
College of Tropical Agriculture and Human Resources

Administration

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Dean: Charles W. Laughlin
Interim Associate Dean: Wayne T. Iwaoka

General Information

The College of Tropical Agriculture and Human Resources (CTAHR) was established with the founding of the University of Hawai'i in 1907. CTAHR is a leading academic institution in tropical agriculture, food science and human nutrition, textiles and clothing, and human resources.

Hawai'i's unique geographic location, ecological diversity, and multicultural population provide students with a living laboratory. The college is the locus of educational opportunities for students preparing to become tomorrow's scientists, business leaders, family development specialists, fashion designers and merchandisers, nutritionists, and policy makers.

The land-grant mission of CTAHR provides students with an opportunity to study in an environment that blends teaching, research, and extension programs dedicated to discovering the secrets of basic science while addressing contemporary issues. Faculty members bring to the classroom the unique perspective of emerging research issues, coupled with an abiding commitment to education.

Degrees Offered

Bachelor's Degrees: BS in agricultural and resource economics, BS in agronomy and soil science, BS in animal sciences, BS in biosystems engineering, BS in

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entomology, BS in family resources, BS in fashion design and merchandising, BS in food science and human nutrition, BS in general agriculture, BS in tropical horticulture

Master's Degrees: MS in agricultural and resource economics, MS in agronomy and soil science, MS in animal sciences, MS in biosystems engineering, MS in botanical sciences (plant pathology or plant physiology), MS in entomology, MS in food science, MS in horticulture, MS in nutritional science

Doctoral Degrees: PhD in agricultural and resource economics, PhD in agronomy and soil science, PhD in botanical sciences (plant pathology or plant physiology), PhD in entomology, PhD in horticulture

Advising

CTAHR Office of Academic Affairs
Gilmore 210
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8183 or (808) 956-6733
Fax: (808) 956-3706

Undergraduate Programs

Undergraduate programs in CTAHR provide students with an opportunity to acquire those scientific, professional, and personal competencies emphasized by Hawai'i's business, governmental, community, and scientific leaders. The college provides a balance of educational experiences that include classroom instruction, laboratory sessions, co-curricular activities, supervised internships, and an international study program.

Admission Requirements

Students may enter CTAHR as first-year students or as transfer students from other departments or academic institutions. Requirements for admission are the same as those for the UH Mānoa campus in general, except for the food science and human nutrition, family resources, and fashion design and merchandising majors, where transfer students are required to have a minimum GPA of 2.5. Additional course requirements may also apply to these majors. Information on CTAHR undergraduate programs can be obtained from the CTAHR Office of Academic Affairs.

College Requirements

To be eligible for a BS degree from CTAHR, students must complete the General Education Core requirements, CTAHR requirements, course requirements of the CTAHR major, and at least 60 credit hours of non-introductory

courses (i.e., those numbered 300 and above or having a college-level prerequisite) and maintain a minimum cumulative GPA of 2.0 in a minimum of 128 credit hours as prescribed by the major. Some majors may require more credit hours. All CTAHR undergraduates are required to complete a set of interrelated courses: SP 151 Personal and Public Speech (except textiles and clothing majors); FAMR 380 Research Methodology or AREC 310 Statistics in Agriculture and Human Resources; and an internship course within their major field.

Double Major or Second Degree

Students seeking a double major must have a minimum cumulative GPA of 3.0, demonstrate that the proposed majors are substantially different, and obtain approval from undergraduate advisers in both of the relevant departments.

Students seeking a second degree must have a minimum cumulative GPA of 3.0 and demonstrate that the proposed second degree is substantially different from the first degree. At least 30 credit hours are required for the second degree in addition to those associated with the first degree.

Related Undergraduate Programs

Veterinary Science

Students interested in becoming veterinarians generally major in animal sciences and participate in CTAHR's pre-veterinary program. A BS degree is desirable but not required for admission to veterinary schools. The CTAHR pre-veterinary adviser assists students in meeting the admission requirements of veterinary schools that participate in the Western Interstate Commission for Higher Education (WICHE) program, including the University of California at Davis, Washington State University, Colorado State University, and other continental United States veterinary schools that accept nonresident students. Students seeking additional information and advising should contact the animal sciences department (Henke 105, (808) 956-8356).

Agriculture Education

Students who wish to teach agriculture at the secondary level in Hawai'i can meet the state Department of Education's requirements by taking courses from CTAHR and the College of Education. Students may obtain a BS degree in CTAHR prior to transferring

to the post-baccalaureate basic certification program in the College of Education. Other students transfer to CTAHR from other programs in the University of Hawai'i system and take courses from CTAHR and the College of Education. Additional information can be obtained from the CTAHR Office of Academic Affairs or the College of Education Student Services Office (Wist Annex 2-126, (808) 956-7849).

Home Economics Education

Students planning on teaching home economics at the secondary level generally begin in CTAHR's Department of Human Resources and then transfer to the College of Education in their junior year. Course work is taken in CTAHR's Department of Human Resources and Department of Food Science and Human Nutrition and the College of Education. Additional information can be obtained from the Department of Human Resources (Miller 110, (808) 956-8105) or College of Education Student Services Office (Wist Annex 2-126, (808) 956-7849).

Graduate Programs

Graduate studies leading to a master of science degree are available in 10 majors: agricultural and resource economics, agronomy and soil science, animal sciences, biosystems engineering, botanical sciences (plant pathology or plant physiology), entomology, food science, horticulture, and nutritional science. Doctor of philosophy programs are available in six fields: agricultural and resource economics, agronomy and soil science, botanical sciences (plant pathology or plant physiology), entomology, and horticulture. Graduate programs in plant pathology and plant physiology are jointly offered with the College of Natural Sciences under the botanical sciences program.

Three of CTAHR's graduate programs in tropical agriculture (agronomy and soil science, entomology, and horticulture) have been recognized as distinctive programs by the Western Interstate Commission for Higher Education (WICHE). Qualified students from participating states may enroll in these graduate programs at Hawai'i-resident tuition rates.

CTAHR utilizes general University facilities, including the libraries, which

offer extensive collections and information services, and the computing center, which provides access to individual computers as well as large mainframes. Along with the Pacific Biomedical Research Center, CTAHR sponsors the Biotechnology-Molecular Biology Instrumentation Facility for the benefit of researchers throughout the University of Hawai'i. The college's facilities include a microcomputer laboratory, several research stations, and specialized laboratories with state-of-the-art equipment, all of which support research and instruction in the food and agricultural sciences. On-campus affiliations with the Hawai'i Institute of Marine Biology, Water Resources Research Center, East-West Center, Harold L. Lyon Arboretum, Sea Grant College Program, and Hawai'i Natural Energy Institute extend CTAHR's resources. The college is also affiliated closely with off-campus institutions, such as the Bernice P. Bishop Museum, USDA/ARS Tropical Fruit and Vegetable Research Laboratory, Hawai'i Agriculture Research Center, U.S. Geological Survey, National Marine Fisheries Service, and Hawai'i Department of Agriculture.

Students may contact individual departments, the Graduate Division (2540 Maile Way, Spalding Hall, Honolulu, HI 96822), or Financial Aid Services (2600 Campus Road, Honolulu, HI 96822) for information on grants, fellowships, assistantships, scholarships, tuition waivers, loans, work-study programs, and job opportunities.

Information on CTAHR graduate programs can be obtained from the Office of Academic Affairs, Gilmore 210, (808) 956-8183.

Admission Requirements

Students must hold a bachelor's degree from an accredited U.S. college or university or its equivalent from a recognized foreign institution of higher learning. Admission requirements for various graduate programs are specified under each department's description. Admission decisions are made by the Graduate Division in consultation with faculty in the field of study.

College Requirements

The requirements associated with the master of science degree vary with each program of study. The master of science

Plan A (thesis) and Plan B (non-thesis) options are available in all programs; the agronomy and soil science program is the only program with a Plan C (examinations) option.

The PhD degree culminates in a set of comprehensive and final examinations and a dissertation of original work. Special requirements exist in some fields of study. Contact the Graduate Division or the departments for additional information.

Instructional and Research Facilities

Hawai'i Institute of Tropical Agriculture and Human Resources

The Hawai'i Institute of Tropical Agriculture and Human Resources (HITAHR) amalgamates the functions previously carried out separately by the Cooperative Extension Service and the Hawai'i Agricultural Experiment Station. HITAHR enables a close coordination of extension and research activities to provide better service to client groups throughout the state.

Through its extension activities, the institute provides off-campus, non-credit educational programs focused on the advancement of agriculture in Hawai'i, the strengthening of families, and the improvement of communities.

Through its research activities, the institute promotes the advancement of agricultural sciences and applications for productive sustainable agriculture. Investigations cover animal physiology; plant biotechnology and physiology; diseases, insects, and parasites; agronomy; soils; food science; food processing; agricultural engineering; biochemistry; human and animal nutrition; breeding and genetics; and culture, production, economics, marketing, and quality of life for individuals and families.

