching in 1972 by the assignment of Gaylen Paxman (Plate 14) as his Research Associate. Paxman began association with the University of California when he applied for graduate student status in Nematology at U.C.B. in the summer of 1957. In July of that year he was appointed as a research assistant to Dr. M.W. Allen. Dr. Allen was transferred to Davis in May, 1959, and Paxman assisted Dr. Maggenti in closing the Department of Nematology at Berkeley. Dr. Maggenti, Mr. Paxman and Bill Nickle (now Dr. Nickle retired USDA) moved all assets of the Department to Davis June 22, 1959. In 1960 Mr. Paxman passed his qualifying exams for the PhD. After this he was assigned to the U.S.D.A. Cotton Field Station at Shafter where he was to assist Dr. Allen in the conduct of field trials. In addition he began conducting research for his dissertation on root knot nematode in potatoes with emphasis on determining the toxin that is present when the potato is green and prohibits the entrance of larvae into the tuber. Mr. Paxman did not complete his thesis and returned to Davis where he was appointed Research Associate to Dr. Allen.

In 1969, while Dr. Allen was in Chile, Paxman worked with Fr. Richard Timm (congregation of the Holy Cross) a visiting Parasitologist-Nematologist from Bangladesh. While Fr. Timm was at U.C.D.

he helped with the Introduction to Nematology class (Appendix Table 10). In 1972 Paxman was assigned as Research Associate to Dr. Maggenti, a position he maintained until retirement in 1991. His work with Dr. Maggenti included research on field-grown ornamentals, fruit and nut trees in the nursery, forest trees in the nursery as well as parasites of fish and birds. Mr. Paxman also was an excellent research librarian, a talent invaluable to the pursuits of Dr. Maggenti. Gaylen Paxman was born July 5, 1929 in Stockton. He died July 26, 2004 at his home in Ripon, California at age 79.

Dr. Maggenti made many outstanding contributions to the control of nematodes in strawberry and ornamental plant production. He also made significant advances in our theories and understanding of nematode phylogeny and the evolution of parasitism in the phylum. His book on "General Nematology" published in 1981 has been particularly useful for reference and teaching purposes with excellent information on the anatomy, morphology, life cycles and classification of the phylum Nematoda. He retired in 1993.

Space Additions and Administrative Actions:

Coincidentally, the second significant change was the building of Hoagland Hall at U.C.D. to provide office and laboratory space for the Department of Soils and Plant Nutrition. It was designed to provide adequate space for the expansion of Soils and Plant Nutrition expected in future years. Meantime the excess space was ideally suited for Nematology, as temporary tenants. It brought all the nematologists together in one building including Dr. Allen from Berkeley and although it was designed fundamentally by and for the Soils and Plant Nutrition sciences nevertheless was close enough to Nematological needs that the differences were not significant. Those fine quarters were enjoyed for twelve years until 1973 when other campus plans dictated the next move, this time to Hutchison Hall.

Sometime about 1960 Nematology faced a serious threat to its identity when the University-wide administration made it known via a memo from Vice President Harry Wellman that small departments, research centers, et al were being reviewed for elimination or possible merger with other departments. Chancellor James Meyer brought this message to a meeting with the Department of Nematology to advise us Nematology had not achieved 'critical mass' as a department and thus was subject to review. About that time, occupants of Hutchison Hall were being reassigned space and in the shuffle Nematology was offered quarters on the 4th and 5th floors of that building. Proximity of Plant Pathology was stressed as one of the advantages besides possibly sharing departmental office space and services with some degree of economy of operations. The ultimate objective seemed to lend weight toward merger with Plant Pathology. The Dean of the College of Agricultural and Environmental Sciences Alex McCalla instructed that merger with Plant Pathology be accepted. Failing that, an alternative proposal for merger of our choice individually or collectively be prepared and delivered to his office. Evidence up to that point in time indicated most members of Nematology preferred merger with Entomology if there was a choice and merger was mandatory. The lone exception was Dr. Bert Lear who preferred moving to Plant Pathology if a move had to be made. Dr. Lear's move to Plant Pathology was promptly implemented by the Dean. However negotiations continued without a resolution until McCalla stepped down as dean and was succeeded by Charles Hess. Dean Hess attempted to merge Nematology by fiat, which was a mistake. In fact the authority to create or remove a department resides with the Chancellor. The final decision on the matter left Nematology as a separate department with teaching jointly administered with Entomology.

A proposal was made to the administration in 1962 to change the name of Plant Nematology by elimination of the adjective 'Plant' to better reflect the breadth and nature of the science of Nematology. As approved formally the name became Department of Nematology. This was followed in 1965 with decentralization of the statewide Department and independent Departments of Nematology were established at U.C.D. and U.C.R.

Nematology in the U.C. Agricultural Extension Service

It was not long after the Department of Nematology was established and the expansion of faculty research and teaching followed that it became quite clear the services of one or more extension specialists were needed. The extension service has a vital role to fulfill being the link between the research program of the University and the growers of California as well as providing assistance in educating the general public on the subject of Nematology.

DOUGLAS E. JOHNSON

Dr. Johnson began his career in the late 1950s when he enrolled in the Soils and Plant Nutrition Department at U.C. Berkeley for study towards a Master of Science degree. In 1959 he transferred to U.C. Davis where he successfully completed, in 1968, a doctorate study under the guidance of Dr. Bert Lear.

He began his career as a Nematologist in the U.C. Agricultural Extension Service in U.C. Berkeley but in later years was stationed mostly at the Kearney Agricultural Center (K.A.C.) in Parlier. He did extensive developmental and demonstration work with fumigant nematicides, including DBCP, for use on field and vegetable crops. Dr. Johnson retired in January 1980 at which time the extension position was transferred to the Department of Nematology at U.C.R. but remained located at K.A.C. The position was subsequently filled by Philip A. Roberts in January 1981.

Shortly after Dr. Johnson was hired, Dr. Ray F. Smith of the Department of Entomology in U.C. Berkeley started a campaign to expand their extension program and made a strong pitch to sell a joint request: two extension specialists who would each share equally 50/50 time for entomology/nematology program needs. Though there may have been some merit to cooperate with a friendly offer from Dr. Smith, there would have been definite advantage to the Entomology Dept. but the benefits to nematology were not so clear. Finally the proposal was gracefully turned down. It seemed much more advantageous to have the full attention, dedication and effort of one person responsive to nematology. In retrospect it is possible part time of two specialists might have served better than one but in fact it is known the specialist who was selected did give a highly satisfactory and effective performance.

WINFIELD HIRAM HART

The conditions at that time did not provide many candidates with qualifications for the position which was finally approved for nematology. Fortunately Winfield Hiram Hart (Plate 5,16) was finally approved for nematology. His record included a Ph.D. degree under guidance of Dr. M.W. Allen at U.C.B. awarded in 1951. Dr. Hart went to work that year in the California Department of Food and Agriculture in Sacramento. Later he transferred to the U.C. Extension Service as a Specialist in Nematology at U.C. Davis. a position he held until he retired in 1984.

Dr. Hart was born in San Jose, CA in 1916. He graduated from San Jose State College with a degree in forestry and worked for the U.S. Forest Service before signing up for military service the day after Pearl Harbor was attacked.

Winfield Hiram Hart passed away in 1997 at the age of 81 leaving his wife, Dorothy, and three sons. He left his colleagues with the memory of his determination that nematode control must meld smoothly with normal farming techniques.

CYNTHIA E. ANDERSON

In 1977, Dr. Hart was provided with a position of Laboratory Technician to assist in his work. Cindy Anderson (Plate 15) filled that position until Dr. Hart retired in 1984. Cindy was born in Massachusetts and moved many times in the U.S. because her father was a career member of the Air

Force which dictated the moves. She ultimately reached Fairfield, CA where she attended Solano Junior College. By 1976 she completed requirements for a Bachelor's Degree in Zoology at U.C. Davis and soon started work with Dr. Hart. Following Dr. Hart's retirement, Cindy held a temporary position in Dr. Howard Ferris's (Plate 17) laboratory. By 1986, Dr. Hart's vacated position was filled by Dr. Becky Westerdahl (Plate 17), Cindy was assigned to assist Becky and has filled that position to the present time.

Visiting Students, Scholars and Interested Individuals

There was, from the beginning, a constant flow of national and international visitors of every sort and for variable periods of time. The shortest period must have been one chap who arrived at the door asking for a briefing of what we knew about nematodes. He requested that this be done in less than one hour as he had a tight schedule! Some were post-doctorals or visiting scientists more likely to be 3 months to a year in collaborative research with a prearranged and agreed-upon subject. The collaborative research projects carried out at U.C. Davis covered a wide range of subjects the results of which made significant contributions to nematology. Some of the outstanding publications included:

1) Dr. Hiroyuki Hirumi who studied the ultrastucture of muscle cells in two plant-parasitic nematode species.

2) Dr. D.R. Roggen who made the first detailed descriptions of cilia in nematode sensory organs and other electron microscope observations of *Xiphinema index*, the vector of fan leaf virus in grapes.

3) Rev. R.W. Timm who accompanied Dr. D.R. Viglierchio on an expedition to Antarctica which was successful in collecting many specimens from type localities from which greatly needed redescriptions were possible in addition to many new species.

4) Prof. Dr. A.C. Coomans who made major taxonomic contributions from specimens collected in Chilean Tierra del Fuego vastly broadening our understanding of interrelationships of many nematode genera and families.

5) Adelina Valenzuela who made possible the journey to Tierra del Fuego by arranging with the cooperation of the University of Chile, the Ministry of Agriculture of Chile and the Chilean Navy to collect specimens of *Criconema giardi*. This provided specimens of fundamental importance in characterizing the genus which had been misunderstood because of inadequate original descriptions.

6) Michel Luc and E. Geraert. First, Michel Luc collaborated in the redescription of *C. giardi* and also in the descriptions of many new species of Criconematidae. Both M. Luc and E. Geraert were members of the team of Luc, Maggenti, Raski, Geraert and Fortuner who completed a monumental revision or reappraisal of Tylenchina helping to restore a great measure of order and taxonomic rationale which for too long had been spinning out of control.

These were extremely valuable contacts for future exchanges of information and progress of research as well as mutual visits and sources of students. (See Appendix Table 1)

Armand Richard Maggenti: Department Chair 1973-1978

In March of 1973 Dr. Raski, then Department Chair, asked Dr. Maggenti to accept appointment as Acting Chair of Nematology; the position was accepted and approved on April 1, 1973. On July 1, 1973, Dr. Maggenti was appointed Chair of Nematology by Dean Alex McCalla. He held that position until 1978 (Appendix Table 7).

Dean McCalla, at that time, was seeking to get acceptance of programs known as *New Directions One* and *New Directions Two*. Both proposals involved the merging or dissolution of many departments in the College of Agriculture. Several departments succumbed to the Dean's pressure, including the Departments of: Soils and Plant Nutrition, Atmospheric Science, and Water Resources, which merged to become the Department of Land Air Water Resources. Nematology staunchly resisted all merger proposals emanating from the Dean's office.

In frustration, the Dean threatened the dissolution of the Department of Nematology. Dr. Maggenti employed the Standing Orders of the Regents and the Rules of the Academic Senate. He showed that forced merger of academic departments was not the prerogative of the Dean and that no precedent for such existed in the history of the University of California. However, the problem did not disappear and continued threats of budget cutbacks and program dissolution caused Dr. Maggenti to reconsider.

The Dean made it quite clear that Dr. Maggenti's position in the College was assured by the Department of Entomology and as such was not in jeopardy but he made no commitment for the remainder of the faculty and staff. The offer was rejected. Dr. Maggenti's motivation was based on his concern that the integrity of the science of Nematology was of paramount importance and must be preserved.

Dr. Maggenti began negotiations with Dr. Oscar Bacon, Chair of Entomology. Two options were developed: (1) merger of Nematology into the Department of Entomology; or (2) merger with Entomology and designation as Department of Entomology and Nematology. The latter was the preferred by both departments but both options were presented to the Dean for his decision.

Unfortunately, in 1974 Dr. Bacon's term as Chair ended and Dean McCalla announced his resignation as Dean of the College of Agricultural and Environmental Sciences. Dean McCalla was reluctant to make a decision that would be binding on the incoming Dean.

Dr. McLean was selected and approved as Chair of the Department of Entomology. Dean Hess replaced Dean McCalla and it was anticipated that either the name change of Entomology would occur or negotiations would resume. However, what transpired was totally unexpected: Dr. Maggenti received notification from Dean Hess that as of July 1 1976 Nematology would be totally merged with Entomology without departmental name change.

Finding this unacceptable, Dr. Maggenti immediately sought counsel with Vice Chancellor Mayhew. Recognizing the urgency of Dr. Maggenti's request for a meeting, the Vice Chancellor agreed to meet that night at his home. Dr. Maggenti presented the Vice Chancellor with the entire file of negotiations with the Dean's office and deliberations of various committees. In addition, Dr. Maggenti presented verification of a pledge by Chancellor Meyer that no decision would be made without his approval, and that negotiation would continue until an amicable conclusion or compromise was achieved. Vice Chancellor Mayhew took the file to Chancellor Meyer the next morning, assuring Dr. Maggenti that if Chancellor Meyer had gone back on his word he would immediately resign as Vice Chancellor.

Chancellor Meyer reminded Dean Hess of his powers and informed him that his precipitous decision was rescinded and that both chairs, Drs. Maggenti and McLean, were to be officially notified.

The end result was that Dean Hess offered a compromise that both departments accepted: Nematology would retain title integrity as the Division of Nematology (research department) and the teaching of Nematology would be under the administration of Entomology. Under the recommendation of Assistant Dean Chris Grain, the two teaching budgets were to remain independent and Nematology gained a half-time secretary in Entomology to handle the teaching program. By 1976, Nematology achieved some degree of stability and had retained integrity and recognition.

Throughout his period as Chair, Dr. Maggenti had maintained his commitment to teaching. In 1974, following the untimely death of Dr. Merlin Allen (Dr. Maggenti's major professor), Maggenti

assumed Allen's teaching responsibilities. He became responsible for Nematology 220, 225, seminars and the undergraduate course, Nematology 110. A new course, Entomology 156 (co-taught by Nematology, Entomology, the Medical School and the School of Veterinary Medicine) was initiated at the same time. Dr. Maggenti became responsible for 30% of the teaching of this course. At the time of his retirement in 1993 he had taught Nematology to more than 3000 students in formal University courses.

It was also in 1976 that the vision of Drs. Maggenti and Viglierchio for Nematology to begin achieving its potential, embracing all aspects of the science, began to come to fruition. Dr. Harry Kaya was hired to study the nematode parasites of insects with an aim at biological control. Drs. Viglierchio, Allen and Maggenti had already commenced research on the physiology, taxonomy and morphology of marine nematodes.

During this period Dr. Maggenti continued his basic research on the systematics and comparative morphology of plant parasitic nematodes as well as nematode parasites of freshwater fish and riparian birds. He accepted requests to write or contribute to several publications and books. Among the commitments accepted were McGraw-Hill's Encyclopedias, a textbook of Nematology, and McGraw-Hill's Synopsis of Living organisms. The later outcome of these publications led to Dr. Maggenti and his wife (Mary Ann [Basinger]) of 25 years and a 15 year volunteer in his laboratory, being selected as two of three lexicographers on Invertebrate Zoology for the Random House Dictionary of the English language 2nd Ed unabridged. Their unpublished manuscript, a Dictionary of Invertebrate Zoology, is now in the possession of Dr. Scott Gardner of the University of Nebraska.

Dr. Maggenti requested that he be relieved of his duties as Chair of the Division of Nematology and recommended that Dr. Viglierchio be appointed as acting chair in June of 1978. Dr. Viglierchio was appointed Chair on July 1, 1978.

In 1982, Dr. Maggenti went on to serve as Associate Dean of Student Matters in the Division of Biological Sciences under Dean McLean (former chair of Entomology). He served in this capacity from 1982 to 1987. Armand R. Maggenti retired in 1993.

Further Reorganizations at U.C. Davis

The Department at U.C.D. was further reorganized in 1976 as a research unit and renamed Division of Nematology. By 1987 it reverted to Department of Nematology.

The death of Dr. Merlin Allen at the age of 62 in 1974 was a great loss to Nematology. Dr. H. K. Kaya was selected as his replacement and hired as insect nematologist/entomologist.

HARRY K. KAYA

Harry K. Kaya (Plate 16), who was raised in Honolulu, Hawaii, received his B.S. (1962) from the College of Tropical Agriculture, University of Hawaii. After discharge as a first lieutenant from military service (Signal Corps, US Army), he entered graduate school at the University of Hawaii, receiving the M.S. degree (1964) in entomology (insect ecology). He then went to University of California, Berkeley and received his Ph.D. (1970) in entomology (insect pathology). He was hired as an assistant entomologist at the Connecticut Agricultural Experiment Station, New Haven in 1971 and conducted research on biological control of forest insects. He was promoted to associate entomologist in 1974. In 1976, he was offered an assistant professorship with 75% research in the Division of Nematology and 25% teaching in the Department of Entomology. Research responsibilities were in the area of insect nematology and insect pathology with teaching emphasis in insect pathology and biological control.

Harry Kaya was promoted to Associate Professor in 1979 and Professor in 1984. He served as Chair of the Department from 1994 to 2001. He was elected as a SON Fellow and has received awards from the Society for Invertebrate Pathology, the University of Hawaii, and the Entomological Society of America. He has served as an officer in Society for Invertebrate Pathology (Treasurer, 1990 to 1994, Vice-President 2000-2002, and President-elect 2002-2004).

He has made significant contributions in entomopathogenic nematodes. His laboratory's many contributions include the following:

a) these nematodes could be encapsulated in alginate gels that offered a means of long-term storage;
b) they could be combined with certain agents increasing their efficacy against soil insects;
c) some species had jumping behavior; and
d) the sheath around the infective stage of juvenile nematodes served as a barrier against infection by some nematophagous fungi.

Harry Kaya has taught a number of courses in Entomology including insect pathology, general entomology, entomopathogenic nematodes, biological control, and natural history of insects for non-majors. In Nematology he taught courses in Ecology of Parasitic Nematodes and Nematodes of Invertebrates (Appendix Table 10).

A number of graduate students and visiting scientists have been trained in his laboratory. Doctoral students include Arnold Hara, Robin Giblin-Davis, Phyllis Hotchkin (Weintraub), Raquel Alatorre Rosas, Richard Dunkle, Mary Barbercheck, Patricia Timper, Jennifer Woodring, John Studdert, James Campbell, and Lien Luong. Masters students include Patricia Molye, Xinsheng (Tom) Zhou, and Darryl Mitani. Visiting scholars include Dr. Ho Yul Choo (Korea), Dr. Patricia Stock (Argentina), Dr. Jaime Ruiz (Mexico), Dr. Jamie Molina (Mexico), Mr. Joao Amaral (Portugal), Mr. Buncha Chinnasri (Thailand), Ms. Vacharee Somsook (Thailand), Dr. Albrecht Koppenhöfer (Germany), Dr. Sudershan Ganguly (India), Ms. Ursula Közler (Germany), and Mr. Selcuk Hazir (Turkey). Postdoctoral fellows in his laboratory include Kirk Smith, Matthew Baur, and Albrecht Koppenhöfer.

ALMA P. ELLIOTT

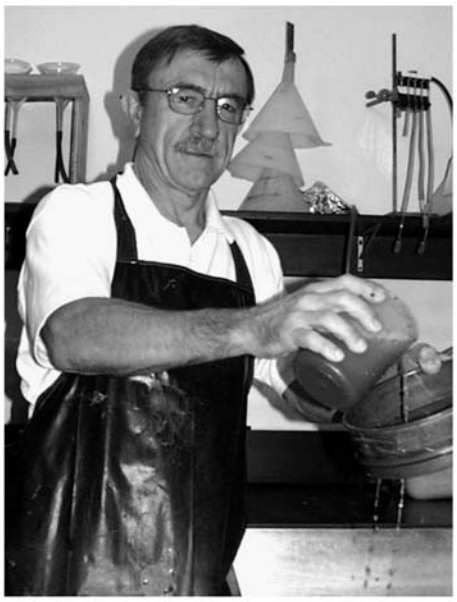
In 1984 Dr. Alma P. Elliott was selected to fill a position funded by an Affirmative Action Agency. She had earned her B.Sc. and M.Sc. in 1972 and '76 at the University of West Indies in Chemistry and Agriculture respectively. She completed the requirements for Ph.D. at Michigan State University in 1980 in Entomology/Nematology under the direction of Dr. G.W. Bird. At U.C.D. she taught General Plant Nematology (Appendix Table 10) and diagnostic techniques for plant-parastici nematodes. Her research was intended to cover diagnostic techniques, nematode ecology and host-parasite interactions. Unfortunately her career was short-lived and she resigned in 1986. Citing personal reasons, she returned to St. Lucia, West Indies.

EDWARD P. CASWELL-CHEN

Edward Caswell-Chen (Plate 17) was born and raised in Michigan and attended Michigan State University where he obtained his B.S. and M.S. in Botany and Plant Pathology in 1979 and 1982, respectively His M.S. degree research was conducted with Dr. G. W. Bird, and focused on nematode parasites of field corn in Michigan. He received a Ph.D. in plant pathology at the University of California, Riverside in 1985 under the guidance of Dr. I. J. Thomason, with research on host-parasite ecology of the sugarbeet cyst nematode. In August 1985 he accepted a position as an Assistant Professor of Plant Pathology at the University of Hawaii at Manoa. His research in Hawaii addressed nematode management in pineapple, with a focus on alternatives to chemical nematicides. In February 1989 he joined U.C.D. as an Assistant Professor and Assistant Nematologist. Among Dr. Caswell-Chen's formal

course offerings were Introduction to Nematology, Ecology of Parasitic Nematodes, Advanced Plant Nematology (Appendix Table 10).

Plate 17



H. Ferris

B.B. Westerdahl

B. A. Jaffee

E. P. Caswell-Chen

The research conducted in the Caswell-Chen lab currently addresses several areas in nematode ecology and biology. A principal interest is how nematode life history attributes influence the population interactions between nematode parasites and their hosts, and how hosts exert selection pressure on

parasite populations. From the applied perspective, the integrated pest management of nematode parasites of ornamental and agricultural plants, with the goal of developing new approaches to nematode management is a primary focus. His lab is also investigating the life history attributes of *Caenorhabditis elegans* relative to aging, with the idea that the nematode serves as a model system for gaining insights into aging in other organisms, including humans.

He has served as the master advisor for the Graduate Group in Plant Protection and Pest Management, and currently serves as the Vice-Chair and master advisor for the Graduate Group in Ecology. In July 2001 he started a five-year term as Chair of the Department of Nematology. Ed notes that "I'm excited to be working with our outstanding faculty in maintaining and improving our teaching, research, and extension. The research in our department addresses important and intriguing questions in nematode ecology and evolutionary biology, and in the management of nematode parasites of plants, animals, and humans."

HOWARD FERRIS

Howard Ferris (Plate 17) was born in Rochdale, England, August 27, 1942. His family migrated to southern Africa, living first in Capetown, South Africa and then in Gweru, Zimbabwe. His high school education was at Chaplin School in Gweru and, for two years, at Christchurch Boys' High School in Christchurch, New Zealand. After graduating high school he was invited to work for the summer at the Tobacco Research Board of Zimbabwe, as a short-list candidate for an academic scholarship. At that institution he was assigned to the Nematology Department under the mentorship of Dr. R.A.C. Daulton. Daulton assigned Ferris two tasks that summer:

1) To read and inwardly digest the first three chapters of J. R. Christie's book "Plant Nematodes, Their Bionomics and Control" (Daulton told Ferris "If you read that material you will have a solid grasp of the current status of Nematology");
2) To collect and propagate the common weed species growing on the research station (there were about 18) and to determine their host status to *Meloidogyne javanica*.

The scholarship was awarded and Ferris studied botany and zoology at the University College of Rhodesia and Nyasaland, a college of the University of London. A proviso of the scholarship award was the requirement to work each summer in the Nematology Department at the research institute and for a further three years following graduation. After graduation, Ferris was sent to the Agricultural University in Wageningen, Netherlands to attend a "total immersion" course in all aspects of Nematology. There he studied with Oostenbrink, Hijink, Loof, s'Jacob, Seinhorst and several other prominent Nematologists. After returning from that course he started research on a MSc project in Zimbabwe as an external student of the University of London.

Those were politically unsettled times in Zimbabwe and Ferris was drafted into the army in the middle of the MSc program. A requirement for completion of the MSc degree was thesis defense before a committee chaired by Dr. Nigel Hague on the parent campus in England. While in England in 1968, he received news that his position at the Tobacco Research Board in Zimbabwe had been terminated as a result of downscaling in response to international economic sanctions on the tobacco industry. He contacted Daulton, who by then was working for the Dow Chemical Company in Zurich, Switzerland and was offered a position with Dow Europe. Unsure whether that option met his career goals, Ferris returned to Zimbabwe where colleagues with contacts at North Carolina State University recommended him for graduate study with Dr. J.C. Nusbaum in the Department of Plant Pathology. He began studying for the Ph.D. degree in September 1968. Among his responsibilities at NC State University, Ferris worked with Nusbaum's technician, DeWitt Byrd, Jr., processing soil samples and assessing nematode populations in field plots conducted by Mr. Furney A. Todd in his Extension Research-on-Wheels program. Working

with Byrd, and following his admonition that "remember Howard, there are always quicker, easier and more efficient way to do things" led to their development of the automated elutriator.

After completion of the Ph.D. program, Ferris was offered two positions; one at the International Potato Center in Lima Peru, the other in the Department of Nematology at U.C. Riverside. He accepted the latter and was appointed Acting Assistant Nematologist on July 1, 1972.

Ferris's academic career at U.C. Riverside was influenced by then department chair S.D. Van Gundy who guided him from the research series appointment to a professorial appointment as Assistant Professor of Nematology and Assistant Nematologist. Teaching responsibilities included taking over Nematology 216: Nematode Diseases of Plants, from Ivan Thomason (Appendix Table 11). He was also involved in the development and steering of the Master's degree program in Pest Management and taught the modeling course for that program.

At the statewide level, Ferris served on the committee that designed the University of California's Integrated Pest Management Program. He served as a member of the Technical Committee of the project for many years and as Associate Director of the project in the early 1980s. In 1984, the position of Chair of the U.C. Davis Division of Nematology was advertised, and Ferris applied. He accepted the position after assurance by Dean Charles E. Hess that the unit would be supported in growth and resource development. Ferris moved to Davis in May 1985. Teaching responsibilities at U.C.D. include General Plant Nematology and Advanced Plant Nematology (Appendix Table 10).

BRUCE JAFFEE

Bruce Jaffee (Plate 17) came to U.C. Davis as an Assistant Professor of Nematology in 1986 filling the position vacated by the retirement of Dr. Lownsbery in 1983. He was born in Detroit, Michigan, went to high school in Los Angeles, and attended many universities in California. He studied English at UCLA and U.C. Berkeley but quit in his junior year to avoid the military draft and to become a mailman. After sorting and delivering mail for 3 years, he returned to school and in 1975 received a B.S. in Fruit Science from California Polytechnic State University in San Luis Obispo. At Cornell University, he studied nematology with Bill Mai and upon completing his Ph.D. in 1981, worked as a post doc with Eldon Zehr at Clemson University. In 1983, Jaffee was appointed assistant professor of plant pathology at the Pennsylvania State University; he was stationed at the Fruit Research Laboratory, Biglerville PA.

At U.C. Davis, Jaffee studied biological control of plant-parasitic nematodes. He has worked primarily with the fungus *Hirsutella rhossiliensis* and with several species of nematode-trapping fungi, and he has focused on quantifying fungus activity and on understanding why these fungi seem to be ineffective control agents. Jaffee also taught courses in scientific writing and in soil ecology. Other teaching responsibilities involve the formal courses Nematodes and the Soil Environment, Advanced Plant Nematology, Biological Control in Insect and Plant Nematology (Appendix Table 10). Dr. Jafffee retired from the University of California in 2007 to pursue his interests as a science editor.

VALERIE MOROZ WILLIAMSON

Dr. Valerie Moroz Williamson (Plate 18) was born in Claremont, N.H. on September 15, 1948. She graduated from Northeastern University in Boston, Massachusetts with a B.A. degree in Biology. After working for three years as a research assistant in the Institute of Marine Science at the University of Alaska, Fairbanks, she entered the Ph.D. program in Biochemistry at the University of California, Davis. There she carried out research on the enzyme RNA polymerase from *Bacillus subtilis* under the supervision of Dr. Roy Doi. She received her Ph.D. in 1978 and then worked as a postdoctoral researcher on yeast molecular genetics at the University of Washington for the next three years. During this period she cloned and characterized genes encoding alcohol dehydrogenase from yeast. In 1981 she became a

research scientist at the ARCO Plant Cell Research Institute in Dublin, California. There her group discovered that movement of a retrovirus-like mutagenic transposon in yeast was strongly influenced by temperature. She also began a project aimed at cloning the root-knot nematode resistance gene *Mi* from tomato.

In 1987 Williamson moved to the Nematology Department at the University of California, Davis, where she continued to work toward cloning *Mi*. This work resulted in the development of a DNA marker that is widely used by breeders for following the inheritance of the *Mi* gene. Working with collaborators in the Entomology Department, Williamson's group discovered that resistance to the potato aphid was associated with nematode resistance in tomato. Williamson was an investigator at CEPRAP the N.S.F. Science and Technology Center at U.C. Davis from 1991-2002. Her group cloned the *Mi* gene there in 1997. Assays with transgenic tomato confirmed that nematode resistance and aphid resistance are

Plate 18

V. M. Williamson

S. A. Nadler

mediated by the same gene. This was the first finding of a single gene that conferred specific resistance against an insect and the first discovery of a gene conferring resistance against two pathogens from distinct phyla. Williamson also worked with Caswell-Chen and Westerdahl in the Department to introduce the use of molecular techniques into nematode diagnostics. Williamson became a full professor in 1997 and has been responsible for training students and postdoctoral researchers in the use of molecular techniques in nematology and plant molecular biology. Dr. Williamson is responsible for the formal classes Molecular and Physiological Plant Nematology, Advanced Plant Nematology (Appendix Table 10).

BECKY BROWN WESTERDAHL

Dr. Becky Westerdahl (Plate 17) who earned her B.Sc. in 1972 at the University of California, Irvine specializing in Biology. Her Ph.D. in Biology followed in 1978 at U.C. Riverside where she specialized in Nematology. From 1977 - Nov. 1981 she served as Post Graduate Research Entomologist with Drs. N.E. Gary and R.K. Washino at U.C. Davis. Then from Nov. 1981 - Dec. 1985 was Technical Representative, and subsequently, Regional Manager for a commercial firm, Biochem Products. She returned to U.C. Davis in 1986 taking up the position vacated by Dr. W.H. Hart in 1984 and continues in that position currently as Associate Professor/Extension Nematologist in the Department of Nematology.