HITAHR, including the field laboratories, is an important part of undergraduate and graduate instruction. Students are able to study the latest methods and results of agricultural research. The institute's programs are conducted cooperatively with the U.S. Department of Agriculture.

Agricultural and Resource Economics

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Web: www.ctahr.hawaii.edu/~arec/

Faculty

- *S. A. El-Swaifi, PhD (Chair)—national resource conservation and restoration
- *R. L. Bowen, PhD—natural resource policy, economics of sustainable agriculture
- *U. Chakravorty, PhD—resource economics
- *C. T. K. Ching, PhD—policy and production economics
- *L. J. Cox, PhD—community economic development
- *C. A. Ferguson, PhD—natural resource and economic policy
- K. D. Fleming, PhD—agribusiness management
- *P. V. Garrod, PhD—marketing and production economics
- *C. Gopalakrishnan, PhD—natural resource economics, environmental economics
- *J. M. Halloran, PhD—marketing and agribusiness management
- *P. S. Leung, PhD—production, fisheries, and aquaculture economics
- *S. T. Nakamoto, PhD—marketing
- *G. R. Vieth, PhD—resource management, non-market valuation
- *J. F. Yanagida, PhD—production economics, price analysis, international trade and development

Cooperating Graduate Faculty

- T. Liang, PhD—systems engineering
- J. K. Wang, PhD—production systems design and aquacultural engineering

Affiliate Graduate Faculty

- J. P. Dorian, PhD—mineral economics
- S. G. Pooley, PhD—fisheries economics

Degrees Offered: BS in agricultural and resource economics, MS in agricultural and resource economics, PhD in agricultural and resource economics

The Academic Program

Agricultural and resource economics (AREC) deals with the practical application of economic theory and analytic methods to diverse aspects of the commercial food and fiber industries. Analyses of public-sector projects and domestic and international policies in agriculture and resource use are also

involved. Students study economic development, trade, and agricultural policy as well as resource use, conservation, and quality.

AREC provides undergraduate students with a well-rounded education and the flexibility to tailor programs to match students' interests. The graduate programs are rigorous in economic theory, quantitative methods, and the application of learned theory and methods to AREC fields or areas of concentration. AREC graduates find employment in the private sector and in government and academic institutions.

Undergraduate Study

Bachelor's Degree

Concentrations available within this curriculum include agribusiness, natural resources, fisheries and aquaculture economics, and general agricultural economics in preparation for graduate work. Students and their adviser will develop an appropriate plan of study.

Requirements

- ACC 201
- AREC 210 or MATH 205
- ECON 300 and 301
- ENG 209
- 18 upper division AREC credit hours, including AREC 310 and at least one 400-level AREC course

Graduate Study

The department offers MS and PhD degrees in the general areas of resource economics, bioeconomics, international development, and policy. A PhD program in agricultural systems analysis is also offered in cooperation with faculty in the biosystems engineering department.

The department maintains close relationships with the UH Mānoa Water Resources Research Center, Sea Grant College Program, and Department of Economics, as well as the East-West Center. Graduate students have considerable latitude for designing programs of study, generally focusing on issues important to Asian and Pacific Basin countries.

Complete details on graduate programs, as well as financial aid available to prospective students, are outlined in a brochure available upon request from the department.

Master's Degree

Undergraduate preparation for admission to the MS program includes courses in intermediate micro- and macroeconomics, statistics, and calculus.

Graduates with MS degrees have found employment in government and international agencies, agricultural extension services, financial organizations, and agribusiness firms.

Requirements

Prospective MS candidates may select either the Plan A (thesis) or Plan B (non-thesis) program. The Plan A program requires 25 credit hours of course work and 6 credit hours of thesis. The student must pass an oral exam in defense of the thesis.

Plan B requires 34 credit hours of course work, of which 18 credit hours must be from courses at the 600 level or above. A scholarly paper, a written comprehensive exam, and a subsequent exam are required. The scholarly paper should reflect the candidate's substantive analysis of a subject in the field of agricultural and resource economics. The written exam covers materials from the core courses.

All students pursuing the MS are required to take the following courses: AREC 458, 627, and 705; ECON 420 (or 627); ECON 425 (or AREC 626); ECON 604 (or 606); and ECON 605 (or 607).

Doctoral Degree

Applicants with a master's degree in either agricultural economics or a closely related field with no undergraduate deficiencies will be considered for admission to the PhD program. Students currently enrolled in the MS program, upon successful completion of 12 credit hours of graduate course work, may petition for admission to the PhD program. Students with outstanding undergraduate records (minimum GPA of 3.3) in agricultural and resource economics or a closely related field with no undergraduate deficiencies may also gain admission to the PhD program. Applicants for the PhD program must have completed all courses required for admission to the master's program.

Employment opportunities for PhD graduates include private and public research organizations and university positions in research, teaching, and extension.

Requirements

Students in the PhD program must take AREC 610, 626, 629, 634, 637, 638, 705; ECON 606, 607, 608, 609, and 627; and two other approved graduate courses.

PhD students must pass a written comprehensive exam based on core courses (see departmental brochure for details). They must also pass an oral comprehensive exam, write an acceptable dissertation based on original research, and defend it in a public examination before being awarded the PhD degree.

Agronomy and Soil Science

Sherman 101
1910 East-West Road
Honolulu, HI 96822
Tel: (808) 956-8708
E-mail: soil1@avax.ctahr.hawaii.edu
Web: agrss.sherman.hawaii.edu/

Faculty

- *S. A. El-Swaify, PhD (Chair)—soil and water conservation, salinity
- I. S. Campbell, PhD—crop management, information systems
- *R. S. de la Pena, PhD—crop management, root crops
- *C. I. Evensen, PhD—water quality extension, environmental education
- *J. H. Fownes, PhD—forest ecology
- *J. B. Friday, PhD—tropical forestry and agroforestry extension
- *M. Habte, PhD—soil microbiology-biochemistry
- *N. V. Hue, PhD—soil chemistry
- *R. C. Jones, PhD—soil mineralogy, x-ray analytical methods
- *H. H. Keyser, PhD—soil microbiology, *Rhizobium*
- *S. C. Miyasaka, PhD—alternative crops, nutrition
- P. S. Motooka, PhD—weed science (forest/pastures)
- *J. A. Silva, PhD—soil fertility and soil chemistry, statistics
- *P. Singleton, PhD—legume BNF
- B. J. Smith, PhD—pasture/grazing management, livestock behavior
- *G. Uehara, PhD—systems simulation in international agriculture
- *R. S. Yost, PhD—expert systems in soil management, fertility

Cooperating Graduate Faculty

- D. Borthakur, PhD—biotechnology, *Rhizobium*
- J. L. Brewbaker, PhD—crop breeding, agroforestry
- C. S. Tang, PhD—biochemistry of crops and soils

Affiliate Graduate Faculty

- K. C. Ewel, PhD—ecology
- F. C. Meinzer, PhD—crop physiology, water relations, gas exchange
- L. D. Swindale, PhD—international agricultural research and development, soil pedology

Degrees and Certificates Offered:

BS in agronomy and soil science, MS in agronomy and soil science, PhD in agronomy and soil science, Graduate Resource Management Certificate (see the "Interdisciplinary Programs" section within this *Catalog*), Environmental Studies Certificate (see the "Colleges of Arts and Sciences" section within this *Catalog*)

The Academic Program

Agronomy (AGRN) is the study of food, fiber, feed, and fuel crops and their physiology, interaction with the environment, and management from a systems perspective. Soil science (SOIL) is the study of natural land and soil resources and their effective management through the application of the principles of basic scientific disciplines, such as chemistry, physics, and biology, and technologies derived therefrom. Understanding the soil is required to intelligently manage and preserve this valuable natural resource. The combination of agronomy and soil science [AGRS] is a logical marriage of two interdependent subjects fundamental to implementing land use practices that are highly productive, sustainable, economically viable, and environmentally safe.

Students majoring in agronomy and soil science are involved in the full spectrum of subjects and activities required to understand and responsibly manage land, water, crops, and climate for the benefit of humankind. Modern scientific approaches and instruments allow agronomists to study soil-plant-atmosphere systems at all scales, from the microscopic level to large land areas. Many find great satisfaction in applying results from the laboratory to large-scale land-use problems. In recent years many students trained in agronomy and soil science have embarked on successful careers in ecological and environmental protection, in international institutions and organizations, and in farm-based agricultural industries. The department is one of only a few in the nation with a special commitment to international linkages with the developing world and the only department fully dedicated to crops and soils of the tropics.

Affiliations

The department's agroforestry and forest ecology programs are complemented by a special memorandum of understanding with the School of Forestry at the University of Idaho and at the University of Wisconsin-Stevens Point.

Advising

Undergraduate students are advised by the department's undergraduate adviser. Undergraduate options are detailed in the following section. Graduate students are advised initially by an adviser or by the department's graduate program chair.

Undergraduate Study

Agronomists and soil scientists utilize fundamental knowledge in physics, chemistry, biology and physiology, genetics, and meteorology to solve basic and applied problems of field crops and soils. Crop and soil scientists work together to investigate problems in plant nutrition, soil fertility, groundwater quality, soil erosion and conservation, agroforestry, and cropping systems. Together they strive to match the requirements of crops to the characteristics of soils and climates. This program offers a BS degree in agronomy and soil science.

Bachelor's Degree

Requirements

Prior to entrance into the program, students should have the equivalent of two years of high school algebra.

- Students must complete a total of 128 credit hours
- Students must complete General Education Core requirements including the following:
 - AREC 310
 - BOT 101/101L or BIOL 171/171L
 - CHEM 161/161L and 162/162L
 - ECON 130
- Required courses for all options:
 - AGRN 200
 - CHEM 152/152L
 - ENG 209
 - SOIL 304 and 450
 - AGRS 492
- Required courses for the agronomy option:
 - BOT 470/470L
 - 29 additional credit hours approved by the department

- Required courses for the crops option:
 - AGRN 460
 - AGRS 499
 - BOT 470/470L
 - MATH 140
 - PHYS 151/151L
 - 25 additional credit hours approved by the department
- Required courses for the soils option:
 - SOIL 430 and 460
 - AGRS 499
 - MATH 140 and 205
 - PHYS 151/151L
 - 22 additional credit hours approved by the department

Graduate Study

Two areas of concentration are offered in this graduate field of study: tropical agronomy and tropical soil science. The first is designed for candidates whose primary interests lie with crops; the second for students who wish to place greater emphasis on soils. Agronomy students may specialize in tropical crop and pasture production, cropping systems, agrometeorology, agroforestry, crop physiology, plant breeding, or plant-soil relationships. Courses offered in botany, horticulture, plant pathology, and agricultural biochemistry, combined with courses offered in agronomy and soil science, will provide considerable flexibility in the development of a program suited to a student's career objectives. In the soil science concentration, students may specialize in tropical soil genesis and classification, soil chemistry, soil physics, soil mineralogy, soil salinity, soil management, soil and water conservation, soil fertility, and soil microbiology.

Successful graduates have pursued a variety of careers within the industrial, educational, and research sectors. Employment opportunities are promising on the international scene.

Both the MS and PhD degrees are offered. Plan A is available to all MS students, but Plan B is restricted to intended PhD candidates. Plan C is designed for selected students.

Entrance Requirements

Applicants must present a bachelor's degree with a minimum of 18 undergraduate credit hours in either agronomy or soil science. All applicants are expected to

meet stated course requirements for department undergraduate majors as a minimum. Certain courses from related subject matter fields may be allowed to fulfill this requirement. Related fields for agronomy are animal sciences, botany, chemistry, climatology, forestry, genetics, horticulture, plant pathology, plant physiology, soil science, and zoology. Related subject matter fields for soil science are biosystems engineering, agronomy, botany, chemistry, civil engineering, geosciences, mathematics, microbiology, physical geography, and physics. A minimum TOEFL score of 520 is required of foreign students. All applicants must submit at least two letters of recommendation at the time of application. The GRE is required for all applicants.

The MS and PhD programs in tropical agronomy and soil science are recognized Western Interstate Commission for Higher Education (WICHE) regional graduate programs. Residents of Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming are eligible, upon admission, to enroll at tuition rates for Hawai'i residents.

Areas of Specialization

Areas of specialization and courses available in each are as follows:

Agricultural Systems Analysis and Methodologies

- AGRN 603 Experimental Design (4)
- AGRS 492 Internship (4)
- AGRS 651 Techniques of Plant/Soil Analysis (3)
- AGRS 654 Communications in Agriculture (1)
- AGRS 671 International Agricultural Systems (2)

Agroforestry/Forest Ecology

- AGRN 480 Agroforestry Systems (3)
- AGRN 680 Forest Agroforest Ecosystem Analysis (3)

Crop Production and Cropping Systems

- AGRN 200 Introduction to Crop Science (3)
- AGRN 460 Cropping Systems (3)
- AGRN 610 Crop Photosynthetic Production (3)
- AGRN 660 Cropping Systems Analysis (3)
- AGRN 710 Mineral Nutrition of Tropical Crops (3)

Land Resource Components and Processes

- AGRS 661 Agricultural Meteorology (4)
- SOIL 304 Fundamentals of Soil Science (4)
- SOIL 430 Soil Chemistry (3)
- SOIL 460 Soil Physics (3)

SOIL 485 Microbial Ecology (3)
 SOIL 604 Advanced Soil Microbiology (4)
 SOIL 640 Advanced Soil Chemistry (3)
 SOIL 660 Hydrologic Processes in Soils (3)
 SOIL 670 Soil Formation & Classification (4)
 SOIL 671 Soil & Clay Mineralogy (3)

Natural Resource Management— Environmental Quality

AGRS 630 Agriculture & the Environment (2)
 AGRS 631 Sustainable Agriculture Seminar (2)
 SOIL 450 Soil Fertility (4)
 SOIL 461 Soil, Erosion, & Conservation (3)
 SOIL 650 Advanced Soil Fertility (4)

New Concepts and Research in Agronomy and Soil Science

AGRS 491 Topics in Agronomy & Soil Science (V)
 AGRS 499 Directed Study (V)
 AGRS 500 Master's Plan B/C Studies (1)
 AGRS 691 Advanced Topics in Agronomy & Soil Science (V)
 AGRS 691 Advanced Topics in Agronomy and Soil Science (V)
 AGRS 699 Directed Research (V)
 AGRS 700 Thesis Research (V)
 AGRS 701 Seminar in Advanced Agronomy & Soil Science (1)
 AGRS 800 Dissertation Research (V)

Master's Degree

A diagnostic examination is required of all MS students and those PhD students who did not receive their MS from this department. The exam is given during the week preceding the first day of instruction in the first semester of enrollment. The examination consists of six parts: botany, chemistry, mathematics, physics, crop science, and soil science. The results of these tests are used to determine the need for remedial courses in the student's program.

Degree Requirements

Candidates are generally expected to follow the Plan A (thesis) program. Under this plan, 30 credit hours are required including 6 credit hours of thesis and a minimum of 24 credit hours of course work. A majority of these must be from agronomy and soil science courses, with 8 credit hours from agronomy and soil science courses at the 600 level and 4 other credits in other courses numbered 600 or above. No more than 2 credit hours of directed research (AGRS 699) are allowed toward the required 600-level credit hours, but 5 credit hours are allowed toward the 24 course credit hours. Mathematical preparation through calculus is required of all MS candidates.

All MS candidates must complete a minimum of 2 credit hours of seminar,

including 1 credit hour of AGRS 654 Communications in Agriculture and at least 1 credit in AGRS 701 Seminar in Advanced Agronomy and Soil Science.

The Plan B (non-thesis) option is available only to intended PhD candidates as explained under PhD requirements. The requirements for Plan B are explained in the "Graduate Education" section of this *Catalog*.

The Plan C (examination) option is open to selected students on the recommendation of their graduate program committee. Criteria for selection include previous academic records, interviews, level of performance in the diagnostic examination, and prior research experience (see the "Graduate Education" section of this *Catalog* for information).

Doctoral Degree

The PhD in agronomy and soil science is awarded only for original scholarly achievement. The dissertation, which is a significant original contribution to basic knowledge in the candidate's field, is required. Only students with above average academic records in predoctoral programs will be accepted into the program. Mathematical preparation at least to the level of differential and integral calculus is strongly recommended. Students accepted as intended PhD candidates directly from BS programs are required to perform successfully in an MS Plan B program. Upon completion of the MS Plan B, such students will be evaluated for admission to the PhD program in the same manner as other intended candidates who receive MS Plan A or Plan C degrees from this department.

A PhD program will have a major in either agronomy or soil science with a minor area of study that consists of courses principally outside the department as a complement. The minor allows the student to expand areas of proficiency.

Degree Requirements

For all PhD students, a minimum of 24 credit hours in courses numbered 600 or above is required for the major, not including seminar, directed research, thesis/dissertation research, or courses taken to fulfill the minor requirement. A majority of the 24 credit hours must be taken in agronomy and soil science courses with at least one course in agronomy (not including AGRN 603) for soils majors and at least one course in soils for agronomy majors. The candidate's committee will determine how many credit hours earned previously in an

MS program can be applied to the PhD credit requirement. Candidates must register for seminar at least one semester of each year in which they are registered as full-time or equivalent, except the final year, in which the dissertation defense can be substituted for seminar. PhD candidates who have not had AGRS 654 Communications in Agriculture or its equivalent may take this course during their first year as a substitute for 1 credit hour of AGRS 701. Mathematical preparation at least through calculus is required of all PhD candidates.

The minor for both the agronomy and the soil science concentrations will consist of a total of at least four courses at the 400 level or above outside the concentration area, with at least two courses at the 600 level. Each of these courses should represent a minimum load of 2 credit hours. The minor should complement the concentration area and include related courses that combine logically under the minor designated by the candidate and approved by the candidate's committee. Minor courses will be predominantly those offered in other departments. Statistics courses, such as ZOOL 631 and AREC 310, which are foundations for other graduate-level courses in statistics, may not be included in the minor as they are fundamental to any well-rounded program in either concentration.