Dr. Becky Westerdahl who had a 100% CE appointment taught Entomology 156, Biology of Parasitism, a course that Dr. Gardner taught with two other faculty members. Dr. Westerdahl also began teaching a graduate course in Nematology and presents classes in Management of Plant-Parasitic Nematode, also Biological Science (Appendix Table 10). Because CE specialists do not get much credit for teaching in formal undergraduate or graduate courses, she was disadvantaged by not having a teaching (I&R) appointment. The Department supported her teaching activities and through a formal application process, she received a 0.15 I&R appointment (Acting Associate Professor) from the Chancellor. She was one of the first 100% CE specialists to receive a teaching appointment and become a member of the Academic Senate. She received tenure in 1997 and the "acting" title was removed.

SCOTT L. GARDNER

The Department recruited another faculty member in the area of taxonomy and systematics when Dr. D.J. Raski retired in 1987. Dr. Scott Gardner filled the position. Dr. Scott Lyell Gardner was born in Hillsboro, Oregon on June 2, 1956. He graduated from Gaston Union High School and then continued his education first at the University of Alaska, Fairbanks and later at Oregon State University where he graduated with a B.S. in Biology. He received his Masters of Arts degree in Zoology/Parasitology from the University of Northern Colorado, Greeley, Colorado where he worked with Gerald D. Schmidt. He completed his Ph.D. at the University of New Mexico where he studied phylogeny and coevolution of nematodes parasites of mammals of the Neotropical region. After a one-year post-doc working on coccidian parasites of the genus *Eimeria*, he was appointed to the position of Curator of Nematology and Assistant Professor in the Department of Nematology, U.C. Davis.

While at UCD, Scott worked on several projects, including the parasites of mammals of Bolivia, nematodes of native and cultivated grapevines in California, nematode/mammal coevolution and cophylogeny, a database of nematodes in the U.C. Davis nematode collection (UCDNC), and the taxonomy and systematics of nematodes and cestodes of both mammals and plants in California and Bolivia. Teaching responsibilities included an Introduction to Nematology, Nematode Taxonomy and Comparative Morphology classes (Appendix 10). Scott left U.C. Davis in 1994 to become Director and Curator of the Harold W. Manter Laboratory of Parasitology in the Division of Parasitology in the University of Nebraska State Museum. He also is an associate curator in Mammalogy at the American Museum of Natural History, New York.

After the resignation of Dr. Gardner in 1994, the systematics position was returned to the Department and Dr. Steven Nadler was hired in 1996.

STEVEN A. NADLER

Dr. Steve Nadler (Plate 18) received his Ph.D. in Medical Parasitology from Louisiana State University Medical Center in 1985. His dissertation research concerned the molecular systematics and population genetics of nematode parasites of vertebrates. From 1985 to 1986 he was a postdoctoral fellow in the lab of Dr. Bronislaw Honigberg at the Center for Parasitology, University of Massachusetts, Amherst. From November 1986 through December 1989, Nadler was a postdoctoral fellow in the

laboratory of Dr. Mark Hafner at the Louisiana State University Museum of Natural Science, where he pursued research on host-parasite cophylogeny.

In January of 1990, Nadler was appointed Assistant Professor of Biological Sciences at Northern Illinois University, DeKalb. His work at NIU emphasized the phylogeny of ascaridoid nematodes, as inferred by using molecular sequence data. In July 1996 Nadler was appointed Associate Professor and Associate Nematologist in the Department of Nematology at UCD, and was also appointed Curator of the nematode collection. Dr. Nadler's research focuses on using molecular sequence data to understand nematode evolution, including such topics as species delimitation, character evolution, and molecular evolution. Nadler's laboratory studies both vertebrate parasites and free-living nematodes, and he shares responsibility for a National Science Foundation PEET (Partnerships for Enhancing Expertise in Taxonomy) grant with Dr. Jim Baldwin (Plate 22) (UCR) that is designed to provide a more comprehensive understanding of the systematics of cephalob nematodes. Teaching responsibilities were assumed with the Introduction to Nematology, Nematode Systematics and Evolution classes (Appendix Table 10).

One assignment for Dr. Nadler was to be the curator of the U.C.D. Nematode Collection. Dr. Scott Gardner also had this responsibility, but the day-to-day operation of the U.C.D. Nematode Collection was conducted by Ella Mae Noffsinger who was the Museum Specialist. Ms. Noffsinger retired in 1991 and over the next 8 years, several individuals were employed on a part-time basis to handle this facility. Only partial funding was provided to support this important facility and, consequently, the work was performed by part-time employees. Soon after his arrival, Dr. Nadler hired Dr. Patricia Stock on a part-time basis to oversee the Collection. We were able to secure sufficient funds equal to a Staff Research Associate II for the facility and Dr. Stock, supplemented by grant funds from Dr. Nadler, was hired as a full-time Museum Specialist in 1998. Dr. Nadler was also able to secure N.S.F. funds to upgrade the facility.

The 1983 USDA-CSRS Review

In 1983, a very significant event, a USDA-CSRS review, was conducted the results of which affected the future of the nematology as a discipline in California. This USDA-CSRS review of nematology statewide was requested by the administration at U.C. Davis as a basis for deciding the future of the program on that campus. However, Dr. Seymour Van Gundy (Plate 19) and others at U.C. Riverside suggested that the future of Nematology at Davis should be reviewed in the context of the statewide program and priorities.

The review team consisted of:

- Dr. John F. Fulkerson, USDA-CSRS, Washington DC. (Chair).
- Dr. Kenneth R. Barker, Department of Plant Pathology, North Carolina State University, Raleigh NC.
- Dr. John Webster, Department of Biological Sciences, Simon Fraser University, Burnaby, Canada.
- Dr. John Anderson, Department of Entomology, U.C. Berkeley.

Extensive data on personnel, history and programs were assembled on both the Davis and Riverside departments. The team traveled to key locations in the state and interviewed administrators, representatives of the agricultural industry, and faculty at U.C. Berkeley, U.C. Davis, U.C. Riverside, and the Kearney Agricultural Center. On the last day of the review, the team provided an oral summary report in a meeting at U.C. Riverside. Dean Charles E. Hess and Executive Associate Dean Calvin Qualset attended that meeting from the Davis campus, and most of faculty from both departments.

The review team recommended that a strong presence in Nematology was necessary at U.C. Davis to support research, extension and teaching needs in the state. Members of the team also addressed the abrasiveness of historical and recent interactions between the department and administration on the Davis

campus that had evolved from the various administrative maneuvers related to department size. Chairman Fulkerson and the review team suggested that in light of the severity of the figurative battle scars, one of the positions provided for growth of the department should be committed to recruiting a new chair from outside the unit.

The Regrowth and Redirection Years under Howard Ferris: 1985-1990

Dean Hess accepted the recommendations and appointed a search committee that conducted an international search for a new chair of the division. The search committee along with the faculty selected Dr. Howard Ferris as the new chair and he transferred from U.C. Riverside in May 1985 to lead the Division.

As part of the negotiation, Ferris accepted the position only with assurance from Dean Hess that the positions vacated by retirement of Dr. Bert Lear (Plant Pathology) and Dr. Benjamin Lownsbery would be returned to the unit, at least one new position would be created, some additional space would be allocated, and reorganization of the unit as a department would be supported. Dean Hess proved true to his commitments, and over a period of a few years, Drs. Bruce Jaffee who would conduct research in biological control of nematodes and Becky Westerdahl who would replace Dr. Winfield Hart as the CE specialist were recruited and added to the faculty.

One of the priorities of the department was to establish a program in molecular biology. That was seen as a vehicle to address application of the emerging technology in understanding the host-parasite interaction, engineering host-plant resistance, and capitalizing on the dramatic advances being made with *Caenorhabditis elegans*. While the Dean accepted the rationale for the program, he was only willing to commit half the funding for a position. He indicated that the department should find the balance of the funds from within its current budget. Ferris considered that such redirection would have a negative impact on existing programs and would adversely affect morale in the unit, so no immediate moves were made.

Space additions to the department consisted of two laboratories formerly occupied by the Department of Avian Sciences at the east end of the 4th floor of Hutchison Hall, and the small laboratory formerly occupied by Dr. Bert Lear in Plant Pathology. The department was also able to acquire three offices in the bridge between Storer and Hutchison halls that were occupied by the Statewide Pesticide Coordinator and staff. The College provided funds for remodeling of laboratory space for Dr. Jaffee.

A major change occurred in 1987. After eleven years as research unit (i.e., Division of Nematology), the U.C. Regents approved the proposal by Ferris, and supported by higher administration, that the Division of Nematology be granted departmental status. Accordingly, by becoming the Department of Nematology, the teaching responsibilities were transferred back to the unit from the Department of Entomology.

Not everything was positive on the space front, however. By 1987, there had been considerable growth in the biochemistry and molecular biology components of the Plant Pathology program, primarily located on the 5th floor of Hutchison Hall. Plant Pathology successfully argued, in the interests of program consolidation, for the transfer of the laboratory occupied by Dr. David Viglierchio on that floor. The only space of equivalent size that could be identified was headhouse 632 at Orchard Park. The Department of Land, Air and Water Resources were using that space essentially for storage. Dean Hess provided funding for remodeling and upgrade of the space to accommodate Viglierchio's program.

The forced move of Dr. Viglierchio to the Orchard Park headhouse resulted in physical fragmentation of the unit. Ferris successfully made the case with Dean Hess that the negative impression

regarding the administration's support of Nematology could be offset by provision of the balance of funding needed for the molecular biology position. Those funds were provided and Dr. Valerie Williamson joined the department in 1988. The hiring required extensive remodeling of the laboratory space formerly occupied by Dr. Raski who retired in 1987.

Following the resignation of Dr. Alma Elliott in 1986, Dean Hess continued his support on the program by returning the vacated position. Dr. Edward Caswell-Chen filled that position.

In part to highlight the new directions and new personnel, but also to contribute to the evolution of the discipline, the department hosted several significant events, including:

- a symposium on nematode vectors of plant viruses to honor Dr. Dewey J. Raski on his retirement in 1987
- a statewide planning and "state of the science" meeting associated with the California Nematology Workshop in 1986
- the annual meeting of the Society of Nematologists in 1989.

The Budget Depression Years Under Howard Ferris: 1990-1993

The State of California entered a period of fiscal crisis in 1990. It resulted in a substantial decrease in the budget allocations to the University of California. Recognizing that there were substantial funds available in its retirement programs, the university initiated an early-retirement plan to relieve salary demands on the annual budget. Those accepting the early retirement offer were credited with several years of service, which increased their retirement income. Dr. Armand Maggenti and two long-term staff members, Gaylen Paxman and Ella Mae Noffsinger accepted the early retirement package.

In response to the budget cuts and to perceived differences in allocations among departments within the College, a faculty committee chaired by Dr. George Bruening was assembled to review the allocation practices. The Resource Allocation Committee (RAC) made suggestions that were adopted by the college administration. Essentially, the RAC formula distributes funds to departments based on numbers of faculty, magnitude of the teaching program, travel and support for the extension program, and any special facility needs.

The result of application of the RAC formula was that the budget allocation to Nematology decreased by about 30%. That dictated further cost-saving measures. The department no longer had sufficient resources to support full time technicians (Staff Research Associates) assigned to faculty research programs. To avoid layoffs, faculty shared technical support staff among programs, but that resulted in a loss of efficiency, and there were problems associated with lack of program-specific technical skills. There was some hope that the budgetary situation would improve and full time support for Staff Research Associates would return. To further budgetary savings, the department's administrative office was clustered with that of the Department of Plant Pathology. While that merger of services sometimes conveys the impression of merger of programs, the department remained programmatically intact and unique. One advantage of the merger was that the administrative unit is large enough to allow trained specialists in various areas of administration to support the scientific staff.

Another initiative to attempt to reduce administrative overhead was the effort to capture advances in computer technology and to develop the electronic office. The notion was that all faculty offices and laboratories would be linked via an intranet which would provide electronic processing of orders, timesheets and access to budgetary information. Development of that project proved costly and not entirely compatible with university procedures at levels above the department. However, the system has

developed quite well within the administrative office and for immediate access to records and information.

Ferris stepped down as chair of the department in 1994 and the role was accepted by Dr. Harry Kaya.

The Harry Kaya Years – 1994 to 2001

After 9 years at the helm of the Department and hiring several new faculty members (Jaffee, Westerdahl, Williamson, and Gardner), Dr. Howard Ferris returned to full-time teaching and research. Dr. Harry Kaya accepted the role of chair of the Department. The clustered administration with the Department of Plant Pathology was in place and a program analyst, who worked for both departments and had a two-year contract, was in place. However, the budgetary situation for the Department was not improving and a major crisis was facing the Department with much of the budget used for two Staff Research Associates. Dr. Kaya appointed a resource committee (Drs. Jaffee, Williamson and Kaya) to examine the technical support issue. It was apparent that the department could no longer support the two Staff Research Associates (Thomas Burlando and Frances Wu) and they left the Department in 1995.

The Program Analyst that was employed in the clustered administrative office and paid from the Nematology budget also left in 1995 and a search was initiated to find a replacement. The position which had been on a renewable two-year contract was turned into a career Program Analyst position and Manuel Melliza was hired to fill it.

Dr. Scott Gardner resigned his systematics position in 1994. The position was returned to the department and Dr. Steve Nadler was hired in 1996.

Limited laboratory space has always been a problem for Nematology. Dr. Viglierchio had relinquished his space to Plant Pathology and was relocated off the main campus site to Orchard Park. Upon Dr. Viglierchio's retirement in 1990, Dr. Ferris moved into this laboratory. This situation was not ideal and Dr. Ferris was isolated not only from the Department but also from the main campus. In 1998, space became available on the first floor of the South Wing of Robbins Hall. Dr. Ferris moved back to campus into this laboratory. Dr. Westerdahl was also located in substandard space in Hutchison Hall. Another laboratory became available adjacent to Dr. Ferris and Dr. Westerdahl moved into this laboratory in 1999. However, the College, also facing a tremendous space crunch, had impromptu plans for the space occupied by Dr. Ferris and Dr. Westerdahl. The College decided that the Genomic Programs would be housed in the South Wing of Robbins Hall. Fortunately, after several anxious weeks, satisfactory laboratory space for Dr. Westerdahl and Dr. Ferris was secured, renovated, and occupied in 2000.

Edward Caswell-Chen, Chair 2001-present

During Dr. Caswell-Chen's tenure, construction of the Contained Research Facility began. The initiative and need for this facility can be traced to a proposal by Dr. David Viglierchio in the early 1980s. There was further development of the proposal by a committee chaired by Robert Webster (Plant Pathology) and Howard Ferris (Nematology) in 1986. Harry Kaya and Ed Caswell-Chen served on the building committee that oversaw the design and implementation of the facility. The facility will allow research on quarantine nematodes, pathogens, insects, and weeds at U.C.D.

During 2001-2002 plans for increased space for the department in Hutchison Hall were implemented. This represents the first real improvement in permanent space for the department in 20 years. Adequate space for students, postdocs, and visitors will significantly enhance the ability of the U.C.D. department to compete effectively in the research arena.

In 2002 a challenge donation of ten thousand dollars was made to the Nematology Department to initiate an endowment in support of graduate students pursuing research in Nematology. This was a generous and valuable contribution to our programs, and efforts are underway to build on this initial donation.

The year 2001-2002 saw a severe economic downturn in California and much time was spent formulating plans for a possible 12% budget cut. As of July, 2002, there is no certainty concerning the magnitude of the cut. However, a 12% budget cut would require significant changes in the structure and size of the College.

The department at U.C.D. made major efforts to expand our teaching contact with undergraduate students. Dr. Westerdahl taught Biological Science 10V to about 140 students. This is the first time that a departmental faculty member taught in the biological sciences and was unique in that the course is delivered via computer. Dr. Caswell-Chen and Dr. Nadler were involved in the development, implementation, and department involvement in the new CA&ES major in "Animal Biology". During 2001-2001 there were approximately 100 undergraduate students involved. This represents a new venture by the department in undergraduate teaching.

MAJOR CONTRIBUTIONS AND ACHIEVEMENTS IN THE FIRST 50 YEARS

TEACHING

Appendix Table 1 (U.C. Davis) and Appendix Table 4 (U.C. Riverside) are clear evidence of the successful program of training students in Nematology. Graduates are found in many states throughout the U.S. holding responsible positions as teachers themselves or serving in industry. Besides, graduates are fulfilling notable careers in other countries throughout the world. Formal courses taught at Berkeley, Davis and Riverside are listed in Appendix Tables 9, 10 and 11.

RESEARCH

1. **Systematics and Taxonomy**.

From the outset there was minimal knowledge about the kinds of nematodes in California soils, their prevalence and extent of damage to crop plants. Meaningful studies can be planned and carried out only when there is reliable and exact information on the species involved. A full appreciation of this was part of the indoctrination of students in the Department of Entomology headed by Prof. E.O. Essig. He encouraged every graduate student to take on a group of species or genera as a personal study. In this way they would have direct experience with the problems of categorizing and naming insects representing new species. Ultimately the students would learn more about species concepts and the fundamental significance of systematics/taxonomy to all biological research. Dr. Merlin Allen was the principal taxonomist who established the U.C. Nematode Collection and was responsible for the preservation and cataloguing of specimens. In addition, at least three other members of the original staff at U.C.D. contributed significantly to our knowledge of nematode morphology/taxonomy: Dr. A.R. Maggenti, an authority on nematode morphology and phylogeny; Dr. D.J. Raski most notably prolific in revisions of the Criconematoidea and Tylenchidae; and Dr. B.F. Lownsbery on a wide range of species.

In addition, one of the early taxonomists was S.A. Sher of U.C. Riverside. As a student he came under the general guidance of Prof. E.O. Essig and studied with Merlin Allen who served as his major professor. Dr. Sher contributed widely to many important plant parasitic species and genera.

2. **Distribution and Host Range**.

Information from field samples was particularly important in judging the significance of a given nematode species. A few had been known only from very restricted areas in a single county. Others, such

as root-knot nematode, were found to be widely distributed throughout every major agricultural area in California. Field samples also added to our knowledge of the range of host plants for each species. Soon laboratory and greenhouse tests augmented those records by testing many more kinds of plants. Accurate and reliable host plant data are fundamental to preparing effective crop rotation schemes.

3. **Pathogenicity**.

For many years Nematology was handicapped by Koch's Postulates which defined the conditions required in order to establish pathogenicity of bacterial, fungal, viral or other organisms studied by Plant Pathologists. To conclude that a given organism is the causal agent for a host plant injury the suspected pathogen had to be produced in pure culture, introduced in or around the host, shown to produce prescribed symptoms then finally recovered again as a pure culture without secondary contaminants. These conditions were considered applicable to Nematology but were cumbersome, difficult and mostly impractical for nematologists to attain.

Simple association of a given nematode species with plant injury was judged insufficient evidence to conclude nematodes were the cause of injury, even if the association was commonly found and widespread. Dr. B.F. Lownsbery made many valuable contributions on this subject during his career at U.C.D. and helped develop schemes to test pathogenicity of a given species of nematode by subjecting the host plants to logarithmically increasing numbers. Such procedures are routinely used throughout the world today.

The introduction of chemical nematicides such as 1,3 dichloropropane and ethylene dibromide was another great aid to establishing pathogenicity of plant-parasitic nematodes.

Previously the only materials available included carbon bisulfide (CS_2), methyl bromide and chloropicrin (originally developed as a gas in World War I) which had major problems for use under field conditions at that time. The first problem was high cost; all three materials were much too expensive for most crops. Secondarily, there were difficulties in controlling application - CS_2 frequently burned in the soil and there was excessive loss to the atmosphere in the case of methyl bromide and chloropicrin. Third and most limiting as a research tool to study pathogenicity, all three biocides eliminated all organisms in a treated site.

On the other hand, DD and EDB made possible treatments under field conditions at costs many growers could afford thus they were very effective in reducing or eliminating nematodes without affecting other organisms and improvements in growth of plants could be attributed to removal of the nematodes. These materials were widely tested throughout California and were intensively studied by Dr. Bert Lear who studied their properties and use as a major part of his mission in Nematology. Others in the U.C. system who studied the properties of nematicides, their behavior in soil, and their possible residue in foodstuff and/or the environment were: R.C. Baines, J.D. Radewald, W. H. Hart, I.J. Thomason and C. E. Castro. Unfortunately, almost all soil treatments have been eliminated from commercial use because of ground water or air contamination but initially they did provide a basic service for Nematology in helping develop an increased awareness of nematode problems amongst the general public and improving crop production for growers while the chemicals were available.

4. **Disease Complexes**

One of the interesting relationships of nematodes and other plant pathogens in disease complexes emerged when interactions were observed both in field tests as well as controlled laboratory/greenhouse tests. Results showed host plants suffered a given loss of growth and productivity in the presence of nematode attacks; a measurable effect of damage by introduction of a fungal bacterial inoculum; but a far greater than simple additive effect when both were present. Dr. Lownsbery made many contributions to

understanding disease complexes such as the above in addition to another serious problem, peach canker. In cooperation with Dr. H. English of the Department of Plant Pathology they demonstrated that the bacterial agent produced canker on the growing points of the host plants only when a ring nematode, *Mesocriconema (Criconemella) xenoplax*, was feeding on the roots of the host. The exact mechanism by which the complex pathology developes is not clear but the fact was established that a synergistic relationship occurred.

Another significant achievement was a cooperative project with Dr. D.J. Raski, Dr. W.B. Hewitt and Dr. A.C. Goheen. They studied a soil borne disease of grapevines caused by fan leaf virus (a polyhedral virus). They found that the virus was transmitted by the dagger nematode, *Xiphinema index*. At about the same time W. Hart and J. Breece showed that yellow bud mosaic of peach was vectored by *Xiphinema americanum*.

Since then the breakthrough in solving these virus/vector relationships has led to many more virus diseases of plants being found to be transmitted by other species of *Xiphinema* and *Longidorus*. Also a whole range of tubular-shaped viruses transmitted by species of *Trichodorus* and species of other related genera have proved to be particularly interesting when the means by which the nematodes acquire the viruses are quite different in the two major groups (*Xiphinema/Longidorus* vs. *Trichodorus*, and others). Also the location of virus particles in the vector differs between the polyhedral and tubular types as also the means of introduction of virus into host plant roots are different.

5. **Nematode Control Strategies**

The concept of IPM (Integrated Pest Management) is based on judicious application of all possible means of control of nematodes to reduce or mitigate losses of production. There are few if any crops totally immune to nematode damage. Soil fumigation did offer a reasonable approach to commercial control even though the nematodes invariably built up again. Thus applications would be required every year. Almost every member of the original faculty carried out soil fumigation trials: in vineyards (D.J. Raski); fruit and nut tree crops (B.F. Lownsbery); cotton and other crops (M.W. Allen); ornamentals and strawberries (A.R. Maggenti): and studies in fumigants and their characteristics (Bert Lear). Similar efforts were being carried out by nematologists at U.C.R. Even as effective as these chemicals were, the adverse characteristics of some which resulted in contaminating ground waters, led to DBCP and EDB's withdrawal from the market.

1) *Crop rotation*. This is a classical and historically long-established measure. Of course it is based fundamentally on full, reliable knowledge of host range for any given nematode species. Studies were made in the case of sugarbeet nematode to determine optimum years of alternate, non-host crops before planting another crop of sugar beets. To be most effective a minimum of 3 years out of beets (or known host plant crops) and a rigorous program of weed control during rotation to avoid building up of the nematode on weed hosts. For many years rotation has been a dependable and economically successful practice if followed carefully.

2) *Cultural practices*. Early planting of beets also worked quite well to help improve yields although nematodes still had a potentially adverse affect in limiting yield. This practice tried to take advantage of the ability of beets to germinate and make significant growth at temperatures lower than required for nematodes to become active. Once past a critical stage the seedlings could keep ahead of nematode effects. Unfortunately early planting meant January or early February and winter rains often made such planting impossible – by March or April beet seedlings were extremely susceptible and total losses could result. Planting to avoid soil temperatures optimum for nematodes was succerssful for several other plant/nematode problems such as root-knot nematodes on carrots (Roberts, U.C.R.). The climatic conditions of the central valleys of California offered another possible means of reducing

nematode populations. After harvesting a given crop the soil would be cleared and tilled, turning the soil several times during hottest part of the summer. Some degree of control was achieved (M.W. Allen) against root-knot nematodes in cotton fields but economic success was marginal, timing often difficult to fit into other crop schedules and activities but such means of control merit further efforts towards improvement.

3) *Crop plants resistant to nematodes*. This has been a goal for many years because it is possible such genetic resistance could mean a permanent source of control genetically. A number of promising plant species have been found effective in varying degrees for limiting nematode reproduction and/or plant injury. Root stock selections in grapes and peaches for example; other sources of resistance reported and used in cotton, tomatoes, etc., mostly against root-knot nematodes. One serious limitation is the biological/genetic diversity of many different plant parasitic species which may have very different pathogenic effects on a given rootstock.

Summing up the total research program in the early years of Nematology at U.C.D. specifically and U.C. statewide in general, every effort was made to examine and test whatever possible means might help growers to control the damages caused by nematodes. Seeking economic feasibility; methods of use and application for best results; and foremost, meeting with farm advisors, growers and industry representatives as often as possible to inform them of the nature of the nematode problem in agriculture. Thousands of soil and root samples were examined to assist growers in documenting the species of nematodes in their lands and to better understand the implications of such species.

THE DEVELOPMENT OF NEMATOLOGY AT U.C. RIVERSIDE

RICHARD C. BAINES

The specific impetus for the development of nematology in Riverside was the citrus replant problem. In the early 1940s a devastating disease, called Tristeza or Quick Decline, struck thousands of acres of citrus in Southern California. The aphid transmitted virus caused the collapse of trees on sour orange rootstocks. When the dead or dying trees were removed and the groves replanted, the new citrus trees were slow to grow and yields were below those expected even for young trees. At the urging of the Citrus Industry, including influential growers such as Mr. Lombard of the Limonera Company in Ventura County, the administration of the University of California took action. At the Citrus Experiment Station a team of scientists were assembled to research the citrus replant problem. Dr. Leo Klotz, long-time member of the Plant Pathology Department, investigated the role of fungi, primarily *Phytophthora* spp. Dr. James Martin, Soil Microbiologist, was hired in the CES Soils Department to investigate the role of various soil microbes. Dr. William Moje, Chemist, was assigned to the Plant Pathology Department to investigate the role of soil toxins including the breakdown products of citrus roots. In 1947, Dr. Richard C. Baines (Plates 19, 30), Plant Pathologist, was hired and assigned to the CES Plant Pathology Department to investigate the role that nematodes might play in the replant problem.

It might be appropriate here to point out that Mr. Fred Foote with the Limonera Company was already engaged in research on citrus nematode control in orchards in Ventura County.

It is interesting to note that a scientist at the U.C. Citrus Experiment Station had studied the pathology of a nematode attacking citrus in the 1920s. Edward E. Thomas published the results of his studies in 1928. This nematode, the so-called citrus nematode had been discovered by Los Angeles County Agriculture Inspector J. R.Hodges. Hodges sent specimen to Dr. N.A. Cobb who in 1913 published the taxonomic description of the nematode and named it *Tylenchulus semipenetrans.* Unfortunately, Thomas' work was not given much credence by horticulturists in the 1920s. Nematode-infected nursery stock was planted in citrus nematode-free soil and they grew vigorously when free of other diseases. There was little basis for comparison between the yields and fruit quality of nematode-free and infected trees, and the infected trees, for the most part, showed no specific symptoms. Thomas' good work was simply before its time.

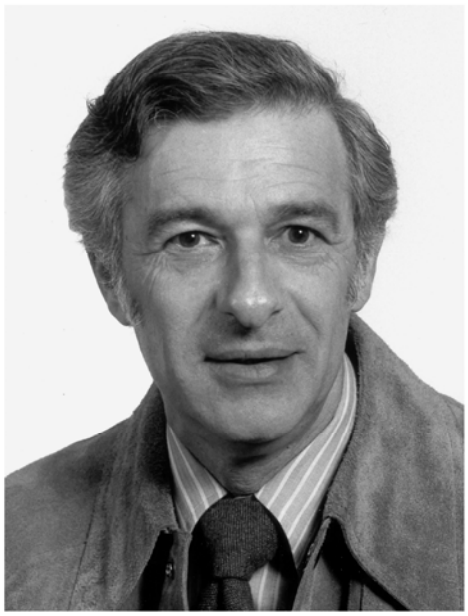
R.C. Baines was uniquely qualified to study the citrus replant problem. He had received his B.S. degree in Plant Science with a major in Horticulture from U.C. Davis in 1927. During this period, he took course-work at both Davis and Berkeley. Following graduation he was Orchard Supervisor for the E.C. Horst Company from May 1927 to October 1929. This large farming company produced fruits and nuts in the Sacramento Valley.

In December 1929, Baines entered graduate school at Purdue University, Lafayette, Indiana. His M.S. thesis was under the guidance of Dr. Max Gardner. Gardner was chairman of the Plant Pathology Department at U.C. Berkeley while decisions were being made about the future of nematology on that campus. Baines' Ph.D. thesis was on *Phytophthora* trunk canker of apple, a serious disease of apple in Indiana and other midwestern states. Gardner later said this was an excellent piece of work and did much to solve the problem that had hurt the apple industry for years.

Baines joined the Plant Pathology faculty at Purdue in 1937 and remained there until June of 1943.

Plate 19

R. C. Baines



S. A. Sher

I. J. Thomason

S. D. Van Gundy

In April 1944 he returned to California with the Bureau of Plant Pathology, California Department of Agriculture in Sacramento. In April 1947 he was appointed to Plant Pathology Department, CES as Assistant Plant Pathologist.

Prior to joining the CES at Riverside, he spent six weeks in the laboratory of U.S.D.A. Nematologist Gerald Thorne in Salt Lake City, Utah. Thorne was perhaps the most active nematologist in the western United States at that time and Baines received intensive training in the techniques required to work effectively with plant parasitic nematodes. He also received a basic course in nematode identification and taxonomy.

Shortly after Baines joined Riverside he had a broad program underway. The introduction of D-D nematicide by the Shell Chemical Company in 1943 provided an effective and relatively economical chemical for preplant treatment of citrus orchard soils. In addition to D-D, he worked with a wide range of nematicidal (and fungicidal) chemicals, many only experimental compounds, determining their efficacy and the proper methods for their use.

Baines also started cooperative work with Horticulturist James Cameron, William Bitters and Robert Soost in an effort to identify sources of citrus nematode resistance either in established citrus rootstocks or in exotic citrus lines that might either be used directly as rootstocks or as parental material in breeding programs. Also cooperating in these efforts was Dr. Leo Klotz and associates who were concerned that any rootstocks used would have *Phytophthora* root rot resistance as well as nematode resistance. Response to various citrus viruses had to be considered also.