After admission to candidacy and the completion of most courses in the candidate's program, the candidate must take written and oral comprehensive examinations covering all subjects considered relevant to the concentration and the minor. A final oral examination, which includes a public defense of the dissertation, is required of all candidates.

Animal Sciences

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 1800 East-West Road
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 E-mail: ta_anisci@avax.ctahr.hawaii.edu
 Web: www.hawaii.edu/ansc/welcome.html

Faculty

*D. L. Vincent, PhD (Chair)—reproductive physiology and endocrinology
 B. A. Buckley, PhD—beef production and breeding
 *J. R. Carpenter, PhD—ruminant nutrition, forage evaluation, dairy production

- *R. J. Early, PhD—ruminant nutrition and biochemistry, growth physiology
- *Y. S. Kim, PhD—meat science, muscle biology, animal growth
- *B. R. LeaMaster, DVM, PhD—veterinary extension, herd health, microbiology, parasitology
- *C. N. Lee, PhD—dairy production and reproduction management
- *S. R. Malecha, PhD—aquaculture production and breeding
- *C. W. Weems, PhD—molecular endocrinology and reproduction
- *H. Zaleski, PhD—swine production and management, reproductive physiology

Cooperating Graduate Faculty

- S. Atkinson—marine mammal biology
- C. Brown, PhD—fish culture, growth and development
- E. G. Grau, PhD—fish endocrinology
- K. Jeraj, DVM—laboratory animal medicine

Affiliate Graduate Faculty

- W. C. Bergin, DVM, MS—livestock production, management, and disease
- J. A. Brock, DVM, MS—aquacultural diseases
- E. Duerr, PhD—aquaculture nutrition

Degrees Offered: BS in animal sciences, MS in animal sciences

The Academic Program

Animal science (ANSC) is the application of experimental investigation, technology, and other scientific principles for the advancement of efficient and environmentally friendly animal agriculture. The present program centers around swine, sheep, beef, and dairy cattle production and pond aquaculture production systems. Students receive training in both basic and agricultural sciences, as well as in animal sciences. Unlike most continental United States institutions, the emphasis of the present program is on tropical production systems with particular relevance to the Pacific Basin area. Animal scientists have careers in management and production, food processing and marketing, veterinary sciences, the pharmaceutical and feed industries, teaching, extension, and research. These positions require skills in disciplines such as management, nutrition, genetics, physiology, meat science, animal health, feed and forage utilization, engineering, business, marketing, and salesmanship. The animal sciences program offers the BS and MS degrees.

Undergraduate Study

Bachelor's Degree

Requirements

- Course work in the basic sciences, mathematics, economics, and animal sciences including the following:
 - AREC 220 or ECON 131
 - CHEM 161/161L, 162/162L, and 272/272L
 - ENBI 402/402L
 - MATH 140 or above
 - PHYS 151/151L
 - One of BIOL 171, MICRO 130, SCI 124, or ZOOL 101
- Animal sciences required courses:
 - ANSC 200, 201, 244, 301, 321, and 445
 - Three of the following: ANSC 451, 453, 454/454L, 462, and 472
 - One of the following production courses: ANSC 431, 432, 433, and 450
- Additional electives to make a total of 128 credit hours

Because of the diversity among fields of specialization within animal sciences, specific course requirements will vary considerably among students. On the recommendation of the student's major adviser, courses will be selected from those offered in animal sciences, as well as in agricultural and resource economics, biosystems engineering, agronomy and soil science, anatomy and reproductive biology, biochemistry and biophysics, chemistry, environmental biochemistry, food science and human nutrition, genetics, horticulture, information and computer sciences, microbiology, oceanography, physiology, and zoology.

Graduate Study

Master's Degree

The MS in animal sciences is offered in the areas of genetics, nutrition, animal diseases, and physiology. Specialty areas consist of beef-cattle nutrition and genetics; dairy-cattle nutrition and physiology (especially the management of cattle in a hot climate); swine management; reproductive physiology and endocrinology of sheep, cattle, fish, and swine; muscle biology and meat science; health and disease; and freshwater shrimp breeding, nutrition, and pond management systems. Emphasis is on tropical animal science, aquaculture pond production systems, yield trials, and animal management. Candidates wishing

to specialize in nutrition, animal diseases, reproduction, or physiology should be strong in chemistry and biochemistry with a good background in mathematics. Candidates wishing to specialize in animal breeding should be particularly strong in mathematics, including statistics, with a good biological background.

Admission Requirements

To be considered for admission to the animal sciences program, an applicant must (1) hold a bachelor's degree with a major in animal science (or the equivalent thereof) from an accredited institution of higher learning, (2) provide evidence of superior scholarship in previous academic work, (3) arrange for three letters of recommendation, (4) submit GRE general and subject (biology) scores, and (5) obtain admission clearance by the Graduate Division. An applicant with a bachelor's degree in a major other than animal or veterinary sciences who otherwise qualifies for admission will be required to take ANSC 200 or 201, one production course, and such other undergraduate courses deemed necessary by the department as essential background to the applicant's studies. The ANSC 200 or 201 requirement may be satisfied through meeting the teaching experience requirement.

Degree Requirements

Two programs leading to the MS degree are available to graduate students in animal sciences. Students may elect to pursue either a thesis (Plan A) or non-thesis (Plan B) program. Requirements are as follows:

Plan A

Students must complete a minimum of 30 credit hours, including

- At least 12 credits of course work numbered 600 and above, including 2 credits of ANSC 641 (seminar) and excluding 699 and thesis 700
- A maximum of 3 credits of directed research (ANSC 699)
- 9 credits of thesis research in ANSC 700 with at least 1 credit taken in the final semester
- Remaining credits must be in courses numbered 400 and above

Plan B

A student must complete a minimum of 32 credit hours, including

- At least 18 credits in course work numbered 600 and above, including ANSC 641 (seminar) and excluding 699
- 4 credits of directed research (ANSC 699)

- Remaining credits must be in courses numbered 400 and above

Candidates must be enrolled during the term in which the degree is awarded; regular course work or ANSC 500 Master's Plan B Studies may be used to meet this requirement. ANSC 500 is offered as a 1 credit course with a mandatory grading of S/NG but does not count toward meeting degree requirements.

Both Plans A and B

- Students are required to attend weekly seminars and to present an animal sciences seminar each semester. Attendance is mandatory unless legitimate reason is given for being absent. A maximum of 2 credits is allowed for graduate seminar (ANSC 641).
- The following courses are recommended as a core for most graduate students in animal sciences: ANSC 642, 643, 644, and a graduate-level statistics course.

In both plans (on the recommendation of the student's graduate committee), the graduate credit hours will be selected from the graduate courses offered in animal sciences, as well as in the fields of agricultural biochemistry, agricultural economics, biosystems engineering, agronomy and soil science, anatomy and reproductive biology, biochemistry and biophysics, chemistry, food and nutritional science, food science and technology, genetics, horticulture, information and computer sciences, microbiology, physiology, public health, and zoology. Because of the diversity of specializations within animal sciences, specific course requirements will vary considerably among students.

A general examination is required.

Biosystems Engineering

Gilmore 111
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8186
Fax: (808) 956-9269
E-mail: ta_engine@avax.ctahr.hawaii.edu
Web: ctahr.hawaii.edu/biosystems/

Faculty

- *C. Kinoshita, PhD (Chair)—thermo-engineering, energy systems
- *L. D. Gautz, PhD—bioproduction control, mechanical systems

- *P. S. Leung, PhD—production and quantitative methods
- *T. Liang, PhD—resource systems engineering, mechanization
- *W. W. Su, PhD—cell culture, biochemical engineering
- *S. Q. Turn, PhD—biomass energy systems, environmental engineering
- *J. K. Wang, PhD—bioproduction systems engineering, aquacultural engineering
- *M. R. Williamson, PhD—mechanization, postharvest technology
- *I. P. Wu, PhD—irrigation engineering
- *P. Y. Yang, PhD—waste/wastewater engineering, bioprocess technology/engineering

Cooperating Graduate Faculty

- E. D. H. Cheng, PhD—hydrology, hydraulics
- Y. S. Fok, PhD—water resource systems, hydrology
- C. C. K. Liu, PhD—hydrology, environmental systems engineering
- J. H. Moy, PhD—food engineering, food irradiation, processing technology
- P. Takahashi, PhD—environmental engineering
- M. C. M. Tsang, PhD—materials handling, processing engineering

Affiliate Graduate Faculty

- G. D. Pruder, PhD—aquacultural engineering

Degrees Offered: BS in biosystems engineering, MS in biosystems engineering

The Academic Program

In biosystems engineering (BE), the emphasis is on life and life-sustaining systems. Biosystems engineers study the design, production, and operation of engineering systems where living organisms (plants, animals, aquatic species, cells, etc.) are a major component. Biosystems engineers deal with structures, machinery, energy, labor, land, water, wastes, and resource variables related to the efficient creation of products and processes to fill human needs. They look at problems in the context of the whole system to balance society's demand for products from biological resources (e.g., food, fiber, and higher-valued products) with environmental integrity and economic success.

The goal of the program is to provide engineering students a unique opportunity to study biological systems from the engineering perspective. The importance of living organisms in both natural and man-made systems has heightened the demand for engineers with an understanding of biology. The program prepares majors in biosystems engineering for interesting and rewarding careers in engineering biological systems essential to the well-being of mankind. The biosystems engineering program at the University of Hawai'i at

Mānoa teaches the importance of the systems approach to problem solving. This approach provides biosystems engineering majors with an extra edge in using their engineering knowledge to study total-system performance and, ultimately, to achieve sustainable resource utilization. Biosystems engineering offers a unique engineering career to students with an interest in biology and resource utilization.

Undergraduate Study

Bachelor's Degree

The BS in biosystems engineering is the only undergraduate degree offered by the department.

Requirements

- General Education Core requirements, including the following:
 - SP 151 or 251
 - AREC 220 or ECON 130
 - BIOL 171/171L
 - CHEM 171/171L (or 161, 162 and lab) and 272/272L
 - MATH 205, 206, 231, and 232
 - PHYS 170/170L and 272/272L
- College requirements:
 - AREC 310
- Basic Engineering requirements:
 - EE 160 and 211
 - CE 270, 271, and 320
 - ME 311
- Biosystems Engineering requirements:
 - BIOL 172/172L or MICRO 351/351L
 - BE 351/351L, 360, 401, 413, 437, 460, 481, and 482
 - At least two courses from BE 411, 431, 435, or 436

A student must have a minimum of 128 credit hours. Most students will take 138 credit hours to complete the requirements.

Graduate Study

Master's Degree

The MS in biosystems engineering is the only graduate degree offered by the department. Research areas open to MS students are management of wastes and wastewater from agricultural and food industries; engineering for cell culture, fermentation, micropropagation, and bioconversion; engineering-intensive horticultural systems; engineering-intensive aquatic biosystems systems;

modeling and optimization of bioresource production and processing systems; water management and irrigation system design; spatial decision support systems for environmental protection and resource development; bioremediation; bioenergy systems and thermochemical conversion; and mechanization and automation of tropical crop production, treatment, and processing. Graduates of the program have entered careers in industry and public agencies or have undertaken further study in a PhD degree program. Intended candidates for the MS must present a bachelor's degree from an accredited engineering program or the equivalent.

Requirements

Biosystems engineering courses as well as courses from the related fields of engineering, agriculture, and sciences may be utilized to fulfill the minimum requirement of 30 credit hours. Both Plan A (thesis) and Plan B (non-thesis) are available.

Entomology

Gilmore 310
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-6737
Fax: (808) 956-2428
E-mail: ta_ento1@avax.ctahr.hawaii.edu

Faculty

- *M. L. Goff, PhD—acarology, medical and forensic entomology
- *J. K. Grace, PhD—termite biology and control, insect behavior
- *A. H. Hara, PhD—horticultural entomology, postharvest insect control, regulatory entomology (Hilo)
- *M. W. Johnson, PhD—biological control, insect pest management
- *V. P. Jones, PhD—insect pest management, insect ecology
- *R. F. L. Mau, PhD—agricultural entomology, extension entomology, insect biology
- *S. D. McCombs, PhD—biotechnology, genetics
- *R. H. Messing, PhD—fruit fly ecology and management (Kaua'i)
- *S. H. Saul, PhD—insect genetics
- *J. R. Yates III, PhD—urban pest management, termite biology and control

Cooperating Graduate Faculty

- B. M. Brennan, PhD—insect physiology, pesticide regulation and use
- J. K. Fujii, PhD—insect pathology, termite biology (UH Hilo)
- R. G. Gillespie, PhD—evolutionary biology and conservation of arthropods

- K. Y. Kaneshiro, PhD—systematics, evolution, insect behavior
- G. K. Roderick, PhD—population ecology and evolutionary genetics
- J. Seifert, PhD—insecticide toxicology
- L. Arita Tsutsumi, PhD—insect behavior, honeybee ecology (UH Hilo)

Affiliate Graduate Faculty

- C. T. Atkinson, PhD—wildlife diseases
- N. Evenhuis, PhD—systematics of *Diptera* (Bishop Museum)
- P. A. Follett, PhD—commodity quarantine treatments, tropical tree fruit IPM (Hilo)
- E. J. Harris, PhD—ecology and control of fruit flies (USDA-ARS)
- F. G. Howarth, PhD—systematics (Bishop Museum)
- E. B. Jang, PhD—insect physiology, fruit fly control (USDA-ARS)
- D. O. McInnis, PhD—insect genetics (USDA-ARS)
- N. J. Reimer, PhD—ant biology and control, biological control of weeds (Bishop Museum)
- G. A. Samuelson, PhD—systematics (Bishop Museum)
- R. I. Vargas, PhD—ecology, mass-rearing techniques (USDA-ARS)

Degrees Offered: BS in entomology, MS in entomology, PhD in entomology

The Academic Program

Entomology (ENTO) is the study of insects and related organisms, such as spiders and mites. Entomologists seek to understand the role of insects in the natural world and their interaction with humans. They work to find environmentally safe, effective, and economical solutions to insect pest problems in agricultural and urban environments.

Hawai'i is an excellent place to study entomology. The uniform tropical climate permits students to observe and collect insects year-round. For those with interests related to evolutionary biology, the unique endemic insect fauna of Hawai'i offer many exciting opportunities for original research.

In the area of applied entomology, insects associated with Hawai'i's tropical and subtropical agricultural and urban environments provide a wealth of challenging problems in pest management research. In Hawai'i, such research strongly emphasizes biological control, biotechnological, and other non-chemical methods in order to minimize negative environmental impacts. The development of entomological technology to support low-input sustainable agriculture is another important area in pest manage-

ment research. Motivated students will find an abundance of challenging opportunities that can help them develop professional competence in the science of entomology.

Advising

All undergraduate entomology majors are advised by a faculty member who has been appointed by the department. New candidates for the graduate program are assigned an interim adviser and committee until such time as a permanent adviser and committee are selected.

Undergraduate Study

Bachelor's Degree

Requirements

- General Education Core requirements
- CTAHR agricultural science required courses
- ENTO 263
- ENTO 374/374L
- ENTO 462
- ENTO 492
- 15 or more credit hours from an approved list of courses (determined in consultation with undergraduate adviser)
- Additional credit hours to total 128

All entomology majors are required to consult with the undergraduate adviser concerning their program prior to registration each semester.

Graduate Study

The department offers graduate programs leading to the MS and PhD degrees in entomology. They encompass independent study, course work, and research in acarology, biological control of insect and weed pests, biotechnology and insect genetics, forensic entomology, insect ecology, insect evolution, insect genetics, insect physiology, insecticide toxicology, insect transmission of plant pathogens, medical and veterinary entomology, pest management, systematics, urban entomology, and tropical economic entomology.

Intended candidates for graduate programs in entomology must present a bachelor's degree with a minimum of 18 undergraduate credit hours in entomology and zoology, including general zoology, general entomology, economic entomology, insect morphology, and systematic entomology. In addition, they must have

had credit for two years of chemistry (including inorganic and organic), one year of physics, MATH 140 or equivalent, and courses in botany, genetics, and microbiology. All deficiencies in undergraduate preparation must be satisfied.

The MS and PhD in tropical entomology are recognized Western Interstate Commission for Higher Education (WICHE) regional graduate programs. Residents of Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming are eligible, upon admission, to enroll at Hawai'i-resident tuition rates.

Master's Degree

The MS degree program is offered under either Plan A (thesis) or Plan B (non-thesis). All students in this program are first enrolled under Plan A. Transfer to Plan B is permissible only after consultation with the candidate's adviser and approval by the chair of the graduate field of study.

A total of 32 credit hours are required for each degree plan. Specific degree requirements are listed below.

Graduates with the MS degree should possess general knowledge of entomology, including basic principles of insect identification, biology, and control. Prospects for employment are in private industry, service-oriented entomological programs of government agencies, and research institutions.

Requirements

Plan A (thesis)

- 16 credit hours of course work
- 2 credit hours of ENTO 699 directed research
- 2 credit hours of ENTO 687 Entomology Seminar
- 1 credit hour of ENTO 690 Foundations in Entomology each year
- 10 credit hours of ENTO 700 thesis research
- Final oral defense of the thesis research
- Submission of an acceptable thesis

Plan B (non-thesis)

- 26 credit hours of course work
- 2 credit hours of ENTO 699 directed research
- 2 credit hours of ENTO 687 Entomology Seminar
- 1 credit hour of ENTO 690 Foundations of Entomology each year
- Final oral defense of the directed research project and on other aspects of entomological training undertaken by the candidate

Doctoral Degree

Intended candidates for the PhD program should have earned the MS degree in entomology or equivalent from a recognized institution. Those with a BS or BA may petition for admittance into the PhD program only after enrolling in the MS program.