During this period, Dr. Baines was assisted by two laboratory technicians, Oscar Clarke (see p.119) and Robert Small. Bob Small was a native of Riverside and stayed with Nematology until his retirement. Bob was employed first in the Citrus Experiment Station in theEntomology Department part time. He joined the Plant Pathology Dept. a year or two after Baines joined C.E.S. Bob was an innovative staff research associate and designed and constructed many items of research equipment.

SAMUEL A. SHER

The second person to be assigned a specific responsibility for research on nematodes at Riverside was Dr. Samuel A. Sher (Plate 19). He was appointed Junior Nematologist in the Department of Plant Pathology, Citrus Experiment Station in December of 1953. S.A. (Skip) Sher was born in San Francisco, California on April 24, 1923. He grew up in San Francisco and graduated from Lowell High School in 1940. He attended San Francisco Junior College in 1940 and 1941, majoring in Zoology. In 1941 and 1942 he was a pre-medical student at the University of California, Berkeley. From 1942 to 1946 he served in the U.S. Air Force in the Air Force Medical Research Program, a considerable portion of this time at the Center for Air Medical Research, Wright-Patterson Air Force Base, Dayton, Ohio.

After the war he returned to U.C. Berkeley and completed his B.A. degree in Zoology in 1948. That same year he entered graduate school at Berkeley in the Department of Entomology and Parasitology. It was at this time that he came under the influence of Merlin W. Allen, Professor of Nematology. Dr. Allen became his major professor and Sher was soon fascinated by plant parasitic and free-living nematodes. From 1949 to 1952 he was a Research Assistant in the department and assisted Allen with his research on nematodes attacking California crops. His Ph.D. thesis research was on *Pratylenchus*. This well-known revision of the genus *Pratylenchus* was published in 1953 and was widely acclaimed for the quality of the work.

In June 1952, Sher joined the staff of the University of Hawaii, Honolulu, as Assistant Nematologist. In Hawaii he worked successfully to solve a serious problem of Vanda orchids caused by the foliar nematode *Aphelenchoides besseyi*. In Hawaii he came into contact with scientists working on nematode problems of pineapple for which they had identified the nematicidal chemical D-D (1,3-dichloropropene-1,2-dichloropropane) as an effective control agent.

After a year in Hawaii, he spent six months as Agriculture Research Officer in the Nematology Laboratory, Department of Agriculture, Ottawa, Canada. During this short stay he worked with several Canadian Nematologists including Dr. A. D. Baker, the principal Canadian taxonomist. At Baker's laboratory a significant nematode collection had been assembled.

As indicated above, S.A. Sher joined the Citrus Experiment Station in December 1953. Thus after an absence of 1 1/2 years he returned to his native state and rejoined the University of California system. Sher's initial assignment was to study the biology and control of nematodes attacking ornamental crops and turf. Southern California had a large and prosperous ornamental industry which faced direct losses due to nematode attack; but it also faced the problem of potential losses associated with the importation of exotic pests. This involved an understanding of nematode distribution in California, the U.S.A. and the world and an ability to accurately and quickly identify potential nematode pathogens. Skip Sher brought those skills to his new assignment. He also brought the E.O. Essig/M.W. Allen philosophy regarding the need for faculty trained in the Entomology Dept. to work in depth on the taxonomy of one or two groups of insects/nematodes. Sher took on the Hoplolaimidae. Among other responsibilities he presented the formal course General Plant Nematology (Appendix Table 11).

When the statewide Plant Nematology Department was formed in July 1954, Sher was transferred from the Plant Pathology Department to Plant Nematology. R.C. Baines was the initial Vice-Chairman of this department but Sher served this role from 1955 to 1960. When the U.C.R. Department of Nematology received independent status, he served as Chairman.

ARNOLD BELL

Skip Sher's first laboratory technician was the wife of a medical doctor. But in October 1954 Arnold Bell (Plate 20) became his laboratory assistant. Bell was a native of North Dakota and had earned a B.S. in Plant Science/Agronomy from North Dakota State University. He had worked several years for the Soil Conservation Service, U.S.D.A.. Bell worked with Sher until Sher's death in May 1976. He then worked with Sher's successor, Dr. James Baldwin, until Bell's retirement in 1989.

Although Sher and Bell might have been considered the "odd couple" because of the dramatic differences in their backgrounds, they were an extremely effective and productive team. Working together they established one of the largest collections of plant parasitic and free-living nematodes in the U.S.A. In this they followed the Thorne/Allen tradition for cataloguing, preserving and mounting specimens, similar to the procedures used at U.C.B. and U.C.D. by Allen, Raski, Maggenti and others.

Sher's untimely death of cancer on May 22, 1976 was a real loss to the science of Nematology and his colleagues in the University of California at Riverside and Davis.

IVAN J. THOMASON

Ivan J. Thomason (Plate 19) was appointed to the Department of Plant Pathology, Citrus Experiment Station, University of California, Riverside on March 1, 1954. He had filed his Ph.D. thesis with the graduate division, University of Wisconsin, Madison but since his doctoral degree was not conferred until June 1954, he was appointed as a Laboratory Technician, Step IV - a technicality that would not even be considered now (2001). However, this inequity was corrected on July 1, 1954 when he was appointed Junior Nematologist in the newly formed Statewide Department of Nematology. Three Nematologists (Baines, Sher and Thomason) were part of the CES, Riverside.

The three scientists were housed in a "temporary" laboratory building - a surplus army building that had been brought in from Camp Haan (an army base southeast of Riverside) after WWII. It is

interesting to note that this "temporary" laboratory served various departments for almost 50 years and was destroyed in September 1999 to make way for a new Entomology building.

Ivan J. Thomason was born in Burney (Shasta County), California on June 27, 1925. He moved to Davis, California in 1927 and graduated from Davis Joint Union High School in June 1943. After service in the Army Corps of Engineers in WWII from August 1943 until February 1946, he entered the University of California, Davis in February 1946. He earned the B.S. degree in Plant Science with an emphasis in Agronomy in February of 1950.

Starting in 1948, he worked as a part-time laboratory assistant in the Department of Plant Pathology, U.C. Davis, for such well-known plant pathologists as Drs. Lyell Leach, Byron Houston, Jack Oswald and Raymond Grogan. While at Davis, Thomason took a number of courses offered in the Department of Plant Pathology.

In February 1950, Thomason began graduate work in Plant Pathology at the University of Wisconsin, Madison. One of his minor subject areas was plant breeding. His major professor was the well-known cereal pathologists, Dr. James (Jim) Dickson. His advisor in the area of plant breeding was Plant Geneticist and Chairman of the Agronomy Department, Dr. D.C. (Clyde) Smith. His M.S. and Ph.D. degrees were earned in 1951 and 1954, respectively. His Ph.D. thesis was on fungal root rot diseases of grasses and cereals. He had no course work on nematode diseases nor nematode identification and taxonomy. He had seen the devastation that both the sugarbeet cyst nematode (*Heterodera schachtii*) and the garlic stem and bulb nematode (*Ditylenchus dipsaci*) could be responsible for while in fields in the Salinas Valley of California with Dr. Lyell Leach. Thus, his background in nematology was meager, to say the least, but he was excited about the opportunity to work with this group of pathogens and anxious to join the Citrus Experiment Station at Riverside. Baines and Sher at Riverside and other colleagues at Berkeley and Davis proved to be very supportive and effective teachers and he soon was carrying out his responsibilities to study the biology and control of nematodes attacking vegetable and field crops in southern California. Dr. Thomason also carried teaching responsibilities with the courses in General Plant Nematology and Nematode diseases of Plants (Appendix Table 11).

Southern California Agriculture

It is interesting to note that southern California (representing the eight counties - Ventura, Los Angeles, Orange, San Diego, Imperial, Riverside, San Bernardino and Santa Barbara) was a very different production agriculture area in 1954 than it is in 1999. Up to WWII, Los Angeles County's agricultural income was the highest in the state and the combined income of the eight counties approached that for the rest of California. Dramatic changes began to occur with the rapid shift to urbanization, escalating costs of both agricultural land and water for irrigation and the high costs of labor for crop production versus non-agriculture industry. Despite the explosive growth of the urban population in Los Angeles, Orange and San Diego Counties, southern California, in total, is still a major contributor to the agriculture income of California. As one small manifestation of the growth, Riverside's population has grown from 70,000 in 1954 to 280,000 in 1999.

From his appointment in 1954 until the start of graduate instruction in agriculture in 1960, Thomason's primary official role was that of research (both applied and basic) on nematode problems of vegetable and field crops. A major unofficial role was that of Extension Specialist in Nematology. Baines served this role in the citriculture area; Sher in the ornamental industry. Thomason covered vegetable and field crops since there was no person appointed to this function in Riverside during those years. In fact, Thomason was approached in 1958 by Dr. George Alcorn, Director of Agricultural Extension in the Division of Agriculture and Mr. Hal Schwalm, Southern Regional Director of AES, and asked to join AES as Extension Nematologist. Since this position could be located at U.C. Davis, it was a

tempting offer. As indicated elsewhere, the position was filled by Dr. Winfield Hart, one of M.W. Allen's students, and at the time, Nematologist with the California Department of Food and Agriculture in Sacramento.

Thomason was promoted from Jr. Nematologist to Assistant Nematologist in the Experiment Station in July 1956.

It may be of significance at this point in the discussion of the development of Nematology in the University of California to mention Dr. Alfred M. Boyce. Al Boyce was an Entomologist who joined the Citrus Experiment Station in 1927. He was a vigorous and effective research leader on the biology and control of insects attacking citrus and walnuts in southern California. He became personally acquainted with the leading growers, managers and professionals associated with the citrus and other agriculturally related enterprises in southern California. In addition, he was widely known within the Division of Agriculture of the University of California being personally acquainted with such key figures as Dr. Harry Wellman, Vice President of the Division and a friend of U.C. President Sproul. Boyce became Director of the Citrus Experiment Station in 1954 when Dr. Batchelor retired. Familiar with the work of Baines at U.C.R. and Allen and associates at U.C. Berkeley, and keenly aware of the needs of the growers and developments in the pesticide industry, including the availability of new nematicides, Boyce was a strong supporter of Nematology in the University of California. He was a strong and effective proponent of the growth of agriculture at the CES and saw the relatively new field of nematology as one of the engines for growth. He was an effective advocate within the University for the development of a separate statewide Department of Nematology in the University and was a supporter of Dr. D.J. Raski for the role of chairman. Throughout his tenure as Director of CES, and later as Dean of the College of Agriculture and Associate Director of the Statewide Division of Agriculture, he never failed in his support of the nematologists and the Nematology Department.

In the fall of 1954 the first undergraduate students were enrolled at U.C. Riverside. This had relatively little impact on Nematology activities at Riverside except that undergraduate students were hired as student assistants in the laboratories.

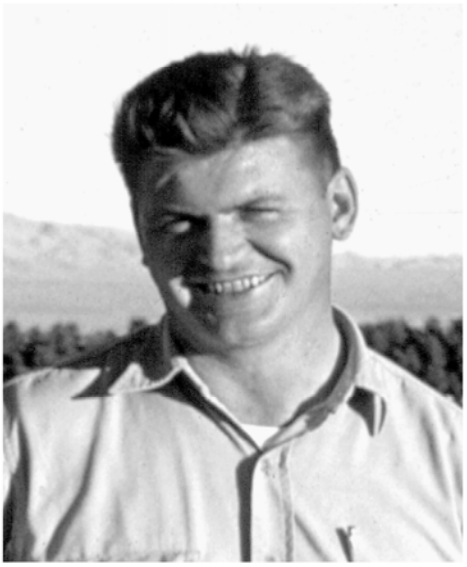
As part of the development of nematology in California and in the USA in general, it might be appropriate to point out the activities of a few individuals in the private sector. The Shell Chemical Company had a research laboratory and experiment station at Salida, California. In addition to others, their staff included a professional nematologist, Dr. C.W. (Mac) McBeth. McBeth had been trained under Gerald Thorne in Utah and had been a U.S.D.A. Nematologist at Tifton, Georgia where he had cooperated in research on nematicides with Nematologist Al Taylor; Taylor later was research leader for the Nematology Section, U.S.D.A. Beltsville, Maryland. McBeth was leading Shell Chemical's research on nematicides including 1,2-dibromo-3-chloropropane - later known as Nemagon. He traveled widely in the United States and foreign countries advising in the development of nematode research programs, especially that leading to effective use of nematicides.

At Seal Beach, California the Dow Chemical Company had a research station devoted to identifying new pesticides including nematicides. Dr. J.F. Kagy led this work and was assisted by Drs. Cleve Goring and Dick Youngson and Mr. George Turner. Amongst other things, scientists at Dow were keenly interested in the behavior (movement, persistence, efficacy) of nematicides in soil.

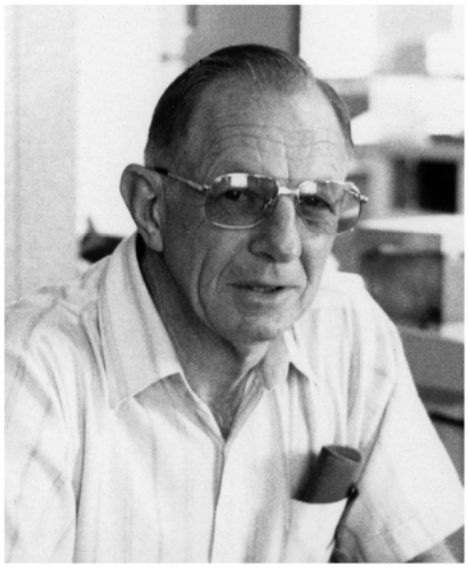
During this period, the Shell Chemical Company sponsored a series of Shell Nematology Workshops. The primary thrust was to make the agricultural industry personnel, including farmers, aware of plant nematodes and developments taking place in the field of nematology. One such workshop took place in the Hotel Stardust, Yuma, Arizona on February 12-13, 1958. Dr. L.C. Glover of Shell was the

organizer and general chairman. Speakers were from the University of California, the University of Arizona, the USDA, the Shell Chemical Company, the California Department of Agriculture and several citrus companies including Mr. Fred J. Foote of the Limoneira Company, Santa Paula, CA.

Plate 20



A. Bell



H. E. McKinney

E. Bartnicki

N. O. Belser

Several other events occurred in 1958 that had an impact on the program of I.J. Thomason and Nematology statewide. In 1958, Dr. Fields Caveness, Nematologist with the Beet Sugar Development Foundation was making a survey of nematodes associated with sugar beet plantings in the western U.S. During this survey he found the sugar beet cyst nematode, *Heterodera schactii*, in the Imperial Valley of California where it had not been known to occur although it was widely distributed in several other

present or past beet growing areas of California including the Tustin area of Orange County, the Chino Valley of San Bernardino County and the Home Gardens area of Riverside County. Subsequent surveys in the Imperial Valley by Dr. Win Hart, California Department of Food and Agriculture and the University of California personnel found it to be in at least 12 to 15 fields and well entrenched. Prior to this time D.J. Raski had the prime responsibility for *H. schachtii* and the beet industry. However, a major discovery by Drs. Hewitt, and Raski and Goheen that the nematode *Xiphinema index* was capable of transmitting a virus disease of grapevines opened a whole new area of critical research and Raski subsequently focused on nematode vectors of viruses and nematode diseases of grapes in addition to his on-going taxonomic work.

Because of the location of the Imperial Valley in the southeast corner of the state, Thomason's familiarity with desert agriculture and the proximity to Riverside, he took on the responsibility for this specific nematode/beet problem and subsequently much of the other field research on nematodes attacking sugar beets in California.

Physical Facilities - UCR

A brief comment about the physical facilities available to the U.C.R. Nematologists in the period 1954 - 1960 might be helpful. Generally speaking they were quite adequate. As indicated previously, Baines, Sher and Thomason were each provided with a combination laboratory/office in a remodeled army surplus building which had been moved to campus. The laboratories had adequate stand up and sit down bench space, sinks, shelving, cabinets and in one of the laboratories, a chemical hood had been installed. There was a small office for the secretary who provided clerical service for the Nematologists. Two vehicles were available for transportation and budgets were adequate to cover the costs of laboratory, greenhouse and field research. Initially, greenhouse space was provided in those controlled by the Plant Pathology Department. However, a new bank of greenhouses (#7, 8, 9 and 10) was under construction. Dr. Baines served on the CES committee that developed the plans for these units and they had a good, useful design incorporating a large headhouse/laboratory with a large walk-in cold box, chemical hood and small office. The large glasshouses were divided into three sections and were cooled with effective custom-made evaporator coolers. Features of headhouse and greenhouse design were such that Greenhouse #9, assigned to Nematology, was very effective for processing the large numbers of soil samples taken from experimental plots. This unit, with modification, still serves U.C.R. Nematology well to this day (2002).

In anticipation of growth of the new College of Letters and Science, which opened at Riverside in the fall of 1954, a second biology building was constructed. Student growth was not as rapid as expected. The first biology building, Webber Hall, was made available to Nematology, Plant Pathology and Biochemistry. Nematology received spacious quarters on the first floor and remained there for a number of years until displaced by the Biomedical Sciences faculty - except for the Nematology Department offices and conference room which exists in one corner of the first floor at this time (2001). Nematologists since that time were never all in one location; and in some cases, faculty and associated graduate students and post-doctoral scientists occupied greenhouse offices and laboratories. However, in general Nematologists were supplied with adequate functional space.

Personnel Additions - UCR

SEYMOUR D. VAN GUNDY

Seymour Dean Van Gundy (Plate 19) was born February 24, 1931in Toledo, Ohio. He graduated from Monclova High School, Monclova, Ohio in 1949. He entered Bowling Green State University on an Edwin Mosley Scholarship and and graduated with a B.A. in Biology in 1953. While an undergraduate he worked part-time at the local H.J. Heinz Crop Research Department crossing tomatoes and cucumbers and screening cucumbers for cucumber scab resistance under a collaborative program with the

Department of Plant Pathology, University of Wisconsin. It was here that he met the famous Plant Pathologist Dr. J.C. Walker. Dr. Walker offered him an assistantship to continue his work on cucumber Angular Leaf Spot when he graduated 1953.

In 1956 Van Gundy finished his Ph.D. research at the University of Wisconsin and continued as a postdoctoral student until February 1957. During this period he was interviewed by D.J. Raski, Chair, U.C. Statewide Nematology Department and subsequently offered a new position in the Nematology Department at U.C. Riverside. In late 1956 Gerald Thorne joined the Department of Plant Pathology at Wisconsin as an Honorary Professor and he provided two months of training to Van Gundy before he went to California.

Van Gundy joined the Department of Nematology,U.C.R. as a Junior Nematologist in March 1957. He rapidly rose through the university ranks and was appointed Professor of Nematology in July 1968. During the 1965-66 academic year Van Gundy spent a sabbatical leave in Australia working with Harry Wallace and Alan Bird to strengthen his interdisciplinary research interest in the ecology of nematodes. From September 1968 to 1970 he served as Associate Dean for Research in the Graduate Division, U.C.R.. From 1970-72 he served as Assistant Vice Chancellor for Research. In 1972, Dean Mack Dugger convinced Van Gundy that this was a critical juncture for the future of Nematology at U.C.R. because of Sher's illness and for his own professional growth to return to the Nematology Department as Chairman. From 1972 to 1984 he was Chairman of the Department of Nematology and through his lobbying efforts he secured state funding for the first Nematology quarantine facility and greenhouse. From 1967 to 1974 he was the first Editor-in-Chief of the Journal of Nematology and served as Vice President and President of the Society of Nematologists. He also organized the annual meeting of the Society of Nematologists meeting in Riverside in 1974. In 1984-84 he spent a sabbatical leave in the laboratory of Dr. Milt Schroth, UCB studying rhizobacteria. He then returned to serve in the College of Natural Sciences and Agriculture as Associate Dean of Research from 1985-88 and Dean of the College from 1988-93. He retired in 1993.

Dr. Van Gundy joined the Nematology Department at a time when activities that related to the management and control of nematodes attacking citrus in southern and central California were at a critical juncture. The nematicide 1,2-dibromo-3-chloropropane (DBCP) had been released for experimental use in the spring of 1954. By 1957 it was apparent that this nematicide had shown great promise for control of nematodes on established trees and now needed research on how best to use and at what rates to use this in commercial groves. Van Gundy was asked to work with the citrus industry on the development of DBCP for the control of citrus nematode. Although important, this effort was only secondary to his research objectives to establish an interdisciplinary research program on the ecology and pathology of nematodes.

Early in his research of nematodes on citrus Van Gundy found a new nematode species infesting desert citrus which was described by Raski as *Hemicycliophora arenaria* (Sheath Nematode). With the financial support of the Shell Chemical Co. he and campus photographer, Ken Middleham, made the first nematode film featuring the feeding and life cycle of the Sheath Nematode. He established collaboration with Dr. David Kirkpatrick, Botany and Plant Sciences Department to study the nature of resistance in citrus to the citrus nematode and the nature of the interaction of multiple nematode associations on citrus and on grapevines. He also formed collaboration with Dr. Lewis Stolzy, Soils Department to study the effects of soil aeration on the ecology of nematodes. In the Department of Plant Pathology, he collaborated with Dr. Peter Tsao on the interaction of soil fungi and citrus nematode and with Dr. Milt Schroth, Department of Plant Pathology, U.C. Berkeley on the interactions between nematodes and rhizobacteria. In 1977, in collaboration with Diana Freckman Wall, he spent a summer at the University of Alaska, Fairbanks Campus to study nematodes in the black spruce-permafrost ecosystem. He trained

numerous graduate students during his career. His research staff support included Robert Rackham, Robert Minteer and Leann Gudmundson. Clearly there was no shortage of research and administrative problems to pursue and Van Gundy pursued them with vigor. Dr. Van Gundy assumed teaching responsibilities with the courses Phytopathogens: Nematodes and Nematode Deseases of Plants (Appendix Table 11).

REINHOLD MANKAU

The rationale for adding the next faculty position at Riverside followed a long history of biological control research in the University of California in general and at the CES, Riverside, specifically. During Dr. Leo Klotz' and associate Tom DeWolfe's research on fungus pathogens of citrus roots they observed and isolated a number of fungi which trapped and destroyed citrus nematodes. In fact, they made a short film demonstrating the activities of these fungi.

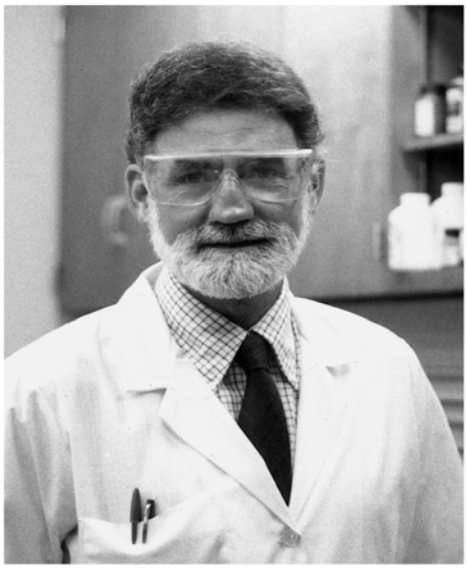
Dr. Reinhold Mankau (Plate 21) was appointed Assistant Nematologist in the Department of Nematology, University of California, Riverside in January 1958. Mankau was born in Chicago, Illinois on July 22, 1928. He graduated from Lane Technical High School, Chicago in 1946. He studied Biology at Wright Junior College, Chicago from 1946 to 1948. He entered the University of Illinois in 1949 and received a B.S. in Biology in 1951 and a M.S. in Biology in 1952. From 1952-1956 he was a Ph.D. candidate in Plant Pathology/Parasitology at the University of Illinois, Urbana where Dr. Maurice B. Linford (Plate 7), the well-known Plant Pathologist/Nematologist was his major professor. Linford had previously worked in Hawaii and was the person to first describe the reniform nematode, *Rotylenchulus reniformis* and its damage to crop plants.

Mankau's thesis was entitled "Studies on the host-parasitic relationships of *Heterodera trifolii*. This clover cyst nematode was later described from California soils by Raski and others.
From September 1956 to January 1958, Mankau was a Fulbright Research Fellow at the Indian Agricultural Research Institute, New Delhi, India. In 1964-65, he was a Fulbright Senior Postdoctoral Fellow at the Agricultural College and Research Institute, Coimbatore, India. In 1973-74, he served as UNDP Consultant in a project designed to upgrade the postgraduate program in Plant Pathology/Nematology at the University of Agricultural Science, Hebbal, Mysore, India. Thus, along with D.J. Raski, he was one of the most knowledgeable California Nematologists regarding nematode problems of the Indian subcontinent and Nematology research in that area of the world.

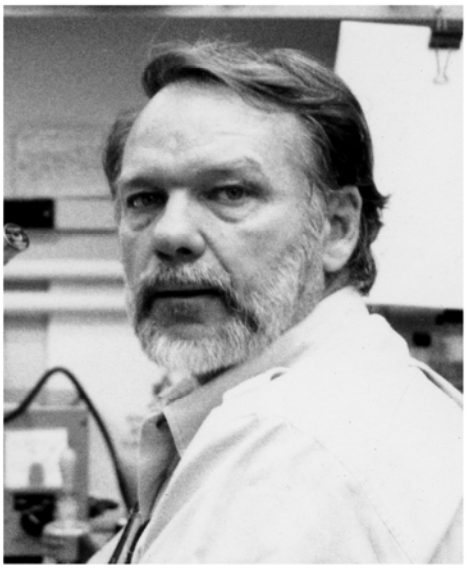
Mankau's research efforts at Riverside focused on identifying biological agents that were parasites and predators of plant parasitic and free-living nematodes; to study the soil and environmental factors that influenced their numbers, persistence and efficacy; and to determine if any biological agent could be efficient and economically useful as a biological control agent. His teaching responsibilities feel to the formal class Nematode Deseases of Plants (Appendix Table 11).

Dr. Mankau trained a number of Ph.D. students, amongst whom is Dr. Graham Stirling, well-known Australian Nematologist, who is active in Queensland. Mankau achieved the rank of Full Professor in 1976 and retired in 1990.

Plate 21



C. E. Castro



R. Mankau

E. G. Platzer

J. D. Radewald

JOHN D. RADEWALD

John D. Radewald (Plate 21) was appointed Associate Cooperative Extension Nematologist in the Department of Nematology, U.C. Riverside in November 1962. This appointment recognized the workload in Extension Nematology that had built up as a result of the research being carried out in California, the nation and around the world. The introduction and use of both preplant and post-plant nematicides, as well as a continuing stream of experimental nematicides, needed the attention of an Extension Nematologist in southern California. It was too much to expect Specialist Win Hart at U.C.

Davis to carry this complete load. Changes in the programs of research nematologists such as Baines, Sher, Thomason and Van Gundy also dictated the need for an Extension Nematologist.

John Radewald was born in Niles, Michigan on February 15, 1929. He graduated from Berrien Springs High School in 1946. He received a B.S. in Biology from Arizona State University in 1952. From November 1952 to December 1954, he served in the U.S. Army Corps of Engineers. He received a M.S. degree in Plant Pathology from Oklahoma A&M College, Stillwater in 1956. At Stillwater he worked on a nematode problem of sweet potatoes. From 1956 until 1960 he was a graduate student in Plant Pathology at the University of California, Davis. His research was in Nematology and his major professor was Dr. D.J. Raski. His Ph.D. thesis was on the nematode *Xiphinema index*, a serious pest of grapevines and the vector of fan leaf virus. His Ph.D. was granted in 1960.

In 1960, '61 and '62 he was employed by the Pineapple Research Institute, Honolulu, Hawaii as a Research Nematologist. During this period, he worked closely with scientists that had developed the nematicide D-D. He also had extensive experience working on the biology and control of several nematodes attacking pineapples - a highly sophisticated plantation crop on several of the Hawaiian Islands. His training at Davis, plus his experience in Hawaii, served him well in his position at U.C. Riverside.

Radewald's work with the ornamental and turf industries, the vegetable growers and the grape growers was particularly notable. He enjoyed an excellent working relationship with the pesticide industry both at the national and local level. His expertise in the utilization of nematicidal chemicals, especially application technology, was one of his major strengths.

CHARLES E. CASTRO

Dr. Charles E. Castro (Plate 21) was appointed Associate Specialist in Nematology, U.C.R. in September 1961. His position in Nematology and the Agricultural Experiment Station responded to a new need created by changes in Federal law relating to pesticides. The Food and Drug Administration modified the Federal Insecticide, Fungicide and Rodenticide Act to include nematicides and mandated that residues of nematicides on edible crops had to be determined and tolerances established. This included bromine residues from Ethylene Dibromide (EDB) and 1,2 dichloropropane (DBCP). Since the University of California, Division of Agriculture had a policy (set forth in Communication #18 from the Vice-President) that all University recommendations for the use of a pesticide (this included nematicides) would be backed by performance data developed by University personnel (most often developed in cooperation with Farm Advisors, Growers and Pesticide Industry personnel). This also included residue data of the pesticide itself or breakdown products (metabolites) in or on the edible portions of the crop. Dr. Francis Gunther of U.C.R. Entomology Department had one of the strongest programs of this type in the nation and a strong program also existed at U.C. Davis. However, these laboratories were not able to take on the work load so Dr. Castro was hired at Riverside to do the above work but also to look at the degradation and/or persistence of nematicides in soils.

Charles Edward Castro was born in San Jose, California on November 17, 1931. He graduated from Santa Clara Union High School in June 1949. He received a B.Sc. in Chemistry from San Jose State College in July 1953. In 1953-54 he studied organic chemistry at the University of Heidelberg (Heidelberg, Germany) as a Fulbright Scholar. In June 1957 he was granted the Ph.D. degree in Physical-Organic Chemistry from U.C. Davis. From August 1957 until August 1960 he was a Research Chemist with the Shell Development Company, Emeryville, CA. In July 1961 Castro's title was changed from Associate Specialist to Assistant Chemist, a move that suggests a change from a temporarily-funded to a permanently-funded position.

The research carried out by Castro was chemical in nature and required significantly different laboratory facilities. Fortunately, funds were made available to permit major modification of existing laboratories so that suitable space was available. In addition, there were additional chemists in other departments of the Experiment Station (Gunther, Fukuto, Entomology; Moje, Kolbezon, Plant Pathology) so that specialized space or equipment could be borrowed.

One of the first actions carried out by Castro was to confirm that none of the widely used nematicides (EDB, DBCP, 1,3-D) were found as residues in edible portions of crop plants. Since only degradation products were found (e.g., bromide ion), it was possible to focus on bromide ion since chloride ion (from 1,3-dichloropropene) was not physiologically important at the rates found. Working with Shell Development Company scientists, Castro found that neutron activation of bromide ion in raw agricultural products (citrus, grapes, potatoes, beans, etc.) converted bromide ion to a radioactive form that could be counted very accurately to determine the original bromide concentration. Thus extensive laboratory work and analysis was avoided and accurate results achieved.