Graduates with the PhD degree should possess broad general knowledge in all areas of entomology, in-depth knowledge in at least one area of specialization, and capability for independent research. Prospects for employment for PhD graduates are in teaching, research, and extension at universities and in research with private industries and government agencies.

Requirements

- 4 credit hours of seminar
- 1 credit hour of ENTO 690 each year
- Diagnostic examination on the basic principles of entomology within two semesters after admission into the program
- Oral and written comprehensive examination in the candidate's area of specialization administered by the doctoral committee
- Preliminary oral defense of the dissertation research for the doctoral committee
- Final oral defense of the dissertation research
- Submission of an acceptable dissertation

Additional course work required for the degree is determined by the candidate's doctoral committee.

Environmental Biochemistry

Henke 329
1800 East-West Road
Honolulu, HI 96822
Tel: (808) 956-8352
Fax: (808) 956-5037
E-mail: ta_agbioch1@avax.ctahr.hawaii.edu

Faculty

H. Ako, PhD—analytical biochemistry/aquaculture
B. Brennan, PhD—pesticide safety
M. Kawate, PhD—pesticide registration
Q. X. Li, PhD—environmental biochemistry
J. Seifert, PhD—biochemical toxicology
C. S. Tang, PhD—plant biochemistry

The Academic Program

The Department of Environmental Biochemistry (ENBI) offers courses in biochemistry, toxicology, and analytical chemistry. The 100-level course accommodates Group 2 of the General Education Core's natural sciences requirement. It covers principles of bio-organic chemistry with emphasis on practical applications for life science, agriculture, and nursing. The 400-level course on principles of biological chemistry is for undergraduate and first-year graduate students, either as a part of their curriculum at CTAHR or as a preparation for a professional school. The accompanying laboratory course covers biochemistry techniques with applications in a number of fields. The 600-level courses provide advanced training in plant biochemistry, mechanistic toxicology and toxicology of pesticides, environmental aspects of pesticide use, and modern techniques of food and pesticide analyses to graduate students of agriculture and environmental sciences.

Food Science and Human Nutrition

Henke 224
1800 East-West Road
Honolulu, HI 96822
Tel: (808) 956-8236
Fax: (808) 956-4024
E-mail: ta_fshn@avax.ctahr.hawaii.edu
Web: www.hawaii.edu/depart/fshn

Faculty

D. L. Vincent, PhD (Interim Chair)—reproductive physiology and endocrinology
J. P. Derrickson, MS, RD—food security, nutrition extension
*D. A. Dooley, PhD—diet and behavior, nutrition education
*M. A. Dunn, PhD—nutritional biochemistry, vitamins and minerals
*A. S. Hodgson, PhD—food technology extension, food safety and quality
*A. S. Huang, PhD—food chemistry
*W. T. Iwaoka, PhD—food chemistry, food safety
*J. H. Moy, PhD—food engineering, food irradiation, processing technology
S. T. Nakamoto, PhD—marketing
*W. K. Nip, PhD—food technology
*R. Novotny, PhD, RD—community and international nutrition
*A. C. Shovic, PhD, RD—dietetics
*C. A. Titchenal, PhD—sports nutrition, energy balance

Cooperating Graduate Faculty

- H. Ako, PhD—nutritional biochemistry, aquaculture, lipid metabolism
 J. Carpenter, PhD—protein and fiber utilization
 C. G. Cavaletto, MS—sensory evaluation of foods
 R. J. Early, PhD—growth biology, protein metabolism
 J. Hankin, DrPH, RD—nutritional epidemiology, cancer
 S. Kathariou, PhD—food microbiology
 D. A. Lally, PhD—exercise physiology
 Q. Li, PhD—analytical methodology to identify environmental toxins
 J. Seifert, PhD—toxicology
 C. S. Tang, PhD—biochemistry of natural products
 C. Waslien, PhD, RD—international nutrition, geriatrics
 C. W. Weems, PhD—reproductive endocrinology, steroids
 P. Y. Yang, PhD—bioprocess engineering

Affiliate Graduate Faculty

- D. Galanis, PhD—Pacific Island nutrition
 K. Glantz, PhD—nutrition behavior, worksite wellness
 R. Hetzler, PhD—exercise physiology, sports nutrition
 C. S. Tamaru, PhD—live feed
 S. J. Taussig, PhD—industrial enzymology, fermentation
 T. Vogt, MD—dietary intervention trials

Degrees Offered:

BS in food science and human nutrition, MS in food science, MS in nutritional sciences

The Academic Program

The curricula in food science and human nutrition (FSHN) have a strong science base that is applied to food and human nutrition. Students are taught problem-solving skills, approaches to critical thinking and basic principles in the two related disciplines. Options in the curricula include dietetics, human nutrition, food science, and foods and nutrition. The last option can be directed toward nutrition education, sports and wellness, or other interests. The human nutrition option can serve as a pre-professional program in medicine, dentistry, nutrition, or other scientific graduate programs.

Interest in nutrition, food, and the relationship of food to human health and fitness has never been greater than today. Students majoring in any of the curricula options are prepared for diverse careers in the food industry, health-care and fitness facilities, hospitals, nutrition education and communication enterprises, government or private-sector food and nutrition agencies, and scientific research laboratories.

The dietetic option has been approved by the American Dietetic Association (Plan V). The food science option has been approved by the Institute of Food Technologists.

Students are strongly encouraged to take chemistry and biological science courses prior to entering the program. Transfer students are required to have a GPA of 2.5 or greater and to have taken FSHN 185 and CHEM 161/161L with a “C” or better. Upon entering the department, students will be assisted by academic advisers to identify their career objectives and select an appropriate option for study.

Undergraduate Study**Bachelor’s Degree**

Complete descriptions of course requirements for each option are available from the department.

Requirements

A total of at least 128 credits are required for graduation.

Advising

All food science and human nutrition majors are required to report for advising prior to registration each semester.

Graduate Study

The graduate program in Food Science and Human Nutrition offers two MS degree programs, one in food science and one in nutritional sciences. Students are encouraged to select their degree program as soon as possible and must select it before admission to candidacy. Both programs offer Plan A (thesis) or Plan B (non-thesis) options.

Admission requirements for both programs include a TOEFL score of 600 or above, GRE examination completion, and two confidential recommendations (utilizing departmental recommendation forms). Prerequisite academic preparation includes a bachelor’s degree (BA or BS); a course in statistics; and courses in biochemistry, physiology, and microbiology (one of the three must include a lab). Admission may be possible without prerequisites, in which case the student must complete deficiencies in the first year. Physics, calculus, and analytical chemistry are strongly recommended.

Requirements

Under Plan A, students must complete a minimum of 18 credit hours of course work, including credits of FSHN 699 Directed Reading and Research and 10 credit hours of FSHN 700 Thesis Research. Under Plan B, students must complete a minimum of 30 credit hours or course work of which a minimum of 18 credit hours must be in courses numbered 600 or higher, including 6 to 9 credits of FSHN 699. The remaining credits are fulfilled by electives that are selected in consultation with the graduate adviser.

MS in Food Science

Complete descriptions of course requirements are available from the department.

Areas of concentration are food technology (including tropical fruit, vegetable, and seafood processing), biochemistry, microbiology, engineering, sensory evaluation, irradiation, safety (including analysis, metabolism, and mode of action/toxicity of natural and man-made chemicals), fermentation, and waste-product utilization.

Graduates have found employment as college instructors; technical personnel in the food industry, regulatory or other governmental agencies; and researchers. Others have pursued further postgraduate studies.

MS in Nutritional Sciences

Complete descriptions of course requirements are available from the department.

Areas of concentration are nutritional biochemistry and physiology, mineral nutrition, nutrition and disease, nutrition and toxicology, nutrition education, nutrition behavior, and community and international nutrition.

Graduates with the MS degree in nutritional sciences have found employment as community college instructors, nutrition educators or consultants in the private sector, nutritionists in regulatory or other governmental agencies, and research workers. Others have pursued further postgraduate studies.

Honors and Awards

The department has several scholarships that are awarded each year to deserving students of junior or senior standing.

General Agriculture

Gilmore 210
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-6733
Fax: (808) 956-3706
E-mail: allene@hawaii.edu

Degrees Offered: BS in general agriculture

The Academic Program

The general agriculture major, with its two areas of emphasis (agricultural management and natural resource management), is designed for students interested in an interdisciplinary education in the agricultural and environmental sciences. Students enrolled in agricultural management take classes in the basic areas of agricultural production and agricultural and agribusiness management. Students in natural resource management study the management of land, water, and biotic natural resources for sustainability and environmental quality. Both emphases provide sufficient electives to permit students the flexibility to tailor the program to their interests. Graduates from the general agriculture major are prepared for an array of occupations in agribusiness, environmental management, and state and federal agencies or for entry to graduate school.

Advising

All general agriculture majors are required to report for advising prior to registration every semester. General agriculture advising and additional information may be obtained from Gilmore 210, (808) 956-6733.

Undergraduate Study

Bachelor's Degree

Two emphases are offered, agriculture management and natural resource management.

Requirements

- General Education Core requirements including the following:
 - AREC 210 and 220
 - BOT 101/101L
 - CHEM 151/151L, CHEM152/152L (CHEM 152 cross-listed as ENBI 152)
 - PHYS 100/100L

- College requirements including the following:
 - AREC 310 or FAMR 380/380L
 - HORT 492W or AGRS 492W
- Additional requirements for the agricultural management option:
 - ANSC 201
 - AREC 322 and 340
 - FAMR 350
 - HORT 200 and 364
 - ICS 101/101L
 - SOIL 304
 - SOIL 461
 - SP 151
 - 12 upper division agricultural management focus credit hours as approved by the adviser
- Additional requirements for the natural resource management option:
 - AGRN 480
 - HORT or AGRN 200
 - GEOG 101/101L, 305, and 405
 - SOIL 304 and 461
 - SP 151
 - ZOOL 200/200L
 - 12 upper division natural resource management focus credit hours as approved by the adviser
- For both options, elective courses to equal 128 credit hours

Horticulture

St. John 102
3190 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8351
Fax: (808) 956-3894

Faculty

- *D. L. Hensley, PhD (Chair)—landscape design and management
- *H. C. Bittenbender, PhD—tropical fruit physiology and management
- *J. L. Brewbaker, PhD—plant breeding, biochemical genetics
- *C. G. Cavaletto, MS—sensory evaluation, food processing
- *C. L. Chia, PhD—tropical fruits
- *R. A. Criley, PhD—floriculture, ornamental physiology, growth regulation
- *J. DeFrank, PhD—weed science
- *J. M. Halloran, PhD—marketing and agribusiness management
- *K. D. Fleming, PhD—agribusiness management
- *K. D. Kobayashi, PhD—fruit physiology and computer modeling
- *B. A. Kratky, PhD—vegetable physiology and management

- *A. R. Kuehnle, PhD—ornamental breeding and genetics
- *J. T. Kunisaki, MS—tissue culture
- K. W. Leonhardt, PhD—floriculture
- *R. M. Manshardt, PhD—tropical fruit breeding and genetics
- *R. K. Nishimoto, PhD—weed science
- R. E. Paull, PhD—post-harvest physiology
- *Y. Sagawa, PhD—developmental morphology, cytogenetics, tissue culture
- *K. Y. Takeda, PhD—solanaceous crops
- *H. R. Valenzuela, PhD—vegetable physiology and management

Cooperating Graduate Faculty

- S. C. Furutani, PhD—horticultural crop physiology
- M. K. Kawate, PhD—pesticide registration/ weed science
- M. A. Nagao, PhD—developmental physiology, growth regulation
- W. S. Sakai, PhD—ultrastructure, physiological plant anatomy
- T. T. Sekioka, PhD—vegetable breeding and genetics
- M. J. Tanabe, PhD—in vitro propagation, turf management, plant propagation

Affiliate Graduate Faculty

- H. T. Chan Jr., PhD—food processing, plant biochemistry
- M. M. M. Fitch, PhD—tissue culture, genetic engineering
- J. J. McHugh, PhD—vegetable management, integrated pest management
- F. C. Meinzer, PhD—plant physiology, water relations
- K. Moody, PhD—weed science, crop management
- C. N. Nagai, PhD—sugar cane genetics and tissue culture
- R. V. Osgood, PhD—weed science
- D. Ragone, PhD—ethnobotany, conservation
- F. Zee, PhD—plant breeding, genetics

Degrees Offered: BS in tropical horticulture, MS in horticulture, PhD in horticulture

The Academic Program

Horticulture (HORT) is the science, technology, and art of growing and using fruits, nuts, vegetables, flowers, and ornamental plants and their products. Students majoring in horticulture can prepare for careers in plant production, management, services, marketing, extension, research, and teaching. The horticulture program at UH Mānoa is unique in its offerings in tropical horticulture. Students will have an opportunity to learn about tropical crop production, and plant management.

Advising

All tropical horticulture majors are required to report for advising prior to registration each semester.

Undergraduate Study

Bachelor's Degree

The department offers an undergraduate degree in tropical horticulture with options in science, production, and business.

Requirements

BS science option

- BOT 470/470L
- ENBI 402/402L
- BIOL 375/375L
- HORT 200, 364, and 492
- HORT 401 or 402
- Organic chemistry
- PHYS 151/151L
- SOIL 304
- 9 credit hours plus four courses from a list available from advisers
- Additional credit hours to total 128

BS production option

- ENTO 263
- HORT 200, 364, 420, and 492
- HORT 369, 401, or 403
- HORT 369, 402, or 404
- PPTH 405
- SOIL 304
- 24 credit hours from a list available from advisers
- Additional credit hours to total 128

BS business option

- ACC 201
- ACC 202 or AREC 341
- ENTO 263
- HORT 200, 364, and 492
- HORT 369, 401, or 403
- HORT 369, 402, or 404
- 1 HORT elective
- HRM 351
- BUS 315 or AREC 340
- BUS 312 or AREC 322
- PPTH 405
- SOIL 304
- Three courses from a list available from advisers
- Additional credit hours to total 128

Graduate Study

The department offers graduate study leading to the MS (Plan A and Plan B) and PhD degrees. Candidates may specialize in genetics and breeding of tropical fruits, vegetables, or ornamentals; physiology, culture, and management of tropical fruits, vegetables, or ornamentals; morphogenesis; stress physiology; post-harvest physiology; growth regulation; plant biochemical genetics; plant cytogenetics; weed science; computer modeling; or turf and landscape management.

Intended candidates for the MS or PhD in horticulture must have completed a minimum of 24 undergraduate credit hours in plant sciences (including botany, horticulture, plant pathology, and soil science) and related fields. Basic courses in chemistry and botany are required. The GRE is required for all PhD applicants and is highly recommended for MS applicants.

Related fields in which credit will normally be allowed toward the degrees in horticulture include agronomy, biochemistry, biophysics, botany, entomology, food science, genetics, microbiology, plant pathology, soil science, and zoology.

The MS and PhD in tropical horticulture are recognized Western Interstate Commission for Higher Education (WICHE) regional graduate programs. Residents of Alaska, Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Utah, Washington, and Wyoming are eligible, upon admission, to enroll at Hawai'i-resident tuition rates.

Master's Degree

Graduates of the Plan A program can further their graduate studies leading to the PhD degree or enter careers as technicians and researchers, while graduates of the Plan B program typically enter careers in education, agribusiness, extension service, and other agriculturally related occupations.

Requirements

All MS candidates are required to pass a written general examination during their first semester in residence. A final oral examination is also required. Plan A students must complete a minimum of 24 credit hours of course work and 6 credit hours of thesis preparation. For Plan B students must complete a minimum of 30 credit hours, including a minimum of 18 credit hours must be earned in courses numbered 600 to 798 of which a minimum of 12 credit hours must be in

horticulture. A maximum of 6 credit hours (Plan B) or 2 credit hours (Plan A) in HORT 699 may be taken. All students must take 2 credit hours of HORT 667 or 1 credit hour of HORT 667 and 1 credit hour of HORT 654.

Doctoral Degree

Graduates of the PhD program have entered careers as researchers and/or educators in institutions of higher learning and in public and private institutions.

Requirements

All PhD candidates are required to pass a written qualifying examination during their first year in residence. Also required are a comprehensive oral examination and 2 credit hours of HORT 667 or 1 credit hour of HORT 667 and 1 credit hour of HORT 654. Other course requirements are established by the student's graduate committee.

Human Resources

Miller 110

2515 Campus Road

Honolulu, HI 96822

Tel: (808) 956-8105

Fax: (808) 956-2239

E-mail: ta_hr@avax.ctahr.hawaii.edu

Web: www.ctahr.hawaii.edu/~hr/

Faculty

- B. A. Harger, PhD (Chair)—textiles, personality and dress
- L. L. Arthur, PhD—history of costumes, social-psychological aspects of dress
- R. A. Caulfield, PhD—infancy, childhood, human development
- D. R. Ching, PhD—agricultural leadership
- D. L. F. Chung, MEd—fashion design
- D. H. Davidson, PhD—cross-cultural child rearing, life span development
- C. A. Dickson, PhD—fashion merchandising, international textile products markets
- J. W. Engel, PhD—family relationships, marriage development
- G. F. Fong, EdD—family resource management
- B. W. Laughlin, PhD—historic costumes, textiles
- M. I. Martini, PhD—parenting and family relationships across cultures
- D. M. Masuo, PhD—consumer economics
- M. A. Morgado, MA—fashion merchandising, fashion and culture
- R. W. Wall, PhD—family financial planning

Degrees Offered: BS in family resources, BS in fashion design and merchandising (textiles and clothing)

The Academic Program

The Department of Human Resources has been an integral part of the land-grant system and of the University of Hawai'i since 1907.

The department offers two bachelor of science degree programs: family resources (FAMR) and textiles and clothing (TXCL).