Castro's expertise in physical-organic chemistry and knowledge of radioisotopes was used in joint projects with other faculty members in the department. Over the 30 years he was employed, he had a remarkable record of funding for his research by the NSF, NIH and other granting agencies. He became one of a few bona fide experts on the fate of nematicides in soil and their mode of intoxicating nematodes. He was appointed Chemist and Professor in the College in July 1970. He retired in 1993.

EDWARD G. PLATZER

Dr. Edward G. Platzer (Plate 21) was appointed Assistant Professor and Assistant Nematologist in the Department of Nematology in July 1971. Edward George Platzer was born October 3, 1938 in British Columbia, Canada. He graduated from King Edward High School, Vancouver, BC in 1956. In 1961, he received a B.Sc. degree in Biochemistry and Zoology from the University of British Columbia in Vancouver. In 1964 he received a M.Sc. in Zoology from the University of British Columbia and in 1968 a Ph.D. in Zoology from the University of Massachusetts, Amherst. From September 1968 to June of 1971 he was a postdoctoral research fellow at the Rockefeller University in New York, NY.

Although Dr. Platzer's degree was in Zoology, his specialty was in physiology and biochemistry of invertebrate parasites and biochemistry of invertebrate parasites and in the general area of parasitology. The Department of Nematology at U.C.R. was weak in this area of research and teaching and Platzer was employed to fill that need. His employment was supported by the Biology Department, where he has carried a joint appointment and cooperated with Professor Irwin Sherman in joint teaching the course in Parasitology. Platzer enjoys a reputation as an outstanding teacher with class presentations in Biology of Nematodes, Biochemistry of Parasites, Physiology of Nematodes (Appendix Table 11).

Platzer's research has covered the biochemistry and physiology of a wide range of nematodes including parasites of animals, insects and plants as well as some free-living forms. Some very interesting work was carried out in conjunction with several Ph.D. students including Becky Brown Westerdahl (now Extension Nematologist at U.C. Davis) on the nematode parasite Romanomermis sp. of mosquitoes.

From September 1982 to July 1983, Platzer was the Associate Dean, College of Natural and Agricultural Sciences, U.C.R.. For six months in 1983, he was Acting Chair of the Department of Biology, U.C.R.. From 1984 to June 1990, he chaired the Nematology Department and he assumed that role again starting in 1997.

Ed Platzer has contributed unselfishly to the programs of both the Nematology and Biology Departments and significantly broadened the perspective of the nematologists and provided linkages to other research groups on campus. His wife, Dr. Ann Platzer, taught Histology at U.C.R..

MICHAEL V. McKENRY

Dr. Michael V. McKenry (Plate 22) was jointly appointed Assistant Specialist and Assistant Research Nematologist in the Department of Nematology, U.C.R. in September of 1972. This was one of the first such appointments in the U.C.R. Nematology Department and involved a part-time Specialist position in U.C. Cooperative Extension and a part-time research appointment in the Agriculture Experiment Station. Although his appointment was in the department at UCR, he was located at the U.C. Research and Extension Center in Parlier, CA. (also known as the Kearney Agricultural Center).

Michael Victor McKenry was born April 7, 1945 in Selma, CA. He was raised in an agricultural setting for, amongst other things, his father grew table and raisin grapes. He graduated from Selma High School in 1962. He received a B.Sc. degree in Soil Science from California Polytechnic Institute, San Luis Obispo, CA in 1966. In 1967, he received a Secondary Teaching Credential from the same institution. For one year, he was Director of Vocational Education and Instructor in Vocational Agriculture in the Yucaipa School District, Yucaipa, CA. During the period he was completing his high school and undergraduate education he was actively involved in farming and other aspects of agri-business.

In the fall of 1968 he entered the Ph.D. program in Plant Pathology/Nematology at U.C.R. and was associated with the research program of Ivan J. Thomason. His Ph.D. in Plant Pathology was conferred in June 1972. His thesis research concerned the movement, persistence and efficacy of fumigant nematicides (1,3-D and EDB) in soil. His training in soil science, as well as biology, served him well and his thesis was very well received. His teaching fell to a class in Field Nematology (Appendix Table 11).

McKenry's academic training, farm background, interest in teaching and personality made him an ideal candidate for the position that the University wanted to establish at the San Joaquin Valley Research and Extension Center in Parlier. This location was not receiving all of the specialist attention it needed at this particular time and nematode problems of tree fruit and nut crops and grapes were in need of more research. McKenry, being from that area, was a logical candidate and has in the last 27 years proved that he was the right choice and that there was no shortage of significant problems to address. Attesting to the quality of his extension educational program as well as his applied research are the Ciba-Geigy Award from the Society of Nematologists for Excellence in Applied Research; the Hilgard Award from the California Association of Farm Advisors and Specialists; and the Outstanding Achievement Award from the Friends of Agricultural Extension.

DIANA H. WALL

Diana (Freckman) Wall (Plate 22) had a most interesting and productive career during her 17-year association with the Department of Nematology at U.C.R.. She was not recruited by the department but rather was a soft money scientist for most of her U.C.R. career. She had earned her Ph.D. in Plant Pathology at the University of Kentucky in 1970. Her Ph.D. research was on nematode interaction (*Heterodera trifolii* and *Pratylenchus penetrans* on clover, *Trifolium repens*). Her major professor was Dr. Richard Chapman, the Nematologist at Lexington.

Diana was teaching biology in the Julius T. Wright High School for Girls in Mobile, Alabama when her then husband, John Freckman was transferred to the United States Coast Guard Station at the Los Angeles International Airport (Los Angeles, CA). In 1972, she contacted a friend at U.C. Berkeley

who told her that Dr. Ron Mankau at U.C.R. might be interested in a postdoctoral scientist to assist in a grant-funded research project. Mankau hired her and she came to the Nematology Department in June 1972 when S.A. Sher was chairperson. She was appointed a Postgraduate Research Nematologist.

Plate 22

M. V. McKenry

J. G. Baldwin

B. Hyman

D. Wall

Diana was on this grant (IBP Desert Biome) until Dr. Mankau left for sabbatical in India. Unfortunately, the grant had not been extended. Diana, with the assistance of S.D. Van Gundy, contacted Dr. Fred Waggoner, Utah State University, Director of the National Science Foundation (NSF)-sponsored IBP Desert Biome Project, who determined what needed to be done and renewed the grant with Van Gundy and Freckman as co-investigators. Thus, she was able to obtain funds for her salary and continue on at U.C.R.. It was also a learning lesson in grantsmanship. Diana was an enthusiastic member of the department and working with faculty members did much to support graduate student training which included her formal class in Soil Ecology (Appendix Table 11).

In 1975 Dr. Michael McKenry informed Diana of the possibility of a teaching position in the Plant Pathology Department at Fresno State University. She obtained a lecturer's position and was there during the 1975-76 academic year. She was an effective teacher and impressed the administration to the point that they offered her a tenure-track position. She declined and during this period submitted grant applications that would continue to support her position as a Postdoctoral Research Scientist at U.C.R.. She obtained a grant from the U.S. Man and the Biosphere (U.S. MAB) program. A grant submitted to N.S.F. was not funded. She traveled to Washington, D.C. to visit N.S.F. to find out why the grant failed and learned a great deal about the whole process. Later the N.S.F. grant was funded and during her academic career, she was extremely successful in obtaining N.S.F. grant support for her salary and research.

From 1976 to 1990 she was a non-tenure track scientist at U.C.R. (Research Nematologist, 1976-1984); Associate Research Nematologist, 1984-1990). For six months (October 1983 – March 1984), while President of the Society of Nematologists, she worked on her research at North Carolina State University at Raleigh as a visiting research scientist in the Department of Botany and Plant Pathology.

From September 1988 to September 1989, she was Associate Program Director, Ecology Program, Division of Environmental Biology, National Science Foundation, in Washington, D.C. In July 1990, she was appointed to a tenure-track position, Associate Professor and Associate Nematologist, Step III at U.C. Riverside. In 1993, she was appointed Full Professor. However, at this same time she was offered and accepted the following positions at Colorado State University, Fort Collins, CO: Professor, Rangeland Ecosystem Science; Director, Natural Resource Ecology Laboratory; and Associate Dean for Research, College of Natural Resources. She served in these three positions from 1993 to 2000 when she resigned as Associate Dean for Research in the College of Natural Resources. She is an active and respected scientist working on soil nematode ecology in agricultural and natural ecosystems. During her distinguished career she was President of the American Institute for Biological Science (AIBS) in 1992 and the Ecological Society of America (ESA) in 1999-2000. Few women faculty have been associated with Nematology in the U.C. system, but we were fortunate to have had Dr. Diana Harrison Wall (formerly Freckman) as one of them.

BRADLEY C. HYMAN

In addition to Professor Ed Platzer's joint appointment in the Biology Department, Nematology at U.C.R. was fortunate to have Dr. Bradley (Brad) C. Hyman (Plate 22) in the Biology Department interested in nematodes. Brad was born on May 14, 1952. His B.A. degree in Biology was taken at U.C. San Diego. He earned his Ph.D. in Cell Biology in 1980 at UCLA. From 1980 to 1983 he was a NIH Postdoctoral Fellow at the University of Wisconsin, Madison. In July 1983 he was appointed Assistant Professor at U.C.R.. He currently is Professor of Biology. He also has a joint appointment in Nematology and is active in the department – serving on committees, cooperating in research and the training of students. In addition, he is active in the Society of Nematologists, serving on the editorial board of the Journal of Nematology. He brings a broad background in biology and cell biology and expertise in genetics and molecular biology. Cooperation and support from Biology has benefited

Nematology at U.C.R. over the years. As noted elsewhere, Dr. Becky (Brown) Westerdahl (Extension Nematologist, U.C. Davis) earned her Ph.D. in Biology at U.C.R. with Dr. Platzer as her major professor.

Samuel A. (Skip) Sher's death in May 1976 left the U.C.R. Nematology Department without a taxonomist and immediate efforts were made to justify replacing this important position. As noted elsewhere, Dr. Michel Luc from Paris, France filled in temporarily as a Visiting Scientist (see Table IIIB).

JAMES G. BALDWIN

Dr. James G. Baldwin (Plate 22) was chosen to replace Dr. Sher. He was appointed Assistant Professor and Assistant Nematologist in July 1978. James G. (Jim) Baldwin was born May 24, 1945. He graduated from high school in Madison, Ohio in June 1963. He attended Bob Jones University in Greenville, South Carolina majoring in Biology and Chemistry and earned a B.S. degree in 1967. He earned his M.S. at North Carolina State University, Raleigh in 1970 and his Ph.D. in June 1973.

He worked in the Department of Plant Pathology at Raleigh and the Division of Plant Industry, Florida Department of Agriculture and Consumer Service in Gainesville, Florida as a Nematologist from June 1976 to June 1978. In July 1978 he came to Riverside.

Baldwin proved to be an outstanding selection. He excelled in teaching, research and public service. His research, although not "traditional" taxonomy and systematics, has emphasized the evolutionary relationships of nematode taxa, the relationship of anatomy and morphology to nematode function and systematics. His teaching was extensive with classes in Identification of Plant Parasitic Nematodes (Special Summer Course), Phytopathogens: Nematodes, Nematode Taxonomy and Comparative Morphology (Appendix Table 11). His laboratory has maintained the outstanding nematode collection housed in the department. He has trained numerous Ph.D. students and attracted postdoctoral students and distinguished visiting scientists.

Baldwin served as chair of the department from July 1990 to June 1995. He was appointed Full Professor in July 1991. He was secretary of the Society of Nematologists from 1988 through 1990, vice-president of SON in 1996-1997, president-elect in 1997-1998 and SON president in 1998-1999. He was recently elected a Fellow of SON.

It may be appropriate at this point to include some comments written by Jim Baldwin on August 2, 2000 and they cover some of his experiences from 1990 to 1995 while he was chair of the department:

I (Jim Baldwin) became chair shortly after a CSRS Department Review (I believe Ivan Thomason had just retired), and while they had all kinds of recommendations for us reality was that we were in very tight budget years and in fact were facing "golden handshake" incentives for early retirements. Consequently, during that period we lost to retirement Ron Mankau, S.D. Van Gundy and Chuck Castro as well as a great many staff positions. Also Diana (Freckman) Wall, during that time, went from her long-standing soft money positions, to a tenure-track position via a "target of opportunity" but shortly thereafter accepted a position in Colorado. In addition, David Bird left during that time.

Somehow we transcended the tight budgets and hiring freezes to add two extension positions, Ole Becker and Ton Ploeg.

Also during this time there was much reorganization driven by tight budgets and the Nematology Department was very vulnerable to dissolution/consolidation. How we would be consolidated (with Plant Pathology, Entomology or elsewhere) was argued, but there was even discussion of combining Plant Pathology and Nematology with Plant Sciences. My argument was that Nematology's strength at U.C.R. transcended Plant Pathology and that was good for the college because as a separate department we better integrated on campus with parasitologists, soil biologists, entomologists, evolutionary and developmental biologists, etc. Also at that time some exciting papers were emerging in C. elegans, Mi

resistance, etc. so I could argue that nematodes were a hot area with opportunities that would be lost if we dissolved into another department (where our positions would ultimately be redirected to different interests in that department) as happened at North Carolina State University and elsewhere.

And then I left, saying that I could not be chair and president of SON at the same time….

PHILLIP A. ROBERTS

Dr. Philip A. Roberts (Plate 23) first came to the U.C.R. Nematology Department as a Postdoctoral Researcher (Step I) in November 1978. He was employed to assist Dr. Thomason in his research program during the period when Thomason was Associate Director of Cooperative Extension for Southern California.

Philip A. (Phil) Roberts was born in England on April 7, 1953. He attended the Bishop Wordworth's School from which he graduated in August 1971. He earned a B.Sc. (Honors) in Agricultural Zoology from the University of Leeds in July 1975. In November of 1978 he was granted a Ph.D. from the University of Birmingham, Department of Plant Biology. His thesis concerned Nematode-Plant Co-evolution and Dr. Alan Stone of the Rothamsted Experiment Station Department of Nematology was one of his thesis advisors. In 1978 Roberts did postdoctoral work at Rothamsted.

As indicated, his first appointment at U.C.R. was in 1978. On November 6, 1979 Dr. Douglas (Doug) Johnson, Extension Plant Nematologist at the San Joaquin Valley Agricultural Research and Extension Center (SJVAREC), Parlier, California – in the heart of the San Joaquin Valley — wrote to Assistant Vice President and Director of Cooperative Extension Jerome B. (Jerry) Siebert that he was retiring from University service on January 31, 1980 after 25 years. Doug Johnson earned his Ph.D. at U.C. Davis while working as a technician for Dr. Bert Lear. He had training in Soil Science as well as Nematology and was a capable technician. After obtaining his Ph.D. he was appointed Extension Nematologist at U.C. Berkeley, his "home department".

On December 5, 1979 in a memo to Dean Mac Dugger, College of Natural and Agricultural Sciences at UCR, Seymour Van Gundy, then chairman of Nematology at UCR, proposed that we combine the Johnson FTE in Extension with the McKenry FTE in research into two (2) 50% research/50% extension positions attached to the Department of Nematology at Riverside. This recommendation was received and approved by the administrators concerned. Mike McKenry, who was already a member of U.C.R. Nematology became a joint appointee stationed at Parlier (SJVAREC). After a search for a candidate, Dr. Phil Roberts was also given a 50% research and 50% extension appointment (Assistant Nematologist, Assistant Extension Nematologist, Step III) in January 1981. Thus he was a member of the U.C.R. Nematology Department but stationed at Parlier.

Roberts' research focus was on vegetable and field crops with utilization of nematode resistant crops for management of root-knot nematode population levels as one area of special interest. He continued his interest on nematode resistance in tomatoes, beans (including Blackeyes) and carrots started while a postdoctoral scientist at UCR.

When Thomason retired in July 1989, the department sought permission for Roberts to fill that vacancy and he was promoted to Associate Professor and Associate Nematologist and transferred to U.C.R. in January 1990. In January 1996 he was appointed chair of the Nematology Department and held that position briefly until being appointed Associate Dean of the College of Natural and Agricultural Sciences in October 1996. He left the Dean's office in 2001.

In addition to his administrative duties, Roberts has served on key ssignments on the UC/IPM project and U.C. Extension service committees. He has been active in the Society of Nematologists

serving as chair of Plant Resistance to Nematodes Committee. His laboratory continues its excellent work on nematode resistance in crop plants. Dr. Roberts was also associated with Dr. McKenry in teaching the formal course Field Nematology and with Drs. Baldwin and Van Gundy in the formal course Phytopathogens: Nematodes (Appendix Table 11).

Comments of Associate Dean Philip Roberts (August 1, 2000) on developments in Nematology at U.C.R. during his brief tenure as chair and later while in the Dean's office:

My tenure as department chair of Nematology at U.C.R. was brief but eventful. I started January 1996 and finished in October of the same year, when I agreed to become Associate Dean in CNAS for AES and CE programs. In the latter position, I have been able to help guide the advancement of the Nematology Department and its programs at the college and campus levels.

I took over as chair from Jim Baldwin. Jim had done a marvelous job of steering the department through probably the worst economic downturn in the department and college history. The California economy had constricted following downsizing of defense-related industry and the University followed suit, losing between 25-30% of state budget in critical areas. The impact of this to Nematology was magnified because of its relatively small size as an academic unit. Faculty numbers were down, and the prospects of rebuilding the department's critical mass looked likely to be a huge struggle. At this same time, the Chancellor had initiated an internal and external review effort to assess the CNAS and its organizational structure, with a view to re-organizing to meet the research and teaching demands that lay ahead.

One of my first efforts as Chair was to rebut the re-organization committee's (Chancellor's Advisory Committee on the future of CNAS, or something to that effect) recommendation that Nematology be dissolved as a department and merged with Plant Pathology, or possibly with Plant Pathology and other departments into a large "Crop Sciences" based department. I believed, as did my faculty colleagues, that any such mergers would effectively erode the core effort in Nematology, disperse its programmatic foci, and render the program without a profile. There was much internal discussion, debate and also a highly positive response from key external stakeholders to write to the administration concerning the value of the program. This period was seen through with the department intact. During that time, we were able to secure the re-allocation of the molecular-based position for hiring, and through that subsequently were able to add Dr. Kaloshian to the faculty.

At the same time, in order to meet the Governor's efficiency targets (budget cuts), the College moved to consolidate department administrative units in the summer of 1996. I was heavily involved in managing the transition from having our own core staff (MSO, budget assistant, and administrative assistants), to a merged unit named NPPS, comprising the offices of Nematology, Plant Pathology and Statistics. Looking back, I consider that we did develop greater efficiency in use of limited resources and the NPPS unit has provided effective service. This move was painful. It meant that all staff employees in the Nematology and Statistics offices were technically terminated, if they were not retiring (Glenda Paulsen and Betty Minton did retire and Deidre Goodwin moved to Soil Science) and were then encouraged to apply for new positions developed to expand Plant Pathology staff into the NPPS unit. We were fortunate to retain Patty Sorrels in the new NPPS through this process.

Thus, I consider my brief tenure as chair to have come at a critical time in the department's history. Four years on in the Dean's office, the present and future look very bright for Nematology at U.C.R.. We have hired Soil Ecologist, Paul De Ley, this year, the Dean has allocated an FTE in Sensory Physiology for recruitment in FY 2000-2001, and the CNAS 5-Year Academic Plan has two additional positions (C. elegans molecular genetics and phytonematode genomics) targeted for recruitment in the near future. While I consider department structure to have unfortunate and artificial boundary effects sometimes, I believe the U.C.R. Nematologists are very effective in maintaining a critical core identity as a department, and at the same time integrating well in teaching and research programs across department lines within the College.

DAVID M. BIRD

Dr. David McKenzie Bird (Plate 23) joined the U.C.R. Nematology Department in October 1987 as Assistant Professor and Assistant Nematologist. He came to Riverside from Dr. Don Riddle's lab at the University of Missouri, Columbia where he was a postdoctoral Fellow from April 1984 to October 1987.

David Bird was born in Australia on January 25, 1958. His father was Dr. Alan Bird, the well-known Parasitologist/Nematologist with CSIRO in Adelaide, South Australia. His undergraduate and graduate training were all taken at the University of Adelaide where he earned his Ph.D. in Biochemistry in 1984. His Ph.D. thesis research involved the isolation of human collagen genes. Thus, it is obvious he had training and expertise in molecular genetics.

His research interest while in D.L. Riddle's laboratory in Missouri involved molecular genetics of nematodes including aspects of nematode collagen.

Plate 23

P.A. Roberts

J.O. Becker

A. Ploeg

I. Kaloshian

P. DeLey

D.M. Bird

While at Riverside and subsequent to his transfer to the Plant Nematode Genetics Group in the Plant Pathology Department at North Carolina State University at Raleigh his research interests have been nematode biology and development; genome organization and evolution; structure-function relationships;

host responses and resistance/susceptibility to pathogens; and plant development. While at U.C.R. he trained undergraduate and graduate students and postdoctoral students and taught the formal class, Developmental Genetics of *Caenorhabditis elegans* (Appendix Table 11).

It is pertinent to point out that Dr. I. Kaloshian of the U.C.R. faculty received her first training in the techniques of molecular genetics while a postdoctoral student in Dr. Bird's lab from June 1990 until May 1992.

OLE J. BECKER

Dr. Ole J. Becker (Plate 23) first came to the U.C.R. Nematology Department as a postdoctoral researcher in Dr. Van Gundy's lab from July 1985 until January 1989. After approximately three years with Ciba-Geigy, Ltd. Of Basel, Switzerland as a research plant pathologist, he returned to the Nematology Department at U.C.R. as Assistant Nematologist and Assistant Cooperative Extension Specialist in December 1992.

Ole Jorn Becker was born in Germany July 10, 1955. He received his Ph.D. in Phytopathology in Germany. His career is quite varied and he has carried out scientific research in the Republic of South Africa; with the U.S.D.A. in the Regional Cereal Disease Research Lab, Pullman, Washington; Plant Genetic Systems, Ghent, Belgium; Zhejiang Agricultural University, China (PRC); and as indicated previously with Ciba-Geigy in Switzerland. Thus, he brought a background of both industrial and academic research to his position at UCR.

Much of Becker's work emphasizes biological control of plant pathogenic nematodes in the broadest sense. The ecology of the root rhizosphere is an area of interest as well as the isolation and characterization of nematode suppressive soil organisms. His position has a major Extension component and he is effective in this role. He has been active in departmental, University and professional programs.

ISGHOUI KAL0SHIAN

Dr. Isghoui Kaloshian (Plate 23) first came to the U.C.R. Nematology Department as a Ph.D. student in 1985. She is a native of Lebanon and her B.Sc. degree was earned at the American University of Beirut in July 1982. Her M.Sc. in Plant Protection was from the same institution. However, a portion of her research for this degree was carried out while on a Fellowship from the Italian government given for training in Nematology and thesis research at the Instituto di Nematologia Agraria, C.N.R., Bari, Italy in 1983. This research concerned a cyst nematode pathogenic on lentils.

Kaloshian was granted her Ph.D. in Plant Pathology/Nematology at U.C.R. in 1989. Her thesis concerned the genetics of inheritance of root-knot resistance in wheat. Her thesis advisors were Thomason and Roberts of Nematology and Dr. Giles Waines of Plant Science at UCR.

From January 1989 through June of 1989 she was a Visiting Postdoctoral Researcher at the Instituto di Nematologia Agraria in Bari. From June 1990 through May 1992 she was a postdoctoral fellow in Dr. David Bird's laboratory at U.C.R.. It was during this period that she trained in the techniques of molecular genetics, adding to her skills in traditional genetics. From June 1, 1992 until August 14, 1997 she was a postdoctoral fellow in the laboratory of Dr. Valerie Williamson, Department of Nematology at U.C. Davis where she continued work on the molecular genetics of nematode and aphid resistance in tomato and honed her molecular genetics skills.

On August 15, 1997 Kaloshian was appointed Assistant Professor and Assistant Nematologist in the Department of Nematology at U.C.R.. In addition to her research on the molecular genetics of nematode resistance in crops she has taught a course on genetics as well as training graduate students and

visiting scientists. She is a respected scientist on campus and amongst her peers in Plant Pathology/Nematology. Her laboratory and office are in the Biology building (Spieth Hall) along with Drs. Platzer, Becker, Ploeg and Hyman.

ANTOON T. PLOEG

Another recent addition to the department has been Dr. Antoon T. Ploeg (Plate 23). Ploeg was appointed Assistant Cooperative Extension Specialist and Assistant Nematologist, Department of Nematology, U.C.R. in July 1995.

Antoon (Ton) Ploeg was born November 6, 1959 in Maarssen, The Netherlands. He graduated from the Gymnasium (high school) Utrecht in 1978. His B.S./M.S. was granted by the Agricultural University of Wageningen (Wageningen, The Netherlands) in 1986. His Ph.D. was granted by St. Andrews University in Scotland in 1992. His research while in Scotland (1989-1992) concerned the transmission of plant viruses by soil nematodes. At U.C.R., he has been concerned about the management of pathogenic nematodes on vegetable and field crops.

PAUL DE LEY

The latest addition to the Nematology faculty at U.C.R. is Dr. Paul De Ley (Plate 23) who was appointed Assistant Professor and Assistant Nematologist on November 1, 2000.

Paul De Ley was born March 21, 1967 in Belgium. His undergraduate degree in Zoology was granted in September 1988 by the University of Ghent (Belgium). His Ph.D. in Zoology was granted at the same university on February 21, 1994. He was a postdoctoral researcher at the University of Ghent from 1994 through September 1999 except for a short appointment in Great Britain. From April 1, 1996 until September 30, 1996 he was a Plant Nematode Taxonomist at the International Institute of Parasitology, St. Albans, England.

De Ley was appointed Lecturer at the University of Ghent and served a year in that capacity before coming to Riverside. At U.C.R. he participated in teaching the Soil Ecology class and a special summer course Identification of Plant Parasitic Nematodes (Appendix Table 11).

PRESENT PERSONNEL

At the present time (2001) there are nine active faculty members, either part-time or full-time on the U.C.R. Nematology faculty. Four living Emeritus Professors (Thomason, Van Gundy, Mankau and Castro) and one Emeritus Extension Specialist (Radewald) are associated with the department. Van Gundy maintains an office on campus. With postdoctoral and visiting scientists, graduate students and support staff there are about 34 persons associated with Nematology at U.C.R. — clearly as large a group as anytime during the last 40 years.

Postdoctoral Students and Visiting Scientists

Over the last 45 years Nematology at U.C.R. has been host to many distinguished visiting scientists and excellent/productive postdoctoral students. Unfortunately, Riverside did not keep a visitor's journal, as Berkeley and Davis did, so there is no complete, formal record of these visitors or students. Furthermore, the appointment records of these individuals, normally kept in the department files, were subject to purging periodically to conserve space. Thus a useful and interesting historical record is lost. What remains is the records (letters, memos, etc.) of individual faculty or their individual recall. Often this is not associated with specific dates unless perhaps a publication resulted from research conducted while on leave. An example would be Seymour Van Gundy's publication with Harry Wallace when Van was on sabbatical leave in Australia in about 1964. Another example would be John Radewald's publication with John O'Bannon when Radewald was on sabbatical in Florida in 1972.

Faculty were asked to generate a list of postdoctoral students and/or visiting scientists but the response was meager. Suffice it to say that in the 1950s and 1960s Dr. R.C. Baines' excellent work on citrus nematode and its control attracted visiting scientists from citrus producing areas of the world including Florida, Arizona, Japan, Italy, Spain, Israel and South Africa.

S.A. (Skip) Sher's excellent work in nematode taxonomy led him to collect in many areas of the world and brought him into contact with distinguished nematologists. Many came to Riverside to use the large collection of specimens housed in his lab. One early postdoctoral student was Dr. Pedro Torrealba, a Venezuelan, who obtained his Ph.D. at the University of Wisconsin under Gerald Thorne. He was attracted to U.C.R. because of Sher's work on the Hoplolaimidae. Torrealba was associated with the Shell Foundation Nematology Lab at Maracay in Venezuela. When I (I.J. Thomason) visited that laboratory in 1965 Pedro's father, Dr. Torrealba (M.D.) an authority on Chagas disease, was the subject of a feature article in the Caracas Sunday newspaper. Pedro spent six months in Riverside.

Another individual who spent time in Sher's laboratory was Nematologist Eli Cohn of the Volcani Institute in Israel. He was a visiting scientist at U.C.R. for six months working on systematics problems with *Xiphinema* and *Longidorus*. This recitation could be repeated for Baines, Castro, Van Gundy, et al., but is summarized in Appendix Table 5.

Support Staff

As is typical of any teaching and research institution support staff and research associates play key roles in the successful functioning of the organization. Several research associates have been mentioned. Others need at least to be recognized. Amongst those are office staff such as Norma Nobles (Plate 24),

Plate 24

N. Nobles

R. Roberts

G. Paulsen

D. Goodwin

P. Sorrels

R. Castro

long-time secretary and administrative assistant. She first came to the U.C.R. campus as secretary to Provost Watkins. Later she was secretary for Extension Specialist John Radewald. Rita Roberts (Plate 24) ran the Nematology office for a number of years, as did Glenda Paulsen (Plate 24) with the assistance of Deidre Goodwin (Plate 24) and Betty Minton. In the 1990s Nematology was extremely lucky to have the many skills of Patty Sorrels (Plate 24), including her exceptional facility with computers.

Marion Hair (Plate 25) ran the department for a number of years. She replaced Rita Roberts in 1975. During that time, the department moved out of Webber Hall into Webber Hall East (later becoming Boyce Hall) while the ground floor of old Webber was remodeled and renovated for the new Biomedical Sciences Department, then moved back into a new suite in Webber Hall. Unfortunately, this move resulted in the department being scattered into several buildings, with only the Administrative offices and library remaining in Webber. Under Van Gundy's enthusiastic and energetic leadership, the department remained a cohesive and flourishing unit. Marian became Management Services Officer of Entomology in 1985. She took early retirement in June 1994.

Betty Lou Pennington (Plate 25) was department secretary through the 1980s and fulfilled that role effectively while concurrently monitoring and mediating the professional, social and emotional needs of the incumbents. She was hired by the Department of Nematology on May 22, 1979 as a part time secretary to Dr. John D. Radewald. On October 16, 1979 she became "career" and began as a Clerk/Typist for the Department of Nematology. In November, 1979 she became secretary to Dr. S. D. Van Gundy, then Chairman and also the Nematology faculty secretary. She served as department secretary until 1989 before transferring to the Dry Lands Research Institute. Betty retired from U.C.R. in October, 1989.

Plate 25

M. Hair

B. Pennington

Harold (Mac) McKinney (Plate 20) was SRA for I.J. Thomason. Mac grew up on a farm in Missouri. After service in the Navy he took a degree in Biology and taught high school biology briefly. He joined Nematology in late 1954 and retired in 1989.

Marc Monson (Plate 26) graduated from U.C.R. with a degree in Biology and joined Nematology as an SRA in about 1970. He was a very innovative SRA and did much to improve greenhouse and field experimentation. Robert Rackham, Robert Minteer and Leann Gudmundson provided SRA support in the program of Seymour Van Gundy.

Nao Belser (Plate 20) and Eleanor Bartnicki (Plate 20) were both trained in Chemistry and Microbiology. They were associated with Dr. Charles Castro's innovative program on the bio-dehalogenation of nematicides for many years. They brought great talent and commitment to their work.

Fuji Shibuya was first associated with Dr. John Radewald at the Pineapple Research Institute in Hawaii. When Radewald was appointed Extension Nematologist at U.C.R., Shibuya was hired as his Staff Research Associate. He proved to be an exceptionally effective and loyal technician.

Jack Imbriani worked as an SRA for Ed Platzer and over the years earned his Ph.D. He has been employed as Nematologist by the North Carolina State Department of Agriculture for many years. Another outstanding SRA is Dr. Manuel Mundo-Ocampo (Plate 26). A native of Mexico, he earned his Ph.D. in Plant Pathology at U.C.R. while employed in Nematology. For many years he has been associated with Dr. Jim Baldwin's program. He is an accomplished systematist and expert on the electron microscope.

Plate 26

M. Mundo

F. Shibuya

W. Matthews

M. Monson

T. Mullens

J. Darsow

Bill Matthews (Plate 26) was associated with Dr. Phil Roberts' program at Parlier and transferred to U.C.R. with Roberts. He took further training in Plant Pathology at U.C.R. and is a valuable SRA. The above represents only a few of the outstanding support staff in Nematology at U.C.R. over the last 50 years. During that time the staff, students and visiting scientists represented a tremendous positive contribution to the department.

Oscar Clarke of Colton, California first joined the University of California in 1941 at the age of 21 or 22. He was hired by Dr. Howard Fawcett in the Department of Plant Pathology, Citrus Experiment Station, Riverside, California. He worked as a laboratory technician for several faculty members including Drs. Fawcett and Leo Klotz. From September 1942 until March 1946 he served in the U.S. Army Medical Corp. In April 1946, he returned to the Citrus Experiment Station.

In conversation with him on March 22, 23, 2001, I (I.J. Thomason) learned that in the year before Dr. R.C. Baines joined the Citrus Experiment Station in April 1947, work had begun on the citrus nematode problem. Clarke, under the general supervision of Fawcett and/or Klotz, was surveying citrus groves for the presence of the citrus nematode. This work may have been stimulated by the citrus replant problem and/or the advent of the new nematicide D-D (1,2 dichloropropane - 1,3 dichloropropene).

Clarke also told of work by Dr. Klotz and his assistant, Tom De Wolfe, in the Stover Grove in the Padua Hills area. This was an effort to suppress citrus nematodes in a lemon grove using a heavy mulch of sawdust and shavings from a sawmill. Early enthusiasm concerning the positive results were tempered by concerns about experimental design and techniques. Klotz and De Wolfe were intrigued by the presence of numerous fungi that attacked nematodes and in fact made a moving picture film on the subject that drew considerable interest. Following Baines' arrival in Riverside and his concentration on the nematode problems of citrus he discouraged Klotz's efforts in this area.

Clarke was assigned to assist Baines full-time on Baines' arrival at the CES. He worked with him until April 1966 when Oscar was assigned to the U.C.R. Biology Department as Herbarium Botanist (Senior Museum Scientist). His talents as a self-trained naturalist were more effectively utilized in that role. Oscar Clarke retired from U.C.R. in July 1979 after 38 years of service. When I saw him on March 23, 2001, he and his wife Marcia were headed to the Coachella Valley in their Volkswagon camper where they were to participate in a Sierra Club-sponsored natural history course and Oscar was to lecture on plant evolution. In addition he was working on a book concerning the plants of the Santa Ana River drainage. Not bad for 82 years!

Teaching Program in Nematology - UCR

In contrast to Berkeley and Davis where both undergraduate and graduate programs had been in place for a number of years, Riverside in 1947 had neither. An undergraduate program started in the fall of 1954; a graduate program in 1960. Meanwhile, the nematologists at Riverside were involved in informal instruction in Nematology through contact with Farm Advisors, County Agricultural Commissioner's personnel, the Synapsis Club (a monthly day-long seminar held for growers and various agricultural industry personnel) and various short courses, such as the Shell Nematology Workshops.

In the fall of 1960 graduate programs in the College of Agriculture were offered including Entomology and Plant Pathology. No undergraduate or graduate program in Nematology was formed. Students wishing to earn either a Master's or Ph.D. degree with a specialization in Nematology could take their degree in Entomology or Plant Pathology. Entomology graduate students were required to have a minor specialization and in the 1960s and 70s many chose Nematology. Plant Pathology required many of their M.S. and Ph.D. students to take a course or two in Nematology. That, plus a few upper-division undergraduate students from Biology, kept our Nematology courses full. Sher and Thomason formulated and taught Nematology 100, a three-lecture, two-lab course. Sher subsequently taught a graduate course in Nematology Taxonomy and Systematics (Nematology 226). This also was a lecture/laboratory course. Seminars and directed courses plus the Parasitology course (Biology Department) offered by Sherman and Platzer rounded out the course offerings in Nematology that were originally available. Most of the students specializing in Nematology research came to us through the Plant Pathology graduate program.

This arrangement was quite harmonious and the Plant Pathology graduate affairs committee (of which I.J. Thomason was a member for many years) was accommodating to the needs of "Nematology Students" when it came to required courses in Plant Pathology and some other subjects. It could be noted here that Dr. J.G. Morse, Entomology, U.C.R. offered Pest Management Modeling and Simulation in Nematology (Appendix Table 11).

The first student awarded a M.S. degree was Alex Rinkov of Israel who was under the guidance of S.D. Van Gundy. The first Ph.D. students (five) were graduated in 1967 (see Appendix Table 4). Since that time some 13 Master's students and 45 Ph.D. students have been trained. Most have gone on to productive careers at academic institutions, government laboratories and/or the private sector. Four Ph.D. students (Duncan, Kaplan, Noling, Rich) were hired in Florida and along with two Davis Ph.D. students (Giblin-Davis and Kinloch) there began to be a concern in Florida that Californians were "taking over" the field. They did not do that but they have served Florida well. Along with the many distinguished students trained at Berkeley and Davis, students trained in Nematology in the University of California have served the nation and the world very well.

Riverside was not significantly involved in graduate instruction until 1960-62. As early as 1913 graduate instruction in subtropical agriculture was approved to be associated with the Citrus Experiment Station, Riverside. Degrees were granted at either Berkeley or Los Angeles and the bulk of the necessary coursework was offered at those institutions. However, limited course work/class instruction and the bulk of thesis research was carried out under the guidance of scientists at the Citrus Experiment Station. This program was terminated prior to WWII.

Following the establishment of the College of Letters and Science in the fall of 1954 the situation at Riverside began to change. Undergraduate students worked in the Experiment Station departments including Nematology. Some students conducted their Senior Thesis research under partial supervision of Experiment Station scientists. One such student was James (Jim) Davis, a Riverside native. His senior thesis in the U.C.R. Biology Department was on root-knot nematode and one of his advisors was I.J. Thomason. He took his Ph.D. in Plant Pathology at U.C. Davis. He has been a Plant Pathologist at the University of Idaho, Moscow for over 30 years.

In 1959 the Legislature and the U.C. Administration declared Riverside a general campus with several colleges and research units. A College of Agriculture was established with several departments including Plant Pathology, Entomology and Nematology. Students wishing to pursue graduate level specialization in Nematology could take a Ph.D. in either Plant Pathology or Entomology (or Biology for that matter) with major professor and housing in Nematology. Nematology offered several courses that satisfied student specializing in Nematology but also served the needs of other students in the College of Agriculture.

Thomason and Seymour Van Gundy held joint appointments in the Department of Plant Pathology with all the rights and privileges that implied. In fact, for several years Thomason was joint instructor for the course Plant Pathology 265, Principles of Plant Pathology. Later Dr. Platzer would hold a joint appointment in the Biology Department.

Several members of the Nematology faculty played a significant role in the U.C.R. Integrated Pest Management (IPM) Masters Program. Thomason chaired this program for several years and taught a course in Pesticides and Their Use. Howard Ferris played a key role on the program’s executive committee and as advisor to a number of students. He also taught the core Pest Management course. Ron Mankau was an advisor to a number of students in the IPM/M.S. program.

The retirement of R.C. Baines in the early 1970s and the death of S.A. (Skip) Sher led to some significant changes. Dr. Van Gundy recruited Dr. Michel Luc, who had spent time in Sher's laboratory, to return to U.C.R. on sabbatical from his duties with OSTROM in Paris, France to teach the Nematology Taxonomy course and keep Sher's laboratory intact until his replacement, Dr. James Baldwin, was identified and appointed.

Following Dr. Luc's successful experience as a Visiting Professor at U.C. Riverside he encouraged several of his French colleagues, e.g. Dr. Jean Claude Prot and Dr. Yves Demeure, to spend a sabbatical at Riverside in Dr. Van Gundy's laboratory.

All of these activities were taking place during the chairmanship of Dr. Seymour Van Gundy whose effective leadership ran from 1972 until 1984.

One development during this period may have had a positive impact on the U.C.R. campus but an adverse effect on Nematology. This was the establishment of the U.C.R. Biomedical Program, a joint training program with the UCLA Medical School. Select undergraduate students joined this program as juniors, completed a portion of their medical training and then transferred to the UCLA Medical School.

To accommodate the faculty in the Biomedical Program all of Nematology's labs and offices on the first floor of Webber Hall were lost. Only three offices (chairperson's office, two clerical offices and a conference room/library) were retained. Nematologists were scattered to the Biology building and two office/headhouse laboratories in the green house complex (H. Ferris and I.J. Thomason). Dr. Platzer had already been accommodated in the Biology building (Spieth Hall) but Drs. Van Gundy, Freckman, Radewald and Mankau joined him there. Drs. Baldwin and Castro were on the first floor of Boyce Hall (originally called Webber Hall East). As an aside it is interesting to note that Thomason chaired the Faculty Building Committee for the building of some 70,000 Assignable Square Feet (ASF). It was eight years in the planning stage and when finally completed housed the Biochemistry Department, portions of the Plant Pathology Department, and the Insect Toxicology section of the Entomology Department. Nematology received only office/laboratory space for two faculty members but these were spacious and well suited to the work of Dr. Castro (chemist) and Dr, Baldwin (taxonomist). Baldwin continues in his space to this time (2001).

The history of the Nematology Department at UCR, and more specifically, the teaching program would not be complete without mentioning the long association of Drs. Edward Platzer and Irwin Sherman. Dr. Sherman is a Parasitologist (officially retired, but active; year 2001) and member of the Biology Department. He has been chair of that department and also Dean of the College of Natural and Agricultural Sciences and Associate Director of the Agricultural Experiment Station. Platzer and Sherman jointly taught the course on Parasitology – Biochemistry of Parasites (Appendix Table 11) This popular course served Biology majors, pre-med students and students specializing in Nematology. Platzer's involvement in this course led to his joint appointment in the Biology Department and office/laboratoroy space in the building (Spieth Hall) occupied by Biology. In fact, Platzer was acting chair of the biology Department for a six-month period.

The point to be made here is that the active participation of Nematology faculty in joint teaching activities, as well as research and administration, created friendships and alliances that served this small department well when decisions were being made about the allocation of resources whether they be faculty, staff, space or finances. Not only was Platzer a close associate of Sherman who served as Dean but Professor of Nematology Seymour Van Gundy served as Associate Dean during this period. Most recently, Nematologist Philip Roberts has served as Associate Dean of the College of Natural and Agricultural Sciences and Associate Director of the Agricultural Experiment Station.

Impact of the 1970s - the Changing Face of Nematology at UCR

The 1970s saw many changes in the U.C.R. Nematology program at U.C.R.. Van Gundy became chairman in 1972 and continued through 1984. U.C.R. student enrollment did not grow, in fact it shrank some. Along with a general budget crunch in the University of California, Riverside saw particularly hard times. It became increasingly necessary to seek outside support for research either from federal or state granting agencies or from agriculturally-related enterprises.

Fortunately, most members of the department were successful in supporting their research programs. Those with significant basic research components obtained funds from federal granting agencies; those with major effort in the applied research area sought and obtained funds from crop commodity boards, growers' organizations, state agencies (e.g., CDFA) and the pesticide industry. To be sure funding had an influence on the research carried out in this department but for the most part it was beneficial.

In the late 1970s Integrated Pest Management (IPM) became a popular teaching and research topic. The U.C. Division of Agriculture, through the office of the President, sought additional line item funding for an IPM Project from the State of California. Howard Ferris and Ivan Thomason were in on the original planning of the proposal and after the project was funded Thomason was the original director of this $1.5 million project. The project started in 1979 and is still operating today (2001). Over the years, Nematologists (e.g. Phil Roberts, Howard Ferris) have played key roles in this operation.

OTHER UC NEMATOLOGISTS

GEORGE POINAR

Dr. George Poinar, Jr. was another of the first scientists to specialize in nematodes in California. He began his career at Cornell University where he earned his Ph.D. degree in 1962. His major professor was Bill Mai (Plate 7) but Poinar also spent time with Harold Welch in Canada for instruction on mermithid parasites of insects. This was followed by a postdoctorate in 1963 at U.C. Riverside where he worked with S. A. 'Skip' Sher in biological control of weeds using insects and nematodes. In 1964 he held a postdoctorate position at Rothamsted, England. There he collaborated with Basil Goodey, F. G. W. Jones, David Hooper, Mary Franklin and Chris Doncaster. By 1965 he arrived at U.C. Berkeley where he joined the faculty of the Department of Entomology, Division of Insect Pathology.

For more than three decades, he conducted research on a broad range of subjects including axenic culture of nematodes, nematode parasites of insects and the fossil records of insects and nematodes in amber. His travels included collaborative research with many outstanding scientists in U.S.S.R., the Netherlands, France, Africa, Denmark and Australia. Dr. Poinar's interests included systematics, ultrastructure, symbiotic associations and especially fossil records. His extensive experiences collecting specimens has earned him the reputation as a world authority on amber itself.

ELLSWORTH C DOUGHERTY

Dr. Poinar also collaborated with nematologists in the Laboratory of Comparative Biology in Richmond, California, which was established by the Kaiser Foundation Research Institute. Dr. Eder Hansen and Poinar early on worked on axenic culture of nematodes together with Dr. Ellsworth Dougherty. Dougherty was a remarkable person, a practicing medical doctor in the Kaiser Hospital system and a Ph.D. attached to the Department of Nutritional Sciences at U.C. Berkeley. He not only reared axenic cultures of nematodes but had a lofty aim to do so on a medium of completely identified and defined components, and almost succeeded. Finally, there remained one unidentified factor of a liver extract that was essential to success in the rearing of these nematodes.

The contributions of these scientists helped establish procedures for maintaining pure cultures of *Caenorhabditis elegans* the single nematode species on which research has been expanded into a world-wide study by thousands of scientists. It has proved to be an ideal model organism that has made possible insight into all organisms and fundamental biological mechanisms of profound significance. All of which has brought broader public awareness to nematodes in general. Dougherty had a particularly significant role in that development. Dougherty first recognized the potential of *Rhabditis* species for genetic research. In the course of his nutritional studies he obtained the "Bristol" strain of *Caenorhabditis elegans* from his French colleague, Victor Nigon. When Sydney Brenner visited his laboratory in 1964, Dougherty convinced him of the potential importance of this organism on studies of developmental biology and provided him with a culture of the Bristol strain. Virtually all the studies on *C. elegans* genetics have been done N2 line that Sydney Brenner derived from the Bristol culture he obtained from Ellsworth Dougherty. Dougherty continued to study the nutritional requirements and axenic cultivation of *Caenorhabditis* species until his death in 1965.

THE DEVELOPMENT OF THE NEMATOLOGY PROGRAM AT THE CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE.

The regulatory agency of the California Departments of Food and Agriculture with its Division of Plant Industry played a vital role in the development of Nematology in California. To span the development of the Nematology program at the California Department of Food and Agriculture, it is necessary to consider, at least in part, the corresponding development and organization of the Department and its Division of Plant Industry, as well as that of certain regulatory programs that necessitated the establishment of the State Nematology Laboratory.

On April 15, 1880, an act for the formation of the viticulture industry of the state provided for the appointment of a Board of Viticulture Commissioners. In 1881, another act enlarged the duties and powers by creating two positions to deal with grape phylloxera issues, a viticulture health officer and a horticulture health officer. In 1882, county boards were appointed in the twenty-one counties of California.

In 1883, the State Board of Horticulture was created. Legislation was amended in 1903 to replace the State Board of Horticulture with a State Commissioner of Horticulture. However, in 1919, the office of State Commissioner of Horticulture was abolished, and instead the legislature created the State Department of Agriculture which was presided over by a Director of Agriculture.

The organization of the California Department of Agriculture included the Divisions of Animal Health and Plant Industry. The latter comprised the Bureau of Entomology, Bureau of Plant Pathology, Bureau of Plant Quarantine and Bureau of Chemistry plus Nursery Service, Seed Certification, Seed Laboratory, Apiary Inspection, Staff Botanist, Weed and Vertebrate Pest Control units. The Bureau of Plant Pathology dealt with nematology and plant pathology. Since then the names of the Department and its various sectors have changed following administrative and operational reorganization.

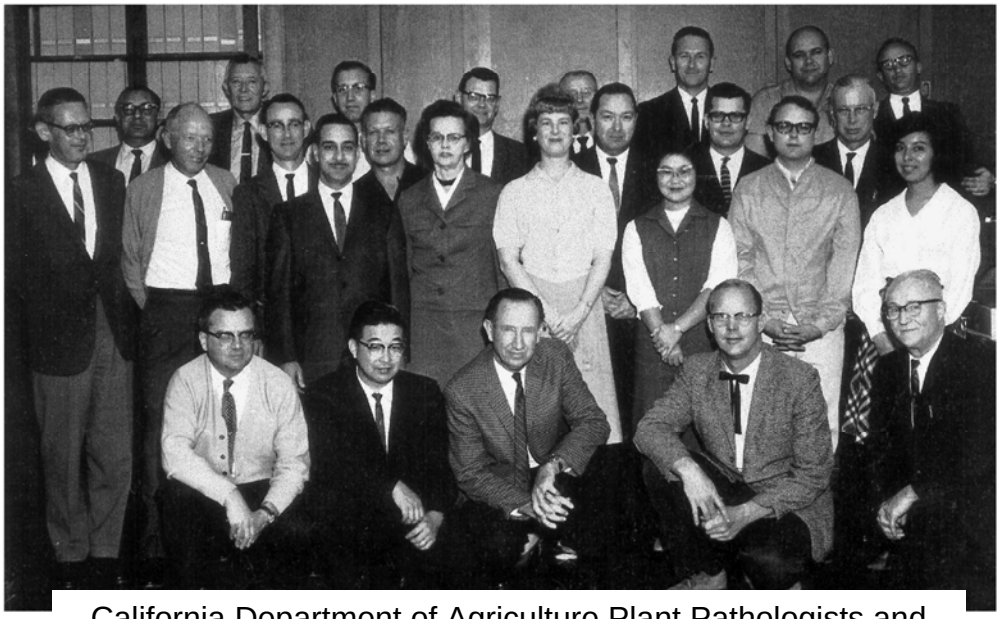
In 1971, The Division of Plant Industry was reorganized so that the Bureau of Plant Pathology became know as "Laboratory Services" and now contained entomology, nematology, and plant & seed taxonomy laboratories. In 1974, the Department became the "Department of Food and Agriculture". Laboratory Services was renamed as the "Analysis and Identification" branch in 1982, which in turn became the "Plant Pest Diagnostics Center" in 1996.

In 1998, the Division of Plant Industry was renamed as "Plant Health and Pest Prevention Services". The following information is presented in numerical bullets in an attempt to specifically highlight chronological events affecting the development of Nematology at the State Department.

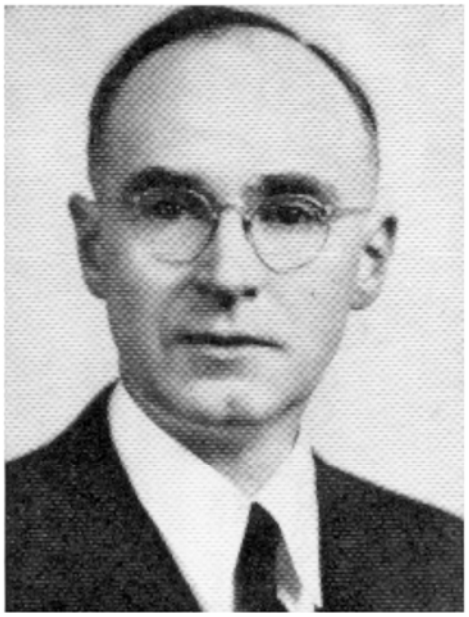
1. In about 1922, D. G. Milbrath (Plate 27) was appointed the first chief of the Bureau of Plant Pathology, California Department of Agriculture. He was a "first generation" protégé of Nathan A. Cobb.
2. The Citrus Nematode, *Tylenchulus semipenetrans*, was discovered as a problem on citrus in California by Los Angeles County Agricultural Inspector J.R. Hodges.
3. In early 1920s D.G. Milbrath conducted surveys for *Ditylenchus dipsaci*.
4. In 1927, the Root Lesion Nematodes, *Pratylenchus* spp., were reported parasitic on fig roots in California.
5. In 1931, Plant Pathologist C.E. Scott, employed by California Department of Agriculture for nine years, became the first extension plant pathologist for University of California U.C. Extension Service until 1955.
6. In 1938, *Pratylenchus* spp. was reported parasitic on apple roots in California.
7. The “Pinto Tag” program was started in 1943, and provided that nursery stock meeting strict standards of cleanliness may be shipped within the State without destination inspection. The program was voluntary for nursery participants. Plant parasitic nematode pests were soon to become a major hindrance to the effectiveness of the program.

8. In 1951, the Joint Legislative Committee on Agriculture and Livestock Problems held hearings at

Plate 27



California Department of Agriculture Plant Pathologists and Nematologists



D. G. Milbrath

which the Department of Agriculture and U.C. reviewed the status of the nematode situation, and produced the first distribution records of plant parasitic nematodes in California. Recommendations for intensified research efforts were made at that time. It is perhaps in the early 1950s that a pest rating system was established by the State Department Bureau of Entomology

and in the late 1960s was adopted by the Bureau of Plant Pathology. The pest rating system was primarily for agricultural commissioners as an evaluation of the statewide importance of particular pest species (including nematodes) and the subsequent actions to be administered. The rating classification of nematodes was revised in 1964 and thereafter with periodic revisions to date.

9. In 1952, the Nematode Study Committee appointed by the committee on agriculture of the California State Chamber of Commerce, recommended that Nematology be treated as an independent science at UC.
10. By the early 1950s the Root Lesion Nematodes were found in numerous orchards and field crops within the State. Prior to Sher and Allen's (University of California) revision of the genus, many problems were encountered by the State Department in trying to restrict the spread of the nematode because of the confusing taxonomy and limited knowledge on distribution and host range of the species.
11. In 1951, D.G. Milbrath retired, and G.L. Stout became Chief of the Bureau of Plant Pathology. Also, W.H. Hart was employed as the Bureau's first nematologist.
12. The following persons were hired to work under W.H. Hart: J.R. Breece, S. Ayoub (1957) (Plate 28) and N.E. El Gholl (joined in 1958?, left in 1960s to become a plant pathologist for Florida Department of Agriculture and Consumer Services). As a result of legislative action in 1947 a system of pest detection was established in the Division of Plant Industry. Three entomologist and three plant pathologist positions were authorized to survey for insects and plant diseases not known to occur in the state, or in the U.S., or of limited distribution in California. At that time the program was called 'permanent survey'. In the Bureau of Plant Pathology the plant pathologists in permanent survey were also involved in nematological survey. In 1958 there was a national survey for the golden nematode of potato which included a statewide survey in California and resulted in negative findings.
13. In 1953, the identification of the Burrowing Nematode (*Radopholus similes*) as the cause for spreading decline of citrus in Florida gave sufficient cause to the California Department of Agriculture to protect California against this devastating nematode pest. In 1954, S.A. Sher (U.C.R.) gave a first report of *R. similis* in California. The nematode species was found infesting banana in a Los Angeles nursery. Consequently, the need for establishing the presence or absence of the nematode species in California was realized along with the necessity to protect the State against the introduction of exotic nematode pests.

The following passages comprise highlights of surveys conducted by CDA for the detection of the burrowing nematode in California:

A. In 1954-56 a state-county survey revealed several ornamental host plants in nurseries to be infested with *Radopholus similis*. Eradicative measures were pursued.
B. In 1956, an exterior quarantine was established by C.D.F.A. against the Burrowing Nematode, *Radopholus similis*. The quarantine is maintained to date.
C. In 1956, a country-wide survey of citrus-producing areas was organized by U.S.D.A.. In California, surveys were conducted through the cooperative efforts of federal, state and county agricultural commissioners. Citrus and avocado orchards, as well as, citrus, avocado and ornamental nursery stock comprising 630 properties from 14 counties were surveyed over 2 months. No *R. similis* was found in this survey.
D. From 1956 to 1963 no organized surveys were conducted for detecting *R. similis*. Some counties conducted their own sampling schemes during this time. Random sampling of indoor decorative plants was encouraged by the State.
E. In February 1963, a fully established Burrowing Nematode infestation of 3,000 Anthurium plants was discovered in San Mateo County during a routine nursery inspection. Based on this occurrence, C.D.F.A. initiated a statewide survey of anthurium plants. Also, C.D.F.A. in

conjunction with federal and county officials developed a statewide survey for the Burrowing Nematode in California.

F. In June 1963, a statewide survey for the Burrowing Nematode was designed. The survey lasted till 1964, and comprised three main inspections.
   i) Inspection of all anthurium plants of cut flower growers, nurseries and hobbyists. Samples were collected at 100 locations in 18 counties. 15,000 plants were included from 67 nurseries, 7 commercial florists and 26 hobbyists. *Radopholus similis* was found in 7 locations in 4 counties: San Mateo, Contra Costa, Santa Barbara and Orange counties.
   ii) Inspection of nurseries engaged in wholesale production of indoor decorative plants.citrus and avocado orchards and nursery stock, as well as, dooryard plants of subtropical host plants adjacent to orchards. More than 4,300 individual properties comprising 150,000 acres of orchards were surveyed. No *R similis* was found in the 6,842 samples, and it was firmly believed that the nematode was not established in California orchards. No *R. similis* was found in the 178 citrus nurseries and 27 avocado nurseries surveyed.
   iii) Inspection of nurseries engaged in wholesale production of indoor decorative plants. 214 nurseries of 19 counties were surveyed. Burrowing Nematode was detected in 29 locations in ten counties. The most extensive infestations were in Los Angeles, Orange, San Mateo and San Diego counties.

Details of the survey results were documented in a report to all county agricultural commissioners from George E. Alstatt, Chief, Bureau of Plant Pathology on October 26, 1964. The following excerpt is quoted directly from the report: "No indication was found that *Radopholus similis* is an established resident of the natural environment of the State. This should not be construed as an indication that the nematode is unable to survive under California soil or climatic condition."

G. In 1964, the State Department created the Burrowing Nematode Detection program for California nurseries.
H. On October 26-28, 1971, in a report prepared by T.T. Matsumoto and I.A. Siddiqui, a survey of 65 lemon orchards in Ventura County failed to yield the Burrowing nematode.
I. Since then the Burrowing Nematode has been intercepted several times in external quarantine situations. These interceptions led to eradicative measures.
J. In 1994, the Burrowing Nematode program was terminated as the pest risk potential did not justify the economic costs and work load.
K. 1996, *R. similis* was discovered in a residential area in Huntington Beach in established banana corms that had been imported from Louisiana. The nematode was eradicated from the area through the administration of effective chemical, cultural and sanitary measures.
L. In 1997, Exterior Burrowing Nematode Quarantine was amended to include the Exterior Burrowing Nematode and Reniform Nematode Quarantine.

14. In the mid 1950s, with the establishment of the burrowing nematode quarantine, agricultural commissioners realized that regulatory actions against nematodes could not be based on visual inspection of plant commodities alone. Subsequently, many counties set up their own laboratories for the extraction and identification of nematodes. This provided intensive laboratory inspection of nurseries, which in turn resulted in many unsuspected problems. California-grown nursery trees, fruit tree seedlings and strawberries were found infested with Root-lesion and Root-knot nematodes. In addition, heavy infestations of the Foliar Nematode were found in California strawberry nurseries. These newly discovered infestations led to plants being rejected by some counties. However, discrepancies arose causing major problems when other counties accepted the plants based on visual inspection alone. In 1956, CDA convened a new study committee, chaired by G.L. Stout to address problems encountered by counties in the inspection of quarantine nursery plants for nematodes. A statewide inspection program

was developed for strawberry nursery stock. This program subsequently became the model for inspections systems.

15. The newly-developed inspection program resulted in excessive sample loads which were too much for the state laboratory to handle without a large staff and expanded facilities. As a result, a system for nematode sample processing was developed and conducted at the county laboratories under the guidance of W.H. Hart. Preserved nematodes in suspension were submitted to the state laboratory for identifications made by state nematologists. Forty out of fifty-eight counties participated by establishing nematology laboratories and personnel trained in nematode extraction and identification.

16. In 1958, J.R. Breece and W.H. Hart CDA showed that yellow bud mosaic of peach was carried through soil by *Xiphinema americanum*.

17. During 1957-59, the sudden change from visual inspection to laboratory methods for nematode detection in nursery, and intra-and interstate quarantine shipments continued to result in considerable concern for California nurserymen as well as those from several western states. This concern led to the eventual development and establishment of the State Department's nematode control policies and permanent Nematode Study Committee. The evolution of the Committee is chronicled below:

A. On April 14, 1959, representative nurserymen from Oregon, Washington and California met with personnel from the California Department of Agriculture, Univeristy of California nematologists, County Agricultural Commissioners and others of Sacramento. As a result of this meeting, the representative nurserymen developed and approved a resolution for the State Department to facilitate the movement of nursery stock and quarantine shipments. This resolution was deemed necessary because of the problems encountered with a confusing taxonomy of the Lesion Nematodes that hindered and/or delayed timely identifications, the lack of information for effective nematode control, the lack of uniformity of inspection among county agricultural commissioners, and the fact that it took a least three years to grow many types of nursery stock. Requests were made for 1) a State-approved method for soil treatment which under proper supervision and guidelines would render nursery stock certified if grown in treated soil, without the need for laboratory inspection; 2) a nematode study committee to further study the problems mentioned above.

B. Immediately following this meeting, a permanent nematode study committee was formed at the request of the Director of Agriculture. The committee comprised of two members each from the Department of Agriculture, the University of California, County Agricultural Commissioners, and the Chemical Industry. Three members represented the Nursery Industry, of which one member was from the California Strawberry Nursery Association. The Committee was designed to serve solely as an advisory group, to the State Department of Agriculture and County Agriculture Commissioners.

C. The first meeting of the Nematode Study Committee was held on June 25, 1959, with W.F. Hiltabrand, Chief, Bureau of Nursery Service elected as Chairman. At this meeting, recommendations made by Nematologists, D.J. Raski and W.H. Hart for "Proposed Methods of Soil Treatment for Nematode Control in Woody Plant Nursery Growing Grounds" were accepted by the Committee as a starting point for a certification program. This motion was presented to the Quarantine and Nursery Committee of the California State Association of County Agricultural Commissioners, and to nurserymen through the California Association of Nurserymen. The Committee emphasized that the motion was not intended to preclude laboratory methods for nematode detection and identification. In fact, laboratory methods were recognized as necessary for quarantine inspection and determining the distribution of plant parasitic nematodes throughout the state. The value of clean, plant parasitic-free nursery stock was emphasized. The recommended dosages and procedures for soil fumigation included D-D and Vidden-D at 100 gallons per acre; Telone 80 gallons; Methyl Bromide (actual), Vapam and VPM 400 pounds per acre.

D. Subsequent to the motion presented by the Nematode Study Committee, in 1960, "The Approved Treatment and Handling Procedures for the Control of Nematodes in Deciduous Fruit and Nut Tree, Grapevine, Berry and Vegetable Pland Growing Ground" were adopted by CDA as a requirement for qualification for use of Intercounty Nursery Stock Certificates, "Pinto Tags". This was a voluntary inspection program, and G.I. Stout and W.H. Hart were leaders in developing and implementing the program. This program required acre-by-acre sampling at 40 x 40 foot intervals, and laboratory examination for nematodes. Sampling requirements were waived if the planting land site had met CDA's specifications for high-voltage fumigation along with specified pre-treatment and post-treatment practices.

18. In 1959, W.H. Hart left CDA for the position of Extension Nematologist at U.C. Agricultural Extension Services. J.R. Breece left CDA soon after W.H. Hart for a position as Extension Plant Pathologist in El Centro, California.

19. In 1961, a special committee of County Agricultural Commissioners and CDA personnel developed a pattern for the current Nematode Control Program. This committee, under the chairmanship of Harold A. Crane, Agricultural Commissioner of San Bernardino County, successfully set a target date of 1965 to inspect all commercial varieties of deciduous and non-deciduous fruit trees, nut trees, grapevines, berry and vegetable plants for commercial planting. This mandatory nursery inspection was combined with the voluntary "Pinto Tag" program. This new regulation required inspection for nematodes using laboratory methods except where plants had been grown in grounds treated in accordance with the Approved Treatment and Handling Procedures of CDA, under the supervision of othe County Agricultural Commissioner.

20. In 1965, the seed garlic certification program was set in place by the State Department's Nursery Service. Seed garlic was certified if inspected and found free from Stem and Bulb Nematode, *Ditylenchus dipsaci* and White-rot fungus.

21. In 1969, the success of the Nematode Control Program in reducing the occurrence of plant parasitic nematodes in nursery stock for farm planting was evident. Less than one percent of the acreage was infested with plant parasitic nematodes of concern in more than 2200 acres of fruit and nut tree, grapevine, berry and vegetable plant nursery stock. The nematode species found infesting the acreage included *Meloidogyne spp., Pratylenchus vulnus, P. penetrans, P. brachyurus, Tylenchulus semipenetrans* and *Xiphinema index*. Between 1958-1963, several surveys were conducted by CDA for the detection of the sugarbeet cyst nematode, *Heterodera schactii*.

22. Between 1958-1963, several surveys were conducted by CDA for the detection of the sugarbeet cyst nematode, *Heterodera schactii*.

23. From 1958 onwards, several statewide surveys for the golden nematode were conducted by U.S.D.A. in collaboration with state and county agencies, with negative findings.

24. In 1964, the origin inspection program was made mandatory.

25. Upon the death of G.L. Stout, G.E. Allstat succeeded him in the early 1960s (1963?) as Chief of the Bureau of Plant Pathology. In the early 1960s, A.M. French, Plant Pathologist at CDA-Riverside transferred to Sacramento, became Program Supervisor in 1962-63 and by 1971-72 became Principal Staff Pathologist/Nematologist.

26. During 1965-71, C.W. Nichols succeeded G.E. Allstat as Chief of the Bureau of Plant Pathology.

27. In 1971, The Division of Plant Industry was reorganized and the disciplines of Nematology, Plant Pathology, Entomology, and Plant & Seed Taxonomy were housed with the "Laboratory Services Program Unit". G. Okumura was appointed the first Chief of Laboratory Services. Each discipline was headed by a Program Supervisor. At about this time, the State Department office in Riverside was closed down and several staff were transferred to the Sacramento office. A. M. French, became the Program Supervisor for Nematology.

Plate 28

S. M. Ayoub

A. C. Weiner

The Nematology staff under A.M. French consisted of the following individuals; S. Ayoub (retired in 1986); D.E. Konicek (hired directly to Nematology in late 1960s, Jensen's student in Oregon, retired in 1991); A.C. Weiner (Plate 28) (joined the nematology program in 1960, retired in 1997); E. Hasbrouck (joined the Nematology section in 1967-68?, transferred out of Nematology 1972?); I.A. Siddiqui (Plate 31) (joined the plant pathology/nematology lab in 1969, transferred to the Control and Eradication Unit in 1975, became Chief of Special Services and Pest Detection in 1982, promoted to Assistant Director, Division of Plant Industry in 1985. He left C.D.F.A. to take a post in Washington D.C. in 1997). A.M. French was promoted to Principal Staff Plant Pathologist/Nematologist sometime near the mid 1970s, and retired in 1985. Adam Weiner (Retired Senior Plant Nematologist) passed away on Thursday, November 6, 2003. He was suffering from cancer, and died peacefully at his home.

23. Meanwhile at the administrative level of the Division, C.W. Nichols was promoted first to Assistant Director of the Division, then to Chief of Special Services and then to Chief of Laboratory Services. Robert Roberson replaced him as Assistant Director, and Roberson was subsequently replaced by R. Magee, who was followed by I.A. Siddiqui. C.W. Nichols retired from Chief of Laboratory Services in 1986.

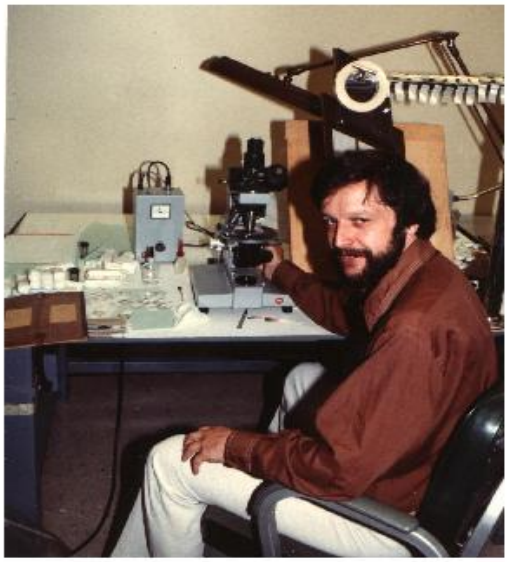
Other nematologists who joined the Nematology Laboratory were: R.T. Robbins (hired in 1972, left in 1979 for an Assistant Professorship at the University of Arkansas), R.W. Hackney (Plate 29) (hired in 1975, continuing), R. Fortuner (Plate 29) (hired about 1979, resigned in 1993), J.J. Chitambar (Plate 29) (hired in 1986, hiatus to CA Waste Management Board Aug. 1992-June 1993, rehired by C.D.F.A. Nematology in July 1993, continuing).

Present permanent staff of nematologists at CDFA's Plant Pest Diagnostics Center, Nematology Laboratory:
J.J. Chitambar - Senior Plant Nematologist (Specialist) (Plate 29)
K. Dong - Associate Plant Nematologist (hired 1999) (Plate 29)

R.W. Hackney - Senior Plant Nematologist (Specialist) (Plate 29)
B. Callison - Chief, Plant Pest Diagnostics Center
R. Wynn - Director, Plant Health and Pest Services, C.D.F.A..

Plate 29

R. W. Hackney



R. Fortuner

K. Dong

J. Chitambar

The role of the C.D.F.A. Nematology Laboratory is four-fold:

i. Regulatory. Samples for nematode diagnoses are collected through different major programs namely, quarantine, nursery, commercial, dooryard. Minor programs may include diagnoses of

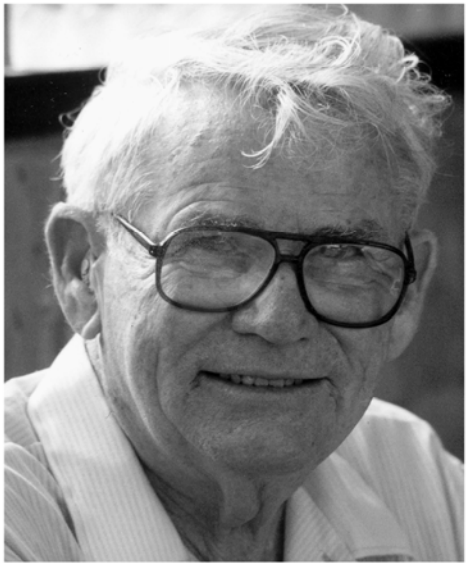
invertebrate nematode parasite, insect parasites and free-living nematodes. The state works closely with county agricultural commissioners' offices to coordinate various aspects of regulating nematode pests:

ii. Professional consultation services;
iii. Training provided primarily to county and state officials, as well as other interested parties,
iv. Research in nematode taxonomy, methodologies and other areas of concern to regulatory nematology.

CHEMICAL COMPANY REPRESENTATIVES AND OTHERS

Over the years there were many other individuals who made significant contributions to the

Plate 30



H. W. Lembright

C. W. McBeth

B. G. Peters, C. W. McBeth, H. Reynolds, R. C. Baines

development of Nematology in California. Among the very early beginners were the Chemical Company representatives who helped determine the efficacy of nematicides. This was done by cooperating in field trials, providing machines to apply the chemicals and obtaining nematode samples as well as collecting yield records. It is not possible to name all of the excellent individuals who were associated in some way with the pesticide industry but two individuals stand out for their professional performances over many years: Clyde McBeth (Plate 30) of Shell Chemical Co. whose early career began in the U.S.D.A. in Tifton, GA. The other is Harold Lembright (Plate 30) of Dow Chemical Co. whose colleagues Dick Youngson and George Turner originally were stationed in the Dow Laboratory at Seal Beach in Orange County, CA. George Turner was later stationed at the Dow Field Station in Davis, Ca. Two others deserve mention here for their generous assistance: Dick Storkin of TriCal, and Nabil Abdalla of Union Carbide. In addition they were all helpful by participating in field day demonstrations in cooperation with County Farm Advisors and University of California members. Special note should be made of the contributions of Shell Chemical Co. to promote public relations and awareness of nematode problems in California by sponsoring a number of nematology workshops in the 1950s.

Dr. Arun Sen is another individual who has served Nematology in California in a unique role starting with industry and presently a member of Pesticide Regulations in the California Department of Food and Agriculture. Dr. Sen enrolled in Oregon State University in 1961 and completed his M.Sc. in 1963 under the direction of Dr. Harold Jensen. For the next year he studied in Europe on a post-graduate

Plate 31

M. Golden

A. Steele

E. Scott

E. Jorgenson

G. Griffin

I.A. Siddiqui

fellowship collaborating with J.W. Seinhorst, N. Goffart and B.A. Weischer. He returned to Corvallis in 1964 to complete his Ph.D. and in 1968 joined the firm of Basic Vegetable Products in Vacaville, California. Five years later he joined the C.D.F.A. where he currently now serves as a Senior Pesticide Evaluation Scientist. This position has kept him focused on the needs of agriculture for adequate control of nematodes affecting crops, especially resolution of best uses of methyl bromide.

Dr. Quentin L. Holdeman was an excellent observer of nematode problems under field conditions. He began his career in nematology in South Carolina but soon left to work with United Fruit Co. in Honduras studying the complex nematode problem on banana. His fine research clarified the differences in symptomatology of root damage by the various nematodes affecting banana including root-knot, lesion, spiral and burrowing nematode species. He then joined Dr. S.A.Sher's laboratory at U.C.R. on a visiting scientist appointment. He later worked for some time as a nematologist/plant pathologist in the California Department of Food and Agriculture. Upon retirement, Dr. Holdeman moved to Louisiana; he died 2003.

U.S.D.A. PRESENCE IN CALIFORNIA

Although many nematologists in the U.S.D.A. traveled to or through California over the years few remained or were stationed in this state for extended periods of time. N.A. Cobb, G. Steiner, A.L. Taylor, J. Christie never reached California but in later years at least four members carried out surveys and control studies.

In 1952 the U.S.D.A. designated a position to be located at the Spreckels Sugarbeet Research in Salinas. Dr. A. Morgan Golden (Plate 31) held that position until 1959 when he moved to Beltsville, Md. He was succeeded in Salinas by Dr. Arnold E. Steele (Plate 31) who continued to study nematode problems of sugar-beets until retirement around 1988.

Dr. Fields E. Caveness in 1957-58 carried out an intensive survey of nematodes affecting sugar-beets in California. This was under the sponsorship of the Beet Sugar Development Foundation. The survey revealed for the first time that *Heterodera schachtii* was present in Imperial Valley. Dr. Caveness in 1965 was appointed to a research position at the U.S.D.A. station at Shafter, Calif. to work on nematode pests of cotton. Caveness left Shafter in 1969 for a position at the International Research Station at Ibadan, Nigeria, from which he retired in Sept. 1988. He was succeeded at Shafter in 1969 by E.C. (Ed) Jorgenson (Plate 31) who continued the research on root-knot nematode resistance in cotton.

One other nematologist, Dr. Harold Reynolds (Plate 5, 30), was stationed in Arizona for many years but seldom came to California. He is seen in a photo of a dozen of the pioneers attending a meeting in 1952 held at Corvallis, Oregon (Plate 5).

CALIFORNIA NEMATOLOGY WORKSHOP

In 1968, recognizing the need to update growers and pest control professionals on current research and the latest development in regulatory policies, Drs. Alex French (California Department of Agriculture) and Skip Sher (U.C. Riverside), conceived and organized the State Nematology Conference. The conference followed the initiative of the Shell Chemical Co. workshops of the 1950s, which promoted public relations and awareness of nematode problems in California.

The first two annual meetings of the State Conference were held in Fresno. Agenda items included the role of commercial laboratories in nematode management, the effectiveness of pest prevention systems at ports of entry, pesticide legislation and environmental pollution, and non-chemical control of nematodes.

Attendance records for the first two State Nematology Conferences do not exist. By 1970, the concept of convening the meeting in a different location each year had emerged. The third conference was held in Anaheim and had an attendance of 150. That attendance level has remained relatively consistent throughout the years.

In the mid-1970s, the name of the annual meeting was changed to the California Nematology Workshop. That change recognized that the meeting was an educational and professional development program and that it had evolved to include demonstration and laboratory sessions. It also recognized that it was easier for industry and state personnel to obtain funding to attend workshops than to attend conferences!

By the late 1970s, the California Nematology Workshop developed an occasional two-component format. The outreach and educational activities were maintained but an in-house planning conference of university and state personnel was added. This latter activity has evolved into the annual planning meeting and discussion of the Nematology Workgroup, which since 1999 has been held on an annual basis concurrently with the California Nematology Workshop.

FOUNDING OF THE SOCIETY OF NEMATOLOGISTS

Soon after Nematology began to flourish across the U.S., it became apparent that several things were urgently needed. One basic requirement for future growth was a form of identity to confer legitimacy on the discipline. Societal associations are of great value in bringing scientists together to exchange information on progress in research, new techniques and for planning.

For some years nematologists mostly attended annual meetings of the American Phytopathological Society, various Entomological Society meetings (regional or national), the Heminthological Society of Washington, and others. Although we found the members and leaders of these organizations gracious and hospitable in welcoming our presence it nevertheless was quite clear that ours was a distinct field of study in many ways and was not always a good fit with the above organizations.

The establishment of a Nematological society seemed the only answer and about 1960 a start was made to organize such a society. A planning Committee of Nine was formed by nematologists in various parts of U.S. including California. A constitution with by-laws was drawn up, modified, agreed upon and the society was in business. The name chosen for the new organization was The Society of Nematologists. Prof. M.W. Allen was the first president of the Society and served in that important role for two years, 1961-63. His highly respected reputation was of immeasurable benefit to the society and helped get it off to a good start.

Soon after, the need for a journal to publish research papers was addressed. A set of rules and by-laws governing the conduct and function of the publication were defined and agreed upon and incorporated in the constitution. The publication was named Journal of Nematology and by this year, 2002 is in its 48th volume. It should be noted S. D. Van Gundy of U.C. Riverside worked arduously to establish the definitions and conditions governing the conduct of the Journal and served as its first Editor-in-chief (1967-71). Over the years it has gained and sustained a reputation as an outstanding and highly respected publication setting a good example for Nematological Societies throughout the world. It serves also to affirm the soundness and fine judgment of Dr. Van Gundy and his associates in creating this Journal.

U.C. Nematologists have maintained an active interest and participation in the Society affairs and activities ever since it was founded. Service on many committees as well as governance as officers and board members. (see Appendix Table 6)

Society of Nematologists AWARDS
University of California Nematologists

Honorary Members: M.W. Allen, R.C. Baines, D.J. Raski, S.D. VanGundy

Fellows of the Society: D.J. Raski, I.J. Thomason, S.D. VanGundy, A.R. Maggenti, H. Ferris, D. (Freckman) Wall, J.F. Baldwin, H.K. Kaya.

CIBA-GEIGY Award: D.J. Raski, H. Ferris, M.V. McKenry, J.D. Radewald, P.A. Roberts, B.B. Westerdahl, O. Becker.

Assistance in the Founding and Development of Nematology in India

California nematologists also had a central role in cooperating with the nematologists of India offering advice and suggestion on how best to plan for development of nematology in that country. One of the most direct aids was to train their students in California not only as future nematologists but also to assure leadership in the development of nematology in their country. The first to arrive was A.R. Seshadri in 1958 completing his Ph.D. in 1961. He was followed by George I. D'Souza in 1964, Sitanath Das in 1966, Dipes R. Dasgupta in 1968 and Usha K. Mehta in 1970. All returned to India to participate actively in promoting the science there.

By 1963, the Central Government of India included in its next 5 year plan a goal of developing nematology to be centered in the Indian Agricultural Research Institute in New Delhi. To help in this the Rockefeller Foundation in its Indian Agriculture Project brought Dr. Raski of U.C.D. to New Delhi to share the experiences in developing nematology in California. There were many conditions in India quite parallel to those facing U.C. nematologists. For one, there were two members at I.A.R.I. prominent in their own careers but also preparing themselves to be leaders in nematology: Dr. Gopal Swarup was a member of the faculty in the Division of Plant Pathology and Dr. S.K. Prasad a faculty member in Entomology. One of the most significant recommendations so crucial to the future development of nematology in India was to unite both positions and any future additions for support and funding into a separate Division of Nematology.

By 1970 the Indian Society of Nematologists was formed and soon began their own publication as the Indian Journal of Nematology volume 1 number 1 in March 1971. The science has flourished wonderfully including a first class journal with high standards of quality and excellence, and the society holds biennial meetings scheduled at various stations throughout the country.

California Nematology: Into the Future

During the past twenty years there have been noteworthy developments in the technological, sociological, and geopolitical realms. The growth in the science of nematology reflects those developments. In considering, in general terms, the future of nematology as a discipline, and the future of the organized research units within the University of California, it is clear that there are exciting opportunities and challenges ahead.

Nematology is first and foremost a biological science, and biology has changed tremendously in recent years. Research on the basic and applied questions in biology, from the level of molecules up to the level of the ecosystems, has become increasingly attainable and increasingly essential.

Developments in molecular biology relative to genetics occur at an amazing pace, and genomics and proteomics are relatively new research areas that have arisen to deal with the quantity of genetic information that accrues. Continuing improvements in computer and communications/satellite technology have opened new avenues for organizing, sharing, referencing, and interpreting information. These are significant developments, because information does not automatically result in understanding. For example, as more information has been gained of genome structure, the function of much of the genome remains a mystery. Understanding organismal function (in the broad biological context) relative to DNA sequence remains an elusive goal toward which many nematologists are contributing.

The improvements in satellite technology allow for detailed monitoring and assessment of the earth's ecosystems. Information on environmental alterations is gained, but our understanding of long-term ramifications of such alterations is in its infancy. As the global population heads toward ten billion people, ameliorating environmental degradation and assuring the availability of a quality food supply remain top priorities. Clearly, this will remain the situation for the next 50 years.

Because nematodes occur in all niches in all ecosystems, and because they are important pathogens of plants, animals, and humans, the increased need for disciplinary-based research that addresses a range of questions is clear. Thus, in concert with recent technological developments, challenges have arisen that highlight new opportunities and demands for nematological research.

Nematodes are the most abundant multicellular animals, in terms of numbers, four of every five multicellular organisms is a nematode. Nematodes occur in many niches that directly and indirectly influence the health and welfare of humanity and the ecological processes upon which humanity depends. Consider the nematode parasites of humans and animals. Billions of people are affected, and health problems are often compounded by poor sanitation, water quality, and living conditions. Consider the nematode parasites of crops. Billions of dollars in production are lost each year due to nematode parasitism, and the use of nematicides to control nematodes in agroecosystems is recognized as a problem. In recent years the potential dangers of nematicides use have been recognized, and the need for alternative tactics for management of plant-parasitic nematodes are well recognized. Novel approaches to resistance, biological control, and crop rotations are being investigated, and much more research is needed in these areas. In addition, a range of problems, including loss of soil quality and atmospheric elevation of carbon dioxide indicate the need for sustainable conservation tillage practices in agriculture. Such practices will require improved understanding of the function of nematodes in food webs, including their roles in nutrient mineralization and their predatory regulation of opportunist pest species.

Thus, nematology remains an important disciplinary focus for research in basic and applied biology. In basic biology, the worm *Caenorhabditis elegans* continues as a model for genetics, genomics, and proteomics. The worm is a model system used to address a range of issues in biology, including questions in developmental biololgy, behavior, gerontology, and soil ecology. Important issues in applied biology are also adderessed in nematology. The management and prevention of nematode disease in plants, animals, and humans remains a major goal. Given that nematodes are found in many niches, understanding the role of nematodes in food webs is important relative to the environment and ecological issues.

The California Department of Food and Agriculture continues to play a vital role not just in regulating the passage of unwanted nematode pests in the State, but also by increasing a necessary

awareness and education of nursery, growers, other state, county and federal governments in the potential economic impact of plant parasitic nematodes on California agriculture and world trade. In addition, it is necessary to note that the regulatory nematode detection program would virtually be ineffective without the essential participation of County Agricultural Commissioners and their staff. Currently, while all counties participate in the nematode detection program, at least five counties have Plant Pathologist/Nematologist staff with nematode sample processing laboratories. The State Department continues to provide training to county staff in sampling and detection.

The regulatory nematode detection program at the State Department of Food and Agriculture has advanced appreciably through the years with the discovery of new exotic nematode pest problems, their distribution and economic impact to California agriculture, and the increased use and limitations of pesticides in nematode management. With a sound foundation historically established for one of the largest nematode regulatory programs of the nation, the California Department of Food and Agriculture still faces many challenges in regulatory nematology. Over the past century, increases in human migration to California have resulted in increases in plant quarantine shipments with their associated parasites, and subsequently, increased demands for clean nursery stock and other plant commodities for local, national and international commerce. California's Nursery Industry alone stands at a net value of $2.5 billion in 2001. Especially during the past few years, the phase-out of certain pesticides effectively used in pre-plant soil fumigation, post-plant nematode management, and quarantine treatments have not only resulted in seeking suitable alternatives but also in increases in laboratory analyses of plant commodities for freedom from plant-parasitic nematodes.

Regulatory action against the entrance and establishment of exotic nematode pests into California is still by far the more cost-effective and certain choice in pest management than suppressive actions against nematode pests already established in the State. Growers seeking phytosanitary certification of local and export plant commodities often demand rapid turnaround time for sample diagnostic results. To meet this demand, the State Department's Nematology Laboratory has maintained its efforts to provide timely and accurate nematode diagnostics by keeping abreast with current technologies and advances in nematode detection and diagnoses. While State Department Nematologists continue to employ traditional means for identifying nematodes based on their morphology using light and electron microscopy, recent advances in molecular diagnoses are also being used as supplemental tools for nematode identification. By far, one of the most pressing needs that may be faced in future years is the availability of professional nematologists well trained in nematode identification. Fewer nematode taxonomists are being produced at universities and colleges than in the past. The need for nematologists experienced in nematode diagnostics is quintessential for the future of any regulatory detection program.

A continued need prevails for reevaluating and establishing cost and time-effective sampling protocol of bulk plant commodities in nursery, field and storage units. Effective techniques are needed for early detection of low populations of harmful plant parasitic nematodes especially in imported and exported quarantine and nursery plant shipments. Updated information on the distribution of many economically important plant parasitic nematodes throughout the state is needed for effective regulatory action to be ministered at state and county levels. Historical survey results cannot be solely relied on when trying to meet phytosanitary quarantine requirements for freedom from target nematode pests mandated by countries importing plant commodities from California. There is need for new surveys for several nematode pests as well as, a consolidated database of survey information on plant parasitic nematode distribution from university, federal, county and state agencies.

With the advancement and reevaluation of technologies and procedures in the science, a quality assessment and standardization of the State Department's nematode detection procedures is necessary to ascertain uniformity of operations amongst all participants in the Nematode Detection Program. It is also

a necessary step in equipping the State Department for any future accreditation capacity. Currently, the California Department of Food and Agriculture is developing rules and regulations to accredit laboratories and private companies for plant disease diagnostics and inspections. This may be offered as a voluntary service at a charge in the near future.

Over the past decade, there has been an increase in interest and information on the affects of diverse microbial fauna in plant-soil ecosystems on plant health. Research information on beneficial insect parasitic nematodes, and free-living soil nematodes as important constituents of the soil food web are continuing to gain foreground in nematode management and crop production. Regulating the commercial use and identity of these non plant-parasitic nematodes may well be a future consideration for the Department.

The challenges in regulatory nematology cannot be faced by the State Department alone as they undoubtedly affect and include all participants of California Agriculture in university, nursery, chemical industry, County Agricultural Commissioners, federal, private companies, and growers. As in the past, the Nematode Study Committee continues to advice and assists the Department on practical issues encountered in nematode management and regulation. The foundation for keeping California's agriculture clean by regulating the entrance, establishment, increase and spread of unwanted economically important plant parasitic nematodes has been historically set in place at the California Department of Food and Agriculture, and continues as an essential means of nematode pest management.

The discipline of Nematology is well recognized, despite the many changes in our society and institutions. The University of California includes two Departments of Nematology that are world centers for the acquisition, development, and dissemination of knowledge on nematodes.

During the 1980s and 1990s, the U.C. Departments of Nematology were restructured to capitalize on advances in technology. They acquired the expertise to vertically integrate knowledge across levels of biological organization and apply it toward understanding of nematodes, their importance, and their management. The critical mass of expertise is continually expanded through creative collaborations. The faculty is successful in obtaining grant funding to support important research endeavors.

In the near term, we need to fortify our strength in the area of nematode behavior as we strive to develop alternative and sustainable management strategies for pest and beneficial species. Clearly, our in-field application experimentation and programs must be supported so that we continue to meet the needs of our clientele relative to the changing demography in California. We need to increase the globalization of our teaching, research and extension programs, again to mirror the changes occurring in demographics and agricultural production. Such changes will include increasing numbers of national and international graduate students; breadth and depth of training courses conducted locally and internationally, international collaboration in important research areas, and international components of our extension activities.

Nematology in California is almost ideally poised to continue world leadership in the discipline. There are some areas that need to be strengthened and some that need to be sustained; the future holds considerable promise.

Appendix Table 1

VISITING SCHOLARS AND POST-DOCTORALS

University of California Davis

Name	Year	Affiliation/Country	Present Location
Oostenbrink, M	1954	Netherlands (deceased)	Deceased
Yuksel, Hassan	1960	Ankara, Turkey	Unknown
Taylor, Charles E.	1964	Dundee, Scotland	Westcroft, Lonforgan, Dundee, DD2 5EX, UK
Amici, Adriana	1964	Bari, Italy	Unknown
Roggen, Domien R.	1965	Belgium	Unknown
Betto, Eliseo	1965	Milano, Italy	Milano, Italy
Hirumi, Hiroyuki	1968	Boyce Thompson Institute, U.S.A.	Unknown
Swarup, Gopal	1971	IARI, New Delhi, India	IARI, New Delhi, India
Timm, Rev. Richard	1974	Notre Dame College, Dhaka, Bangladesh	Notre Dame College, Dhaka, Bangladesh
Lamberti, Franco	1976	Bari, Italy	Instituto di Nematologia Agraria, Via G. Amendola 165/A, Bari, Italy
Croll, Neill	1977	Quebec, Canada (deceased)	Deceased
Luc, Michel	1978	ORSTOM, France	6 Rue Boutard, 92200 Neuilly-sur-Seine, France
Loof, P.A.A.	1981	Netherlands	Department of Nematology, Wageningen University, P.O. Box 8123, 6700ES, Wageningen, The Netherlands
Mehta, Usha K.	1981 -83	Coimbatore, India	Sugarcane Breeding Institute, (ICAR), Coimbatore, India
Geraert, Etienne	1984	Ghent, Belgium	Department of Biology, Universiteit Gent, Ledeganckstr. 35, 9000 Gent, Belgium
Valenzuela, Adelina	1984	Santiago, Chile	Unknown
Decraemer, Frieda	1984	Ghent, Belgium	Rue Vautier 29, Brussels, B-1000, Belgium
Choo, HoYul	1984	Korea	Department of Agricultural Biology, Gyeongsang National University, Gyeongnam Province, Chinju, 660-701, Republic of Korea
Mohandas, Chellapau	1985	Keralla, India	CPCRI,-Keralla.-India
Brzeski, M.W.	1986	Poland (deceased)	Deceased
Zheng. Liang	1986 -87	China	Department of Nematology, U.C. Davis
Gaspard, Jerome T.	1986 -87	U.C.R., now in Japan	Japan
Verdejo-Lucas,	1986	1986	IRTA, Dept. Proteccion Vegetal, Carretera de Cabrils

Soledad			S/N, 08348, Cabrils (Barcelona), Spain

Melakeberhan, Haddish	1986-88	now at Michigan State U. postdoctoral	Department of Entomology, Michiogan State University, East Lansing, MI 48824
Coomans, August C.	1987	Ghent, Belgium	Department of Biology, Universiteit Gent, Ledeganckstr. 35, 9000 Gent, Belgium
R.Winoto, Suatmadji	1987	Australia (deceased)	Plant Research Institute, Victoria Department of Agriculture, Melbourne, Australia (Deceased)
Seshadri, A.R.	1987	New Delhi, India	Unknown
Van de Velde, MarieClaire	1987	Ghent, Belgium	Department of Biology, Universiteit Gent, Ledeganckstr. 35, 9000 Gent, Belgium
Taylor, Charles	1987	Dundee, Scotland	Westcroft, Lonforgan, Dundee, DD2 5EX, UK
Myuge, S.G.		U.S.S.R.	Unknown
Prot, Jean-Claude	1988-89	ORSTOM, France	France
Queneherve, Patrick	1989	ORSTOM, Senegal, now in Martinique	B.P. 8006, Centre IRD, Fort de France Cedex, 97259, Martinique. Email: queneherve@ird-mq.fr
Sultan, Sufian A.	1989	Palestine, Visiting Scientist	Department of Agricultureal Sciences, An Najah National University, PO Box 7, Nablus, Palestine
McInnis, Tom	1989	South Carolina	Department of Plant Pathology, Clemson University, Clemson, SC29634-0377
Choo, HoYul	1985 and 1994	Korea	Department of Agricultural Biology, Gyeongsang National University, Gyeongnam Province, Chinju, 660-701, Republic of Korea
Mostafa, Fatma	1989	Egypt, Visiting Scientist	Faculty of Agriculture, Agricultural Zoology Department, Mansoura University, Mansoura, Egypt
Okada, Hiroaki	1999-00	Japan, Visiting Scientist	Lab. Plant Protection, National Agricultural Research Center, Arai, Fukushima-city, 960-2156, Japan. Email: hokada@affrc.go.jp
Matute, Martin	2000-01	Cameroun, Visiting Scientist	mmatute@iwu.edu
Stock, Patricia	1991-96	Argentina (now Univ. of Arizona)	Dept. of Plant Pathology, University of Arizona, P.O. Box 210036, Tucson, AZ 85721-0036
Ruiz, Jaime	1998-99	Mexico	Department of Natural Resources, CIIDIR-OAXACA, Instituto Politecnico Nacional, Calle Hornos 1003 Sta. Cruz, Xoxocotlan, Oaxaca 71230
Amaral, Joao	1992	Portugal	Unknown
Chinnasri, Buncha	1996	Thailand	Plant and Environmental Sciences, 3190 Maile Way, University of Hawaii, Honolulu, HI 96822
Somsook, Vacharee	1989	Thailand	Biological Control Research Group, Division of Entomology and Zoology, Department of Agriculture, Bangkhen, Bangkok 10900, Thailand
Koppenhöfer, Albrecht	1994-99	Postdoctoral Fellow, Germany	Department of Entomology, Blake Hall, 93 Lipman Ave, Rutgers University, New Brunswick, NJ 08901
Ganguly, Sudershan	1990	India	Division of Nematology, Indian Agricultural Research Insititute, New Delhi, 110012, India
Közler , Ursula	1990	Germany	Schillersrasse 12, 51429 Bergisch Gladbach, Germany
Hazir, Selcuk	1998-00	Turkey	Hacettepe University, Faculty of Science, Department of Biology, 06532, Beytepe, Ankara-Turkey

Smith, Kirk	1986	USA	University of Arizona, Maricopa Agricultural Center, Maricopa, Arizona 85239-3010
Baur, Matthew	1994 -95	USA	Department of Entomology, Louisiana State University, Baton Rouge, LA 70803
Berkelmans, Robert	2001 -02	The Netherlands	Biological Farming Systems Group, Wageningen University, Marijkeweg 22, 6709 PG Wageningen, The Netherlands. Email: Robert.Berkelmans@wur.nl
Tenuta, Mario	2001 -02	Canada	Department of Soil Science University of Manitoba, Winnipeg, MB Canada R3T 2N2. Email: tenutam@Ms.UManitoba.CA

Appendix Table 2
Graduate Students
Department of Nematology, University of California Davis

First Name	Last Name	Degree	Major	Year	Dissertation Title	Major Professor
Nabil Abdelmoti	**Abdalla**	**Ph.D.**	Entomology	1973	Distribution, Persistence and Nematicidal Activity of Monobromomethane and a Pesticide Containing 1,3-dichloropopene in Soil	Lear, Bert
Fawzia Hassan	**Abdel-Rahman**	**Ph.D.**	Entomology	1981	Taxonomy, Morphology, and Biology of Two New Species of Nematodes Parasitic on Sedge, Scirpus robustus Pursh	Maggenti, Armand
Cyrus	**Abivardi**	**Ph.D.**	Entomology	1968	A Study of Anthelmintic Natural Plant Products, Exhibiting Nematocidal Activity to Plant Parasitic Nematodes	Lear, Bert
Luma	**Al Banna**	**M.S.**	Plant Pathology	1992	Nematode Diversity of Native Grape in California	Gardner, Scott
Luma	**Al Banna**	**Ph.D.**	Plant Pathology	1996	Systematics of the Genus Pratylenchus Filipjev, 1936 (Nemata: Pratylenchidae)	Williamson, Valerie/ Gardner, Scott
Raquel	**Alatorre-Rosas**	**Ph.D.**	Entomology	1988	Competition for Insect Resources between Steinernematid and Heterorhabditid Nematodes	Kaya, Harry
Merlin Walters	**Allen**	**Ph.D.**	Entomology	1947	The Transmission of Lettuce Big Vein Virus in the Abscence of a Vector	Essig, Edward O.
Mario	**Araya Vargas**	**M.S.**	Plant Pathology	1993	The Host Status of Crotalaria juncea, Dolichos lablab, Sesamum indicum and Elymus glaucus to Meloidogyne javanica	Caswell-Chen, Edward
Alejandro	**Ayala**	**Ph.D.**	Entomology	1965	Transmission of the California Tobacco Rattle Virus by Three Species of the Nematode Genus Trichodorus Cobb, 1913	Allen, Merlin
Mary Ellen	**Barbercheck**	**Ph.D.**	Entomology	1990	Interactions Between Entomogenous Nematodes and Beauveria bassiana in Hosts and in Soil	Kaya, Harry
Glenn Bernard	**Bergeson**	**Ph.D.**	Entomology	1957	Factors Affecting the Survival of Eggs and Larvae of Meloidogyne incognita acrita Chitwood 1949 in the Absence of a Host	Allen, Merlin

Nena	**Bloom**	**M.S.**		1997		Caswell-Chen, Edward
Adolf Louis	**Braun**	**Ph.D.**	Plant Pathology	1974	The Pin Nematode, Paratylenchus neoamblycephalus, and Its Effect on Myrobalan Plum (Prunus cerasifera Ehrh.)	Lownsbery, Benjamin
Eric David	**Brenner**	**Ph.D.**	Plant Biology	1997	Investigations into the Role of Two Nematode Induced Genes in Tomato roots: Lycopersicon esculentum miraculin (LeMir) and Monodehydroascorbate Reductase	Williamson, Valerie
Thomas Michael	**Burlando**	**M.S.**	Plant Pathology	1978	Parasitic Nematodes of Irrigated Pasture: Identification, Pathogenicity, and Control	Maggenti, Armand
James Fulton	**Campbell**	**Ph.D.**	Entomology	1999	Entomopathogenic Nematode Ambush Foraging Strategies: Behavioral Mechanisms for Finding Hosts	Kaya, Harry
John Jashwant	**Chitambar**	**Ph.D.**	Plant Pathology	1983	Effects of Pratylenchus vulnus and Meloidogyne spp. on Grape Rootstocks, and Life-history and Morphology of P. vulnus	Raski, Dewey
Ignacio	**Cid Del Prado Vera**	**Ph.D.**	Entomology	1982	Taxonomy, Morphology, Biology, and Histopathology of Rhizonema sequoiae n. gen. n. sp. (Nemata: Heteroderidae) on Coast Redwood Sequoia sempervirens (D.Don) Endl.	Lownsbery, Benjamin
George Iraeneus	**D'Souza**	**Ph.D.**	Entomology	1964	The Pathogenicity of Pratylenchus vulnus to Peach	Lownsbery, Benjamin
Frederico	**Dao**	**M.S.**	Plant Pathology	1959	Host Range and Morphology of the Root-Knot Nematode Meloidogyne arenaria thamesi Chitwood, 1952	Allen, Merlin
Sitanath	**Das**	**Ph.D.**	Plant Pathology	1966	Virus-vector Relationships of Grapevine Fanleaf Virus and its Nematode Vector Xiphinema index Thorne and Allen, 1950	Raski, Dewey
Dipes Ranjan	**Dasgupta**	**Ph.D.**	Entomology	1968	A Revision of the Genus Rotylenculus Linford and Oliveira, 1940 and Notes on the Biology of R. parvus (Williams) Sher	Raski, Dewey
Silamar	**Ferraz**	**Ph.D.**	Plant Pathology	1973	The Pathogenicity of Four Plant Parasitic Nematodes on Carnation, Their Interaction with Fusarium oxysporum f. sp. dianthi, and Their Control	Lear, Bert
Jeffrey	**Gardner**	**M.S.**	Plant Protection and Pest Management	1993	Evaluation of Raphanus sativa, Sinapis alba, and Fagopyron esculentum as Trapping Crops for Mangament of the Sugarbeet-Cyst Nematode, Heterodera schachtii	Caswell-Chen, Edward

Jeffrey	**Gardner**	**M.S.**	Ecology	1995	Influence of Cyst Maturation on Apparent Population Increases by Heterodera schachtii on Host Root Remnants	Caswell-Chen, Edward
Robin Michael	**Giblin**	**Ph.D.**	Entomology	1982	Biology and Taxonomy of Nematode Associates of Soil-Dwelling Bees	Kaya, Harry
John Alden	**Griesbach**	**Ph.D.**	Ecology	1987	Morphometrics and Vector Competency of Xiphinema americanum sensu lato in California	Maggenti, Armand
Saad Labib	**Hafez**	**Ph.D.**	Entomology	1980	Systemic, Non-fumigant Nematicides and Their Mode of Action for Nematode Control on Grapevines	Raski, Dewey
Arnold Hajime	**Hara**	**Ph.D.**	Entomology	1982	The Entomogenous Nematode, Neoaplectama carpocapsae: In Vitro Rearing, Infectivity to Pupae of Spodoptera exigua, and Compatibility with Chemical Pesticides	Kaya, Harry
Adrian Ross	**Harris**	**Ph.D.**	Plant Pathology	1989	Interactions between Fusarium oxysporum f. sp. tracheiphilum and Meloidogyne spp. in Vigna unguiculata	Ferris, Howard
Winfield Hiram	**Hart**	**Ph.D.**	Entomology	1951	The Biology and Morphology of the Foliar Nematode, Aphelenchoides ritzema-bosi (Schwartz, 1911) Steiner, 1932	Allen, Merlin
Larry Ross	**Hodges**	**Ph.D.**	Entomology	1971	Distribution and Persistence of 1,2-dibromo-3-chloropropane in Soil	Lear, Bert
William Duane	**Hope**	**Ph.D.**		1964	A Taxonomic Review of the Genus Thoracostoma Marion, 1870 (Nemata: Leptosomatidae) and a Study of the Histologic Morpholoy of Thoracostoma californicum Stiner and Albin, 1933	Maggenti, Armand
Phyllis Gail	**Hotchkin (Weintraub)**	**Ph.D.**	Entomology	1984	Parasite-Pathogen Interactions in the Armyworm, Pseudaletia unipuncta	Kaya, Harry
Chaw-Shung	**Huang**	**Ph.D.**	Plant Pathology	1968	Mechanism of Giant Cell Initiation and the Subsequent Intracellular Changes Caused by Root-Knot Nematode	Shalla, T.A. ? Maggenti, Armand?
Harold James	**Jensen**	**Ph.D.**	Entomology	1950	The Biology and Morphology of the Root Lesion Nematode Parasitic on Walnuts in California	Allen, Merlin
Ruth Nichols	**Johnson**	**Ph.D.**	Entomology	1966	The Influence of Environmental and Chemical Factors on the Penetration and Development of Heterodera schachtii in Aseptic Root Cultures	Viglierchio, David
Douglas Eric	**Johnson**	**Ph.D.**	Entomology	1968	The Dispersion of 1,2-dibromo-3-chloropropane in Soil with and Evaluation of Limiting Factors	Lear, Bert

Miriam	**Kaplan**	**Ph.D.**	Plant Pathology	1997	Influence of four plants of differing host quality on three genetically disticnt isolates of Heterodera schachtii: A morphometric, demographic, and genetic analysis of host- induced selection	Caswell-Chen, Edward
Robert Armstrong	**Kinloch**	**Ph.D.**	Entomology	1967	Species Dominance in Co-incident Infections by Meloidogyne hapla and M. javanica on Tomato	Allen, Merlin
Umesh Chengappa	**Kodira**	**Ph.D.**	Plant Pathology	1993	Competition Between Pratylenchus neglectus and Meloidogyne chitwoodi on Barley and Potato	Ferris, Howard
Brent Allen	**Lackey**	**M.S.**	Plant Pathology	1992	Development of the Nematophagous Fungus Hirsutella rhossiliensis for Biological Control of Plant-Parasitic Nematodes	Jaffee, Bruce
Kris Nicholas	**Lambert**	**Ph.D.**	Biochemistry and Molecular Biology	1995	Isolation of Genes Induced Early in the Resistance Response to Meloidogyne javanica in Lycopersicon esculentum	Williamson, Valerie
John Edward	**Larson**	**Ph.D.**	Entomology	1959	The Biology of Pratylenchus thornei Sher and Allen, 1953	Allen, Merlin
Helen Mei	**Ma**	**M.S.**	Biochemistry and Molecular Biology	1993	Molecular Characterization of Aps-1 in Tomato	Williamson, Valerie
George Macdougal	**Mackintosh**	**M.S.**	Entomology	1957	The Morphology of the Cabbage Root Nematode (Heterodera cruciferae Franklin, 1945)	Allen, Merlin
Armand Richard	**Maggenti**	**Ph.D.**	Entomology	1959	The Morphology, Biology, and Taxonomy of the Genus Plectus (Nemata: Plectidae)	Allen, Merlin
Nahum	**Marban-Mendoza**	**Ph.D.**	Entomology	1979	Behavioral Effects of Selected Non-Fumigant Nematicides, Carbofuran and Phenamiphos on Pratylenchus vulnus Allen and Jensen, 1951 (Nemata: Pratylenchidae)	Viglierchio, David
Michael Allen	**McClure**	**Ph.D.**	Entomology	1964	Physical and Nutritional Factors Affecting the Penetration, Development and Sex-Ratio of Meloidogyne incognita (Kofoid and White, 1919) Chitwood, 1949 (Nematoda: Heteroderidae)	Viglierchio, David
Usha Kirtilal	**Mehta**	**Ph.D.**	Entomology	1970	Revision of the Genus Criconema Hofmanner and Menzel, 1914 and Other Related Genera (Criconematidae: Nematoda)	Raski, Dewey
Starr Toshiharu	**Miyagawa**	**M.S.**	Entomology	1963	Factors Influencing Survival in Soil of Ditylenchus dipsaci (Kuhn, 1857)	Lear, Bert

Hassan	**Mojtahedi**	**Ph.D.**	Plant Pathology	1974	The Biology of Criconemoides xenoplax and its Pathogenicity to Plum Rootstocks	Lownsbery, Benjamin
Carl Max	**Monroe**	**Ph.D.**	Plant Pathology	1962	Comparison of In Vitro and In Vivo Bioassay of Foliage Fungicides	Yarwood, C.E.
Eugene Huffine	**Moody**	**Ph.D.**	Plant Pathology	1974	Growth, Nutritional Status, and Water Relations of Myrobalan 3J Plum (Prunus cerasifera) Inoculated with a Root-lesion Nematode, Pratylenchus vulnus	Lownsbery, Benjamin
Patricia Loraine	**Moyle**	**M.S.**	Entomology	1980	Dispersal and Infectivity of the Entomogenous Nematode, Neoaplectana carpocapsae (Rhabditida: Steinernematidae)	Kaya, Harry
William Robert	**Nickle**	**Ph.D.**	Entomology	1963	The Endoparasitic Nematodes of California Bark Beetles with Descriptions of Bovienema n. g. and Neoparasitylenchus n. subg. and with the Presentation of New Information on the Life History of Contorylenchus elongatus n. comb.	Allen, Merlin
Gregory Ross	**Noel**	**Ph.D.**	Plant Pathology	1977	The Pathogenicity of Macroposthonia curvata, Meloidogyne hapla, Paratrichodorus christiei, and Tylenchorhynchus clarus to Alfalfa, and the Interaction of M. curvata with Alfalfa Mosaic Virus	Lownsbery, Benjamin
Surindar Mohan	**Paracer**	**Ph.D.**	Plant Pathology	1965	Studies on the Biology of Paratylenchus hamatus Thorne & Allen, 1950 and Its Effect on Three Host Plants (Nematoda: Paratylenchidae)	Lownsbery, Benjamin
Edmond D.	**Pattimore**	**M.S.**		1961		
Jorge Brieva	**Pinochet**	**Ph.D.**	Plant Pathology	1976	Effect of Pratylenchus vulnus on Growh and Development of Vitis vinifera 'Thompson Seedless' and the Interaction of this Nematode with Xiphinema index	Raski, Dewey
Anastasius George	**Polychronopoulos**	**Ph.D.**	Plant Pathology	1967	Effect on Young Sugar Beet (Beta vulgaris L.) Plants of Heterodera schachtii Schmidt 1871, Alone, and in Combination with Rhizoctonia solani Kuhn 1858	Lownsbery, Benjamin
Jinya	**Qiu**	**M.S.**	Plant Pathology	1992	Evaluation of Hot Water Treatments for Management of Ditylenchus dipsaci and Fungi in Daffodil Bulbs	Westerdahl, Becky
John D.	**Radewald**	**Ph.D.**	Plant Pathology	1962	The Biology of Xiphinema index and the Pathological Effect of the Species on Grape	Raski, Dewey
Dewey John	**Raski**	**Ph.D.**	Entomology	1948	The Biology and Morphology of the Sugar-beet Nematode, Heterodera schachtii Schmidt	Essig, Edward O.

Benjamin Newton	**Shouse**	**M.S.**	Ecology	2000	The Relationship of an Agricultural Soil Microarthropod and Nematode Community to Ecosystem Function	Ferris, Howard
Gerald Sunao	**Santo**	**Ph.D.**	Plant Pathology	1974	Influence of Pratylenchus vulnus, Meloidogyne hapla, and Verticillium dahliae on the Growth of Manetti Rose Rootstock	Lear, Bert
Alleppey R.	**Seshadri**	**Ph.D.**		1961		Raski, Dewey
Catherine Rivera	**Smith**	**M.S.**	Vegetable Crops	1988	The application of an excised root assay for the determination of susceptiblilty or resistance to root-knot nematodes (Meloidogyne spp. Goeldi) in potatoes Solanum spp. L.).	Voss, R. E.
Karen Marie	**Sobczyk**	**M.S.**	Ecology	1990	Prevalence, Intensity, and Comparative Biomass of Diplotriaena obtusa (Rudolphi, 1802) (Nemata:Diplotriaenoidea) in Four Species of Swallows from California	Maggenti, Armand
John Patrick	**Studdert**	**Ph.D.**	Entomology	1988	Survival and Infectivity of the Entomopathogen Beauveria bassiana in the Soil Environment	Kaya, Harry
Abd-El-Samie Hazem Youssef	**Taha**	**Ph.D.**	Entomology	1968	Interrelationships between Root-nodule Bacteria, Plant-parasitic Nematodes and their Leguminous Host	Raski, Dewey
Eric Craig	**Tedford**	**Ph.D.**	Plant Pathology	1994	Transmission of the nematophagous fungus Hirsutella rhossiliensis to plant-parasitic nematodes	Jaffee, Bruce
Daniel	**Teliz-Ortiz**	**Ph.D.**	Plant Pathology	1965	Transmission of Tomato Ringspot, Grape Yellow Vein, Peach Yellow Bud Mosaic, and Tobacco Ringspot Viruses by the Nematode Xiphinema americanum Cobb, 1913	Lownsbery, Benjamin
Paul Rhys	**Thomas**	**Ph.D.**	Entomology	1963	Studies on the Biology, Morphology and Taxonomy of the Nematode Genus Acrobeles von Linstow, 1877	Allen, Merlin?
Patricia	**Timper**	**M.S.**	Entomology	1987	Dispersal of Entomogenous Nematodes by Infected Adult Spodoptera exigua	Kaya, Harry
Patricia	**Timper**	**Ph.D.**	Entomology	1991	Parasitism of Entomogenous Nematodes by the Fungus Hirsutella rhossiliensis	Kaya, Harry
Alan John	**Towson**	**Ph.D.**	Plant Pathology	1982	The Role of Heat-Hardening and Dormancy in Increasing Tolerance of Hot-Water Treatment of Rose to Control Endoparasitic Nematodes	Lear, Bert
Jose Trinidad	**Vazquez**	**Ph.D.**	Entomology	1967	The Effects of Host Nutrition and Soil Fumigation on the Penetration and Pathogenicity of Meloidogyne javanica (Treub, 1885) Chitwood, 1949 on Tomato	Lear, Bert

Robert Charles	**Venette**	**Ph.D.**	Ecology	1997	Assessment of the Colonization Potential of Introduced Species During Biological Invasions	Ferris, Howard
Miriam	**Volat**	**M.S.**	Vegetable Crops	1999	Determining Supplemental Nitrogen Requirements in Cover Cropped Processing Tomato Systems	Ferris, Howard
Thomas Ray	**Watson**	**Ph.D.**	Plant Pathology	1969	Factors Influencing the Hatching of a Root Knot Nematode Meloidogyne naasi Franklin, 1965	Lownsbery, Benjamin
Jennifer Lee	**Woodring**	**Ph.D.**	Entomology	1990	Recycling of the Pathogenic Fungus Lagenidium giganteum in the Rice Field Mosquito Culex tarsalis	Kaya, Harry
Tom Toshio	**Yamashita**	**Ph.D.**	Plant Pathology	1985	Resistance, Increased Susceptibiltiy and Related Behavioral Changes in Nematodes Stressed with Nonfumigant Nematicides	Viglierchio, David
Inga Anne	**Zasada**	**Ph.D.**	Plant Pathology	2002	Chemical Components of the Brassicaceae that Suppress Plant-parasitic Nematodes	Ferris, Howard

Appendix Table 3
Current Positions of Graduate Students
Department of Nematology, University of California Davis

First Name	Last Name	Previous Appointment		Current Position
Nabil Abdelmoti	**Abdalla**	Staff Research Associate, Dept. of Nematology, U.C. Davis, Davis, CA 95616	Deceased, 2001	Formerly with Rhone Poulenc, now Aventis.
Fawzia Hassan	**Abdel-Rahman**	Dept. of Biology, Texas Southern University, 3100 Cleburne Ave., Houston, TX 77004		Department of Biology, Texas Southern University, 3100 Claburne Ave., Houston, TX 77004
Cyrus	**Abivardi**	Chair and the Professor of Entomology and Nematology (Department of Plant Protection); Associate Dean of Academic Affairs (College of Agriculture), Pahlavi University (Shiraz/Iran)		Swiss Federal Institute of Technology (ETH), College of Environmental Sciences, Department of Geobotany. Address: Geobotanisches Institut ETH Zürich, Zürichberg-Str. 38 CH-8044 Zurich, Switzerland. Tel. +41 01 632-5976 Fax +41 01 632-1215. Email: abivardi@geobot.umnw.ethz.ch
Luma	**Al Banna**		Assistant Professor	Department of Horticulture and Plant Protection, Faculty of Agriculture, University of Jordan, Amman, Jordan
Luma	**Al Banna**		Assistant Professor	Department of Horticulture and Plant Protection, Faculty of Agriculture, University of Jordan, Amman, Jordan
Raquel	**Alatorre-Rosas**		Professor	Colegio de Postgraduados, Instituto de Fitosanidad, Montecillo, Estato de Mexico, 56230, MX
Merlin Walters	**Allen**	Professor, Department of Nematology, University of California, Davis	Deceased, 1974	Professor of Nematology, UCB/UCD
Mario	**Araya Vargas**		Scientist, Corbana Corporation	Apdo #375, Turrialba 7150, Costa Rica
Alejandro	**Ayala**	Dean, College of Agricultural Science, University of Puerto Rico, Rio Piedras, Puerto Rico 00928	Ad-Honorem Professor, Assistant Dean for Science and Technology	Faculty of Agriculture, EAAM, P.O. Box 5261, Mayagüez, P.R. 00681
Mary Ellen	**Barbercheck**		Associate Professor	Department of Entomology, Box 7634, North Carolina State University, Raleigh, NC 27695-7634
Glenn Bernard	**Bergeson**		Professor	Nematologist in Department of Plant Pathology, Purdue University, West Lafayette, IN 47907-1158

Nena	**Bloom**			
Adolf Louis	**Braun**	Director of Research, Plant Disease Laboratory, Del Monte Corp., Davao, Mindinao, The Philippines	Virologist	CDFA, Sacramento,CA
Eric David	**Brenner**		Post-Doctoral Researcher	Dept. of Biology, New York University, New York, NY 10003
Thomas Michael	**Burlando**		Walnut Growers Association	P.O. Box 329, Clarksburg, CA 95612
James Fulton	**Campbell**		Research Scientist	USDA, ARS, 1515 College Ave., Manhattan, KS 66502
John Jashwant	**Chitambar**		Senior Plant Nematologist Specialist	California Dept. of Food and Agriculture, Plant Pest Diagnostics Center, Nematology Lab, 3294 Meadowview Rd., Sacramento, CA 95832-1448
Ignacio	**Cid Del Prado Vera**		Professor	Colegio de Postgraduados, Instituto de Fitosanidad, Montecillo, Estato de Mexico, 56230, MX
George Iraeneus	**D'Souza**	Director of Research, Central Coffee Research Station, Mysore State, India	Retired, 1977; Deceased, 1999	Director of Research of the Coffee Board, Bangalore, India from 1971-77
Frederico	**Dao**			
Sitanath	**Das**	Dean of Research, Dean of Extension, College of Agriculture, O.U.A.T. Bhubaneswar 751003, Orissa, India	Retired Head, Dept. Nematology	College of Agriculture, O.U.A.T. Bhubaneswar 751003, Orissa, India
Dipes Ranjan	**Dasgupta**	Pool Officer, Indian Agricultural Institute	Retired Head, Division of Nematology	Indian Agricultural Research Institute, New Delhi 110012, India
Silamar	**Ferraz**		Dean, Academic Curricula	Dept. Fitopatologia, Universidade Federal de Vicosa, 36570 Vicosa-Minas Gerais, Brasil
Jeffrey	**Gardner**			Ithaca, NY

Jeffrey	**Gardner**			Ithaca, NY
Robin Michael	**Giblin**		Professor	University of Florida, 3205 College Ave., Ft. Lauderdale, FL 33314-7799
John Alden	**Griesbach**			Plant Pathologist, Oregon Dept. of Agriculture. jgriesba@oda.state.or.us. (503)986-4661
Saad Labib	**Hafez**		Professor	29603 University of Idaho Ln., University of Idaho R & E Center, Parma, ID 83660
Arnold Hajime	**Hara**		Professor	Dept. of Entomology, University of Hawaii, Beaumont Research Station, Hilo, HI 96822
Adrian Ross	**Harris**	Senior Research Scientist, CSIRO Division of Soils, Adelaide, Australia	Manager	Manager, Biosecurity Australia, Department of Agriculture, Fisheries and Forestry. GPO Box 858 Canberra ACT 2601, Australia. Email: adrian.harris@affa.gov.au
Winfield Hiram	**Hart**	Professor, Extension Nematologist, Department of Nematology, University of California Davis; CDFA	Deceased	U.C.D. Extension Specialist Nematologist
Larry Ross	**Hodges**			Rhone Poulenc, now Aventis
William Duane	**Hope**		Curator, Smithsonian Institution	Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560
Phyllis Gail	**Hotchkin (Weintraub)**		Research Scientist	Gilat Experimental Station, Mobile Post Negev, 85-280 Isreal
Chaw-Shung	**Huang**	Research Fellow, Institute of Botany, Academia Sinica, Nankang, Taipei, Taiwan, China	Retired Chair, Department of Plant Pathology	University of Brasilia, Brasilia, Brasil
Harold James	**Jensen**	Professor, Department of Plant Pathology, Oregon State University	Retired from Oregon State University	23619 Harris Road, Philomath, OR 97370
Ruth Nichols	**Johnson**	Dean, Community College System, Denver, Colorado	?	(Contact Mae Noffsinger for information), Denver, CO
Douglas Eric	**Johnson**	Extension Nematologist, San Joaquin Valley Agricultural Research and Extension Center, Parlier, CA 93648	Retired Nematologist	Rhone-Poulenc Chemical Company

Miriam	**Kaplan**		School teacher, Santa Barbara, CA	Formerlu Peace Corps, Nigeria
Robert Armstrong	**Kinloch**		Professor of Nematology	University of Florida, West Florida Research and Experiment Station, 4253 Experiment Rd., Jay, FL 32565-9524
Umesh Chengappa	**Kodira**		Plant Pathologist	CDFA, 1220 N Street, Sacramento, CA 95814
Brent Allen	**Lackey**		Researcher	Zeneca Ag Products, Southern Regional Tech. Center, Route 1, Box 65, Leland, M.S. 38756
Kris Nicholas	**Lambert**		Assistant Professor	University of Illinois at Urbana-Champain, Dept. of Crop Sciences, AW-101 Turner Hall, 1102 So. Goodwin Ave., Urbana, IL 61801-4798
John Edward	**Larson**		Retired	School of Forestry, UCB
Helen Mei	**Ma**		Homemaker	
George Macdougal	**Mackintosh**			
Armand Richard	**Maggenti**	Professor, Department of Nematology, U.C. Davis	Retired, Emeritus Professor	818 Sycamore Lane, Davis, CA 95616
Nahum	**Marban-Mendoza**		Professor of Nematology	Department de Parasitologia Agricola, Universidad Autonoma de Chapingo, Chapingo, Mexico CP 56230. Phone: 595-556-230. Email: mahumm@taurus1.chapingo.mx, nmarbanm@serve.net.mx
Michael Allen	**McClure**		Professor, University of Arizona	Department of Plant Pathology, 204 Forbes Building, University of Arizona, Tucson, AZ 85721
Usha Kirtilal	**Mehta**	Pool Officer, Indian Agricultural Research Institute, New Dehli 12, India	Retired Head, Division of Plant Protection (Entomology, Nematology, Plant Pathology)	Sugarcane Breeding Institute, ICAR, Coimbatore, 641007 Tamil Nadu, India
Starr Toshiharu	**Miyagawa**	Staff Research Associate, Department of Plant Pathology, University of California, Davis, CA 95616	Retired	Sacramento

Hassan	**Mojtahedi**	Nematologist, Plant Pest and Diseases Research Institute, Tehran, Iran	Nematologist	Washington State University-Prosser, IAREC 24106 N. Bunn Rd., Prosser, WA 99350
Carl Max	**Monroe**			
Eugene Huffine	**Moody**		Retired	Former Professor, University of Georgia Extension, 430 Greencrest Drive, Athens, GA, 30605. Phone: 706-546-5212
Patricia Loraine	**Moyle**		Stockbroker	San Francisco, CA
William Robert	**Nickle**	Research Nematologist, U.S. Department of Agriculture, Beltsville, MD	Retired Nematologist	USDA, 11201 Montgomery Road, Beltsville, MD 20705-2821
Gregory Ross	**Noel**		Nematologist	U.S.D.A. ARS, Dept. of Crop Sciences, University of Illinois, 1102 S. Goodwin Ave., Urbana, IL 61801
Surindar Mohan	**Paracer**	Professor of Biology, Massachusetts State College, Worcester, MA 01610	Professor	Department of Biology, Worcester State University, Worcester, MA 01610
Edmond D.	**Pattimore**	Plant Pathologist/Nematologist, Nicaragua Division, Castle & Cooke Foods, San Francisco, CA 94111		
Jorge Brieva	**Pinochet**		Nematologist	IRTA, Centre de Cabriles, 80348 Cabriles, Barcelona, Spain
Anastasius George	**Polychronopoulos**	Development Manager of Pesticides, Zootechniki S.A. Athens, Greece		Greece
Jinya	**Qiu**			5414 Calder Way, #412, Indianapolis, IN 46226
John D.	**Radewald**	Extension Nematologist, U.C. Riverside	Retired, Emeritus Faculty Member	University of California, Riverside, CA 92502
Dewey John	**Raski**	Professor Department of Nematology, University of California Davis	Retired, Professor Emeritus	1912 Alpine Place, Davis, CA 95616. Email: DeweyRaski@webtv.net

Gerald Sunao	**Santo**		Nematologist/Plant Pathologist	Washington State University, IAREC, 24106 N. Bunn Rd., Prosser, WA 99350-9687
Alleppey R.	**Seshadri**	Head, Division of Nematology, Indian Agricultural Research Institute	Retired Dean of Instruction	Indian Agricultural Research Institute, New Delhi, India
Benjamin Newton	**Shouse**		Scientific Writer	Santa Cruz, CA
Catherine Rivera	**Smith**			Summit Plant Laboratories, 2301 Research Boulevard, Suite 106, Fort Collins, CO 80526
Karen Marie	**Sobczyk**			
John Patrick	**Studdert**	Farm Advisor, Yuba/Sutter Co.		Formerly U.C.D. IPM Specialist; denied tenure.
Abd-El-Samie Hazem Youssef	**Taha**		Professor of Nematology	Faculty of Agriculture, Department of Plant Protection, Ain Shams UNiversity, P.O. Box 68, Haddiek Shoubra, Cairo, Egypt 11241
Eric Craig	**Tedford**		Researcher	Zeneca Ag. Products, 1200 S. 47th St., Box 4023, Richmond, CA 94804-0023
Daniel	**Teliz-Ortiz**		Professor	Dept. Plant Pathology, Univ Postgraduados, Momtecillos, Mexico Colegio de Postgraduados, Texcoco, Mexico
Paul Rhys	**Thomas**	Vice Director, The Open University in Wales, Cardiff, Wales		Pearl Assurance House, Greyfriars Rd., Cardiff CF 3PK Wales, England
Patricia	**Timper**		Research Scientist	USDA, ARS, Tifton, Georgia 31793-0748
Patricia	**Timper**		Research Scientist	USDA, ARS, Tifton, Georgia 31793-0748
Alan John	**Towson**			Idaho
Jose Trinidad	**Vazquez**		Director of Research	Instituto Mexicana Del Cafe, Xalapa, Ver., Mexico

Robert Charles	**Venette**	Research Ecologist	Assistant Professor, Department of Entomology & Midwest Ecological Risk Assessment Center, 1980 Folwell Avenue, 219 Hodson Hall, University of Minnesota, St. Paul, MN 55108
Miriam	**Volat**	Motivational Trainer	Santa Rosa, CA
Thomas Ray	**Watson**		Plant Pathologist, CDFA, 1220 N Street, Sacramento, CA 95814
Jennifer Lee	**Woodring**	Homemaker	C/o 3503 E. Fairmont, Fresno, CA 93726
Tom Toshio	**Yamashita**	Private Consultant	Sun Burst Plant Disease Clinic, 677E Olive Ave, Turlock, CA 95380. Phone: 209-667-4442
Inga Anne	**Zasada**	Nematologist	USDA-ARS Nematology Laboratory, Bldg. 011A, BARC-West, Beltsville, MD 20705-2350. Phone: 301-504-5813. Email: ZasadaI@ba.ars.usda.gov

Appendix Table 4

Graduate Students

Department of Nematology, University of California Riverside

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Alden	**Elizabeth (Wiggins)**	**Ph.D.**	Thomason, I.J.	1979	Independent Nematologist; Private Consultant, Environmental and Pesticide Issues	99 Via La Paz Greenbrae, CA 94904 415/461-0238
Ammati	**Mohammed**	**Ph.D.**	Thomason, I.J.	1985	Professor and Research Nematologist	Dept. of Plant Pathology Institut Agronomique et Veterinaire Hassan II University BP6202 Rabat – Institute Rabat, Morocco
Anwar	**Safdar**	**Ph.D.**	Van Gundy, S.D.	1985	Research Nematologist	Kearney Agricultural Center 9240 S. Riverbend Avenue Parlier, CA 93648
Atilano	**Ray**	**Ph.D.**	Van Gundy, S.D.	1977	Early career – Research and Extension Nematologist in Florida	Unknown
Brown (Westerdahl)	**Becky**	**Ph.D.**	Platzer, E.G.	1978	Extension Specialist in Nematology	Dept. of Nematology University of California Davis, CA 95616
Cap	**Guillermo B.**	**Ph.D.**	Roberts, P.A.	1991	Research Nematologist	Instituto de Microbiolgia y Zoologia Agricola Instituto Nacional de Technolgia Agropecuaria (INTA) C.C. 25-(1712) Castelar Buenos Aires, Argentina
Cares	**Juvenil E.**	**Ph.D.**	Baldwin, J.G.	1993	Professor and Research Scientist	Universidade de Brasilia Instituto de Ciencias Biologicas Departmento de Fitopatologia Caixa Postal: 15-3081 70.901 Brasilia, DF Brazil

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Carta	**Lynn K.**	**Ph.D.**	Baldwin, J.G.	1988	Research Scientist Nematology Section	USDA-ARS Bldg. 011A, Rm. 165B, BARC-W Beltsville, MD 20705
Caswell	**Edward P.**	**Ph.D.**	Thomason, I.J.	1985	Associate Professor and Associate Nematologist	Dept. of Nematology University of California Davis, CA 95616
Cooper	**A.F.**	**Ph.D.**	Van Gundy, S.D.	1967	Professor of Biology	Biology Dept. Cal Poly State University San Luis Obispo, CA 93401
Cordero	**Diogenes A.**	**Ph.D.**	Baldwin, J.G.	1989	Professor and Administrator	Colegio de Ciencias de Agricultura University of Panama Apartado 43, Penonom Cocl, Rep. Of Panama
Dolinski	**Claudia**	**Ph.D.**	Baldwin, J.G.	1999	Research Scientist, Nematology	Plant Protection Lab Universidade Estadual do Norte Fluminense Campos, Brazil
Duncan	**Larry**	**Ph.D.**	Ferris, H.	1983	Research Nematologist	University of Florida – IFAS Citrus Research & Education Center 700 Experiment Station Road Lake Alfred, FL 33850
Edongali	**Ezarug**	**Ph.D.**	Ferris, H.	1980	Professor of Nematology and Plant Pathology	University of Alfateh P.O. Box 13274 Tripoli, Libya North Africa
Friedman	**Paul**	**Ph.D.**	Platzer, E.G.	1979	Not Active in Nematology	S. Rothschild & Co., Inc. 225 West 37th Street New York, NY 212/354-8550 212/362-1187 (FAX)
Gaspard	**Jerome T.**	**Ph.D.**	Mankau, R.	1986	Research Scientist Biological Control	Nematec Co., Ltd. Tsukuba City 45 Miyukigaoka Ibaraki Prefecture 305 Japan

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Golden	**Jimmy**	**Ph.D.**	Van Gundy, S.D.	1974	Nematologist; Director	Sandhill Research & Education Ctr. P.O. Box 23205 Columbia, SC 29224-3205
Goodell	**Peter B.**	**M.S.**	Ferris, H.	1979	IPM Specialist in Nematology and Entomology	Kearney Agricultural Center 9240 S. Riverbend Ave. Parlier, CA 93646
Goodell	**Peter B.**	**Ph.D.**	Ferris, H.	1986	IPM Specialist in Nematology and Entomology	Kearney Agricultural Center 9240 S. Riverbend Ave. Parlier, CA 93646
Hough	**Johannes**	**Ph.D.**	Thomason, I.J.	1974	Hough Citrus & Avocado Nursery Consultant	Hough Citrus & Avocado Nursery P.O. Box 77 Schagen 1207, South Africa
Huang	**Shiou-Pin**	**M.S.**		1976	Unknown	Unknown
Imbriani	**Jack**	**Ph.D.**	Platzer, E.G.	1981	Nematologist, North Carolina State Dept. of Agriculture	4300 Reedy Creek Road Raleigh, NC 27607-6465
Johnson (Wade)	**P.W.**	**Ph.D.**	Van Gundy, S.D.	1967	Director, Atlantic Food & Horticulture Research Center Agriculture & Agri-Food Canada	32 Main Street Kentville, Nova Scotia B4N 1J5 Canada 902/679-5700 johnsonw@em.agr.ca
Kaloshian	**Isghoui**	**Ph.D.**	Thomason, I.J.	1988	Assistant Professor and Assistant Nematologist	Dept. of Nematology University of California Riverside, CA 92521
Kaplan	**David**	**Ph.D.**	Thomason, I.J Keen, N.	1978	Nematologist and Plant Pathology Section Leader	USDA-ARS Horticultural Research Laboratory 2120 Camden Road Orlando, FL 32803-1419
Kolodge	**Craig**	**Ph.D.**	Radewald, J.D.	1980	Farm Advisor/Plant Pathology & Nematology	UCCE Santa Clara County 1005 Timothy Drive San Jose, CA 95133

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Lamberti	**F.C.**	**M.S.**		1968	Professor of Nematology Director of Institute	Instituto di Nematologia Agraria C.N.R. Applicata Ai Vegetali Trav. 174 Di Via G. Amendla, 68/5 Bari, Italy 70126
Luong	**Lien**	**M.S.**	Platzer, E.G.	1998	Ph.D. Student	Dept. of Nematology University of California Davis, CA 95616
Marks	**C.F.**	**Ph.D.**	Thomason, I.J.	1967	Director, Canadian Dept. of Agriculture, Agriculture Experiment Stations (Retired)	83 Rosehip Place London, Ontario Canada N6K 4H4
McElroy	**F.D.**	**Ph.D.**	Van Gundy, S.D.	1967	Owner/Manager, Private Agricultural Diagnostic Lab	P.O. Box 43 Hansville, WA 98340-0043
McKenry	**Michael V.**	**Ph.D.**	Thomason, I.J.	1972	Nematologist, U.C.R. Dept. of Nematology	Kearney Agricultural Center 9240 S. Riverbend Ave. Parlier, CA 93646
Mundo-Ocampo	**Manuel**	**Ph.D.**	Baldwin, J.G.	1982	Staff Research Associate Baldwin Research Program	Dept. of Nematology University of California Riverside, CA 92521
Neipp	**Paul W.**	**M.S.**	Becker, J.O.	1998	Research Associate	USDA-ARS Horticulture Crops Research Lab 2021 S. Peach Avenue Fresno, CA 93727
Noling	**Joseph W.**	**Ph.D.**	Ferris, H.	1985	Extension Specialist in Nematology	University of Florida Citrus Research & Education Ctr. 700 Experiment Station Road Lake Alfred, FL 33850
Omwega	**Charles O.**	**Ph.D.**	Thomason, I.J.	1989	Research Scientist, Insect Physiology and Ecology	Crop Pest Programme The Intl. Centre of Insect Physiology and Ecology P.O. Box 30772 Nairobi, Kenya

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Othman	**Abubaker A.**	**M.S.** **Ph.D.**	Baldwin, J.G.	1982 1985	Nematologist	Post Box 556 El Bieda Libya, North Africa
Rammah	**Abdallah**	**M.S.**	Baldwin, J.G.	1980	Professor of Nematology and Plant Protection	Institute Agronomique Veternaire Hassan II University BP 6202 Rabat Institute Rabat, Morocco
Renaud	**J.E.**	**M.S.**	Thomason, I.J.	1971	Science Officer, Ministry of Agriculture/Ornamental Nurseryman	Caracas, Venezuela
Rich	**Jimmy**	**Ph.D.**	Thomason, I.J.	1976	Professor of Nematology and Research Nematologist	University of Florida Route 3, Box 4370 Quincy, FL 32351-9500
Rinkov	**A.**	**M.S.**	Van Gundy, S.D.	1960	Nematologist, Agricultural Production and Research	Israel
Rodrigues	**Rafael**	**Ph.D.**	Sher, S.A.	1976	Professor of Nematology Chancellor of the College	Colegio de Postgraduados Escuela Nacional de Agricultura Chapingo, Mexico
Sachchidananda	**J.**	**M.S.**		1971	Unknown	Unknown
Schmidt	**Steven P.**	**Ph.D.**	Platzer, E.G.	1979	Research Scientist	Union Carbide/Rhone Poulenc Ag. Co. 10612 Lowery Drive Raleigh, NC 27615-9715 919/846-6549
Schneider	**Sally M.**	**Ph.D.**	Ferris, H.	1985	Nematologist/System Scientist Program Leader	Research Plant Pathologist USDA ARS San Joaquin Valley Agricultural Science Center 9611 S. Riverbend Ave. Parlier, CA 93648 559-596-2890
Shamseldean	**Mohammed**	**Ph.D.**	Platzer, E.G.	1989	Scientific Consultant, Private Entrepreneur	49 Giza Street, 12th Floor, #123 Giza, Egypt

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Shih	**J.J.M.**	**M.S.**	Platzer, E.G.	1995		3138 Cowley Way, #1 San Diego, CA 92117
Souza (de)	**Ricardo**	**Ph.D.**	Baldwin, J.G.	1999	Research Scientist, Nematology	Plant Protection Lab Universidade Estadual do Norte Fluminense Campos, Brazil
Stirling	**Graham**	**Ph.D.**	Mankau, R.	1978	Private Consultant in Nematology/Plant Pathology	Brisbane, QLD 4068 Australia
Swanson	**T.A.**	**Ph.D.**	Van Gundy, S.D.	1984		DECEASED
Tsai	**Bie Yun**	**Ph.D.**	Van Gundy, S.D.	1987	Professor of Nematology and Research Nematologist	Dept. of Plant Pathology & Entomology National Taiwan University 1 Roosevelt Rd., Section 4 Taipei, Taiwan, ROC
Tudor	**Mark E.**	**Ph.D.**	McKenry, M.V.	1993	Nematologist, United Fruit Company, Honduras	DECEASED
Ubandu	**Atu**	**M.S.**			Unknown	Unknown
Veremis	**John C.**	**Ph.D.**	Roberts, P.A.	1995	Postdoctoral Research Scientist	Dept. of Nematology University of California Riverside, CA 92521
Vilchez	**Miguel**	**M.S.**		1974	Staff Research Associate	Dept. of Plant Pathology University of California Riverside, CA 92521
Wang	**Lu Hong**	**M.S.**		1969	Nematologist; Government Science Officer	Bahamas
Westphal	**Andreas**	**Ph.D.**	Becker, J.O.	1998	Extension Specialist in Nematology	Texas A&M University Westlaco, TX
Wouts	**Wim**	**Ph.D.**	Sher, S.A.	1967	Nematologist, Taxonomic Research, Nematode Parasites of Insects	Landcare Research Mt. Albert Research Centre Private Bag 92170 Auckland, New Zealand

Last Name	First Name	Degree	Major Prof	Year	Current Position	Address
Zavaleta-Mejia	**Emma**	**Ph.D.**	Van Gundy, S.D.	1985	Professor of Nematology and Plant Pathology	Centro de Fitopatologia Colegio de Postgraduos Chapingo, Mexico 56230
Zhang	**Yongcun**	**Ph.D.**	Baldwin, J.G.			

Appendix Table 5

VISITING SCHOLARS AND POST-DOCTORALS
(University of California Riverside)

Name	*Year*	*Affiliation/Country*
Seinhorst, J.W.	1957	Wageningen, The Netherlands
Colbran, Robert	1958	Brisbane, Australia
Jones, F.G.W.	1958	Rothamsted, England
Daulton, Roy A.C.	1960	Tobacco Research Board, Rhodesia
Oteifa, Bakir	1960	Cairo University, Egypt
Holdeman, Quinton	1960	United Fruit Co., Honduras
Vythilingam, M.K.	1960	Tea Research Institute, Ceylon
Pitcher, R.S.	1961	East Malling, England
Orton, R.	1962	Volcani Centre, Israel
Poinar, George	1963	U.C. Berkeley
Wilmot, Sheila	1963	St. Albans, England
Shepherd, Audrey	1964	Rothamsted, England
Miyakawa, S.	1964	Japan
Sauer, Max	1964	CSIRO, Australia
Mulvey, R.H.	1965	Ottawa, Canada
Toung, Mo-Chu	1966	Taipei, Taiwan (ROC)
Sontirat, Suebsak	1966	Kasetsurt University, Thailand
Van der Laan, P.A.	1966	Wageningen, The Netherlands
Das, Sitanath	1966-67	O.U.A.T., Bhubaneswar, India
Yokoo, T.	1968	Saga University, Japan
Bergeson, Glen	1968	Purdue University, Indiana
Evans, A.A.F.	1968	Adelaide, Australia
Hosestra, Heyn	1969	Wageningen, The Netherlands
Townsend, J.L.	1969	Vineland Research Station, Canada
Blake, Cliff	1970	University of Sydney, Australia
Caveness, Fields	1970	Ibadan, Nigeria
D'Herde, C.J.	1970	Wetteren, Belgium
Ishibashi, N.	1970	Saga University, Japan
Mercer, E.	1970	Cal Poly, Pomona
Cohn, Eli	1971	Volcani Centre, Israel
Unny, K.L.	1972	Ibadan, Nigeria
Ferris, V.	1973	Purdue University, Indiana
Ferris, J.	1973	Purdue University, Indiana
Hackney, R.	1973	CDFA, Sacramento
Stone, Alan	1973	Rothamsted, England
Brezeski, M.W.	1974	Horticultural Station, Poland
Hogger, C.	1974	McGill University, Canada
Meagher, J.W.	1974	Victorian Plant Research Institute, Australia
Wyss, Urs	1974	Kiel University, Germany
Cooke, David	1976	Broom's Barn Exp. Station, England
Webster, John	1976	Simon Fraser University, Canada

Wormersly, C.	1976	England
Luc, Michel	1977	ORSTOM, France
Evans, K.	1978	Rothamsted, England
Prot, J.C.	1978	ORSTOM, Senegal, Africa
Demeure, Yves	1978	ORSTOM, Senegal, Africa
Greco, Nicola	1978	Bari, Italy
Roberts, Philip	1978	Rothamsted, England
Nigh, Ed	1979	University of Arizona, Tucson
Bird, George	1980	Michigan State University, Lansing
Weischer, B.	1980	Munster, Germany
Brown, Rob	1982	Melbourne, Australia
Giblin-Davis, R.	1982	Ft. Lauderdale, Florida
Garabedian, S.	1984	Unocal, Sacramento
Griffen, G.	1984	USDA, Logan, Utah
Bird, Alan	1985	CSIRO, Australia
Becker, Ole	1985	Germany
Verdejo-Lucas, S.	1985	Barcelona, Spain
Al-Sayed, A.A.	1986	Cairo, Egypt
Ciancro, A.	1986	Bari, Italy
Shaffiee, F.	1988	Cairo, Egypt
Omwega, C.	1989	Nairobi, Kenya
Kaloshian, I.	1990	Beruit, Lebanon
Lamberti, F.	1990	Bari, Italy
Kerry, Brian	1991	Rothamsted, England
Ogallo, J.L.	1992	Nairobi, Kenya
Veremis, J.C.	1996	Greece
Lambshead, J.J.D.	2000	England

Appendix Table 6

SERVICES AS OFFICERS OF THE SOCIETY OF NEMATOLOGISTS BY FACULTY AND BY FORMER STUDENTS OF THE UNIVERSITY OF CALIFORNIA

Name	Position	Year	Affiliation
Faculty at UC			
M.W. Allen	President	1961-63	U.C. Berkeley/U.C.D.
S.D. Van Gundy	President Vice President	1973-74 1972-73	U.C. Riverside
I.J. Thomason	President Vice President	1975-76 1974-75	U.C. Riverside
D.W. Freckman	President Vice President	1983-84 1982-83	U.C. Riverside
J.W. Baldwin	President President Elect Vice President Treasurer	1998-99 1996-97 1995-96 1988-91	U.C. Riverside
Former Students			
H.J. Jensen	President Vice President	1971-72 1970-71	Oregon State, Corvallis
G.S. Santo	President President Elect	1994-95 1993-94	Washington State - IAREC Prosser, WA
M.A. McClure	President President Elect Vice President Treasurer	1997-98 1996-97 1995-96 1992-95	University of Arizona Tucson, AZ
W.R. Nickle	Treasurer	1971-74	U.S.D.A. Beltsville MD.
R.A. Kinlock	Treasurer	1986-89	University of Florida Jay, FL

APPENDIX TABLE 7

DEPARTMENT OF NEMATOLOGY

University of California, Davis,

Chronological Listing of Chairs

Name	Dates of Service
D.J. Raski	1959-1964 1969-1973
M. Allen	1964-1969
A.R. Maggenti	1973-1978
D.R Viglierchio	1978-1985
H. Ferris	1985-1994
H.K. Kaya	1994-2000
E.P. Caswell-Chen	2001-present

APPENDIX TABLE 8

DEPARTMENT OF NEMATOLOGY

University of California, Riverside,
Chronological Listing of Chairs

Name	Dates of Service
Baines, R.C. – Vice Chair of Statewide Department	1954 - 1957
Sher, S.A. – Vice Chair of Statewide Department	1957 – 1963
Thomason, I.J. – Chairman (separated departments)	1963 – 1969
Sher, S.A. – Chairman	1969 – 1972
Van Gundy, S. – Chairman	1972 – 1984
Platzer, E.G. – Chairman	1984 – 1990
Baldwin, J.G. – Chairman	1990 – 12/1995
Roberts, P.A. – Chairman	1/1996 – 9/1996
Platzer, E.G. – Chairman	10/1996 – 2002
Baldwin, J.G. – Chairman	2002 – Present

Appendix Table 9
Nematology Courses Taught at University of California Berkeley from 1948 to 1966

Course Number	Course Title	Units	Instructor	Years Taught	Not Offered
117	Helminthology	4	Stewart	1948-50	
			Stewart and Furman	1950-62	
			Furman	1962-63	
			Weinmann and Furman	1963-66	
118	Plant Nematology	4	Allen	1948-50	1961-62, 1965-66
			Allen and Raski	1950-53	
			Allen	1953-66	
150	Helminthology	6	Furman, Weinmann and Anderson	1966-67	
	Medical and Veterinary Helminthology	6	Furman and Weinmann	1968-69	
250	Advanced Helminthology	2	Furman, Anderson, Weinmann	1966-69	1968-69
260	Plant Nematology	5	Instructor not listed	1966-69	
291	Seminar in Parasitiology	1	Anderson, Furman and Weinmann	1966-69	
202A-202B	Seminar in Parasitology	1	Stewart	1948-50	1961-62
			Stewart and Furman	1950-66	

Appendix Table 10
Nematology Courses Taught at University of California Davis from 1959 to 2002

Course Number	Course Title	Units	Instructor	Years Taught	Not Offered
100	General Plant Nematology	3	Lownsbery and Raski	1959-61	
			Raski	1961-62, 1963-68	
			Allen and Maggenti	1962-63	
			Lownsbery	1968-83	
			Brown	1984	
			Elliott	1985	
			Yamashita	1986	
			Ferris	1987-present	
110	Introduction to Nematology	2	Allen	1966-68, 1969-75	
			Timm	1968-69	
			Maggenti	1975-93	
			Gardner	1993-95	
			Caswell-Chen	1995-98	
			Caswell-Chen and Nadler	1998-present	
120	Nematode Behavior	2	Viglierchio	1982-87	alternate years
121	Nematode Biology	2	Viglierchio	1982-87	alternate years
130	Principles of Nematode Control	4	Lear and Maggenti	1966-70	
			Lear	1970-1985	
			The Staff	1985-87	
199	Special Study for Advanced Undergraduates	1 to 5	The Staff	1987-present	
201	Molecular and Physiological Plant Nematology	2	Williamson	1995-present	alternate years
202	Nematodes and the Soil Environment	2	Jaffee	1995-present	alternate years
203	Ecology of Parasitic Nematodes	2	Caswell-Chen	1995-present	alternate years
204	Management of Plant-Parasitic Nematodes	2	Westerdahl	1995-present	alternate years
205	Insect Nematology and Biological Control	2	Kaya	1995-present	alternate years
206	Nematode Systematics and Evolution	2	Nadler	1998-present	alternate years
220	Principles and Techniques of Nematode Taxonomy and Morphology	3	Maggenti	1961-65, 1966-78	alternate years
			Allen	1965-66	alternate years
			Raski	1978-88	alternate years
			The Staff	1988-95	alternate years
221	Nematode Pathogenicity and Control	3	Lear and Lownsbery	1961-66	1965-66

222	Nematode Pathogenicity to Plants	3	Lownsbery	1966-83	alternate years
			The Staff	1983-87	alternate years
	Advanced Plant Nematology		Ferris and Jaffee	1987-89	alternate years
			Ferris, Jaffee and Williamson	1989-90	alternate years
			Caswell, Jaffee and Williamson	1990-95	alternate years
225	Nematode Taxonomy and Comparative Morphology	4	Allen and Maggenti	1961-65	alternate years
			Allen	1965-75	alternate years
			Raski	1975-76	alternate years
			Maggenti	1976-78	alternate years
		5	Maggenti	1978-93	alternate years
			Gardner	1993-95	alternate years
			The Staff	1995-98	alternate years
240	Nematodes of Invertebrates	2	Kaya	1982-87	alternate years
	Biological Control in Insect and Plant Nematology		Jaffee and Kaya	1987-95	alternate years
245	Field Nematology	1	The Staff	1987-present	
290	Seminar in Plant Nematology	1	Staff	1960-present	
298	Group Study	1 to 5	The Staff	1978-present	
299	Research in Plant Nematology	1 to 6	Staff	1960-present	
290c	Advanced Research Conference	1	The Staff	1991-present	

Additional Information on Teaching Activities by U.C. Davis Nematology Faculty (1960 – 2002).

In 2002, Dr. Westerdahl taught Biological Science 10V to about 140 students. This is the first time that a departmental faculty member taught in the biological sciences and was unique in that the course is delivered via computer. Dr. Caswell-Chen and Dr. Nadler were involved in the development, implementation, and department involvement in the new CA&ES major in “Animal Biology”. During 2001-2001 there were approximately 100 undergraduate students involved.

Appendix Table 11
Nematology Courses Taught at University of California Riverside from 1960 to 2002

Course Number	Course Title	Instructor(s)
NEMA 100	General Plant Nematology	S.A. Sher, I Thomason
NEMA 120	Soil Ecology *	D. Wall (Freckman), D. Crowley, P. De Ley
NEMA 159	Biology of Nematodes **	E. Platzer
NEMA 190	Special Studies	The Staff
NEMA 205	Biochemistry of Parasites **	E. Platzer, I Sherman
NEMA S205	Identification of Plant Parasitic Nematodes (Special Summer Course)	J. Baldwin, P. De Ley
NEMA 206	Phytopathogens: Nematodes ***	J. Baldwin, P. Roberts, S. Van Gundy
NEMA 216	Nematode Diseases of Plants ***	I Thomason, R. Mankau, H. Ferris, S. Van Gundy
NEMA 222	Physiology of Nematodes	E. Platzer
NEMA 225	Developmental Genetics of *Caenorhabditis elegans*	D. Bird
NEMA 226	Nematode Taxonomy and Comparative Morphology	J. Baldwin
NEMA 240	Field Nematology	M. McKenry, P. Roberts
NEMA 250	Seminar in Nematology	The Staff
NEMA 260	Current Research in Plant Pathology and Nematology	The Staff
NEMA 286	Pest Management Modeling and Simulation ****	J. Morse, H. Ferris
NEMA 290	Directed Studies	The Staff
NEMA 297	Directed Research	The Staff

* Cross-listed with Soils and Environmental Science
** Cross-listed with Biology
*** Cross-listed with Plant Pathology
**** Cross-listed with Entomology

Additional Information on Teaching Activities by U.C. Riverside Nematology Faculty (1960 – 2002).

Pest Management M.S. Program

H. Ferris, R. Mankau, and I. Thomason served on the Steering Committee for many years. They also served as graduate advisors to M.S. students in the program. I. Thomason chaired the program from 1983 to 1989. H. Ferris developed the course Pest Management 286 entitled, "Systems Analysis of Crop/Pest Interaction." This course was taken over by J. Morse when Ferris transferred to U.C. Davis. Thomason was responsible for Pest Management 202 entitled, "Properties and Utilization of Pesticides" for a number of years. In the academic year 1978-79, S.D. Van Gundy was responsible for the seminar in Pest Management, Pest Management 250.

Plant Pathology

I. Thomason served on the Graduate Affairs Committee of the Plant Pathology Department for many years. In 1975, he was joint appointed in the Department and received the title of Professor

of Nematology and Plant Pathology. In the late 1980s he assisted Dr. J. Alan Dodds in teaching Plant Pathology 265, "Principles of Plant Pathology." In 1979, S. D. Van Gundy was joint appointed in the Plant Pathology Department and received the title of Professor of Nematology and Plant Pathology.

Biology

Dr. Edward Platzer had a long and rewarding association with the Department of Biology where he held a joint appointment. For many years he was associated with Dr. Irwin Sherman in the teaching of Biology 157, "Parasitology." In addition, he trained masters and Ph.D. students from the Biology program. Our own Dr. Becky Westerdahl is one of those students. The respect by which he was held in Biology was attested to by the fact that he was asked to be acting chair for a 6-month period during a leave of the regular chair. Platzer was and is a very popular teacher at both the undergraduate and graduate level.

It should be noted that Dr. Isgouhi Kaloshian is now responsible for Biology 102, "Introductory Genetics," one of the basic courses in the Biology curriculum.