The FAMR program focuses on child and family studies. The FAMR curriculum emphasizes the study of child-, adolescent-, and adult-development; family development (such as marriage and parenting); family resource management (such as consumer and family economics and management); community needs; and leadership in human services occupations. The program requires an internship providing important supervised work experience. Students are prepared for bachelor-level careers in human and family services and for graduate training in child and family studies, early childhood education, human development, family-life education, family and consumer sciences, and marriage and family therapy. With supplemental course work, students are prepared for graduate training in other social science disciplines (social work, educational counseling, public health, psychology, etc.). FAMR courses are also functional in that they relate to students' personal development and family lives.

The TXCL program integrates theoretical and applied knowledge regarding apparel design, consumer textiles, historic costume, and apparel production with fashion marketing and merchandising theory and practice, both domestic and international. The program fosters the development of professionals prepared for management-level positions in business and industry. Positions include apparel designer, buyer, merchandise manager, sales representative, costume designer, manufacturer, and store owner. Majors specialize in fashion design, fashion merchandising, and fashion promotion, or they develop individualized programs in consultation with an adviser.

Undergraduate Study

Advising

Family Resources

Krauss Annex 7
2515 Campus Rd
Honolulu, HI 96822
Tel: (808) 956-6519

Textiles and Clothing

Miller 202
2515 Campus Road
Honolulu, HI 96822
Tel: (808) 956-8133

Family resources students are encouraged to come for initial advising during or before their first year at the University and prior to their application for admission.

Family Resources Program

The family resources program provides students with a comprehensive education in family development and resource management, including course work and study in the areas of family relations and marriage development, parenting, family economics and resource management, consumer economics, human development, and community leadership and resource development. The curriculum prepares students to work proactively in multicultural settings to enhance the quality of family life. It fosters an understanding of the social systems perspective as it relates to the study of how families operate.

Students study the theoretical and applied literature that addresses the biological, social, cultural, psychological, and economic well-being of individuals and families and the environments in which they live. Students also study the changing functions of the family, the roles of its members, and the community programs and policies that affect the decisions and well-being of families and consumers. An internship in the student's area of focus is an integral part of the curriculum.

Entrance Requirements

New students may be admitted directly into the program when they apply to the University. Students transferring from other colleges within the University of Hawai'i system or from other universities must have a minimum GPA of 2.5 to be considered for admission.

Degree Requirements

A summary of degree requirements is available in Miller 110 (808) 956-8105 or Krauss Annex 7 (808) 956-6519.

Textiles and Clothing Program

The textiles and clothing program prepares students for management-level positions in the fashion industry. All students take a prescribed set of courses in clothing aesthetics, fashion theory and marketing, textiles, and historic Western and Asian costumes. Fashion is examined nationally and internationally from the perspective of business, industry, education, government, family, and the consumer. Classroom work is enhanced by major Pacific, Asian, Hawaiian, and Western clothing and decorative arts study collections. Internships in the students'

areas of focus are an integral part of the curriculum. The program also provides opportunities for exchange programs with other universities and study tours to fashion centers of the world. A strong foundation for graduate study in clothing and related areas is provided.

Career Focus Areas

Several career focus areas are available.

Apparel Design. The apparel design focus prepares students for careers in the fashion industry as designers, assistant designers, fashion stylists, and manufacturers. Students have a unique opportunity to study the theoretical and applied aspects of fashion design and costume history in a multicultural environment enhanced by major costume collections; a computerized creative design system; and a computerized grading, marker-making, and pattern-making system.

Fashion Merchandising. The fashion merchandising focus offers a unique combination of fashion theory, marketing, and product information relative to retail and wholesale operations. Graduates are prepared for fashion industry management careers as buyers, merchandise managers, sales representatives, and fashion coordinators for the local, national, and international markets.

Fashion Promotion. In the fashion promotion focus, students take courses in communication, writing and reporting, video production, and advertising to supplement the required textiles and clothing courses. The curriculum is designed to equip students with an understanding of the use of communications media for promoting sales of fashion-related products and services. Graduates are working in mall management, advertising, and visual merchandising.

Individualized Programs. For an individualized program, students work with an adviser to develop a curriculum of their own choosing. Examples of individualized programs include historic costume, theater costume production, and fiber/apparel arts.

Entrance Requirements

New students may be admitted directly into the program when they apply to the University. Students transferring from other colleges within the University of Hawai'i system or from other universities must have a minimum GPA of 2.5 to be considered for admission.

A summary of degree requirements is available in Miller 202 (808) 956-8133 or Miller 110 (808) 956-8105.

Plant Molecular Physiology

St. John 503-B
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Fax: (808) 956-3542
E-mail: dulal@hawaii.edu
doriv@hawaii.edu
Web: www.ctarm.hawaii.edu/pmp

Faculty

- *D. Borthakur, PhD (Chair)—molecular genetics of rhizobia, plant-microbe interaction, biotechnology
- *J. E. Bowen, PhD—mineral nutrition
- *D. A. Christopher, PhD—photosynthesis, plant biochemistry, plant molecular biology
- *H. M. Harrington, PhD—biochemistry molecular biology of heat shock, signal transduction in plants
- *J. I. Stiles, PhD—plant molecular biology, genetics, agricultural biotechnology
- *H. Y. Yamamoto, PhD—plant biochemistry, photosynthesis

Cooperating Graduate Faculty

- G. Goldstein, PhD—water relations, crops-vegetation environment interactions
- R. E. Paull, PhD—postharvest physiology and handling of tropical fruits, flowers, and vegetables
- C. S. Tang, PhD—natural products chemistry and biochemistry

Affiliate Graduate Faculty

- H. Albert, PhD—plant molecular biology
- M. M. Fitch, PhD—micropropagation and genetic transformation of papaya
- F. C. Meinzer, PhD—plant physiology, water relations
- P. H. Moore, PhD—sugar cane physiology

Degrees Offered: MS in botanical sciences (plant physiology), PhD in botanical sciences (plant physiology)

The Academic Program

The faculty of the Department of Plant Molecular Physiology (PMP) conducts research on the physiological, nutritional, biochemical, and molecular biological processes that underlie metabolism, growth, development, and biotechnology, especially as related to tropical plants. The department offers graduate education leading to the MS and PhD degrees in plant physiology as an option in the botanical sciences graduate field of study. The plant physiology option features an interdepartmental faculty and offers a challenging instructional curriculum that stresses the fundamentals of plant

biology, chemistry, biochemistry, genetics, molecular biology, and biotechnology.

The department's mission in basic research and an active, internationally recognized faculty combine to provide students with exciting graduate research opportunities. The degree programs are research-intensive. Students develop an in-depth understanding of contemporary research approaches and master state-of-the-art laboratory techniques and equipment. Many students are employed as research assistants and conduct research as part of ongoing faculty grant projects. Other alternative forms of support are also available to highly qualified candidates. Students who choose the plant physiology option are afforded the unique opportunity to participate in research at the forefront of plant physiology and to make significant contributions through scientific publications.

Graduate Study

The department offers the MS Plan A (thesis) and Plan B (non-thesis) and the PhD in the plant physiology option of botanical sciences (BTSC). Applications from prospective students must include GRE scores for verbal and quantitative aptitude. Foreign applicants must also submit TOEFL scores. The application deadline for fall admission is **February 1 (January 15 for foreign applications)**. All applicants must have completed courses or equivalents in calculus, physics, chemistry through organic and quantitative analysis, basic biology or botany, genetics, biochemistry, and plant physiology and one upper division course in either botanical sciences or in cellular or molecular biology. While not a requirement, physical chemistry is also highly recommended.

Admission to candidacy for all degree programs requires the student to pass a general examination demonstrating the ability to critically read and evaluate the literature in a given subject area of plant physiology. Potential MS Plan A and PhD students must also demonstrate the potential to organize and conduct research. General requirements for all students also include at least two courses from the PMP core and presentation of a minimum of one approved seminar course each semester (excluding summer term).

A final examination is required for the MS Plan A thesis or PhD dissertation and consists of two parts: (a) a public presen-

tation of the research, and (b) an oral examination/defense of the thesis or dissertation.

Students who obtain degrees in the plant physiology option may expect to find employment in academia, private industry, or government agencies or continue their studies elsewhere.

Master's Degree

The MS Plan A is a research degree including course work and original research to be presented in the form of a written thesis. This plan is designed for students who intend to progress to a PhD degree program or for those who desire a career in research. Minimum course requirements include 12 credit hours in thesis (BTSC 700) and at least 18 additional credit hours approved by the candidate's graduate program committee. These shall include 6 credit hours in courses numbered 400 to 798 but not PMP 699 or BTSC 200 and 12 credit hours in courses numbered 600 to 798 excluding research methods courses, PMP 699 and BTSC 700. Students must enroll in at least 1 credit hour of BTSC 700 during the semester of graduation.

The MS Plan B is regarded as a terminal degree and is intended for those who do not wish to pursue research as a career. Plan B includes course work and a limited amount of directed research. Students who intend to pursue a research career or enter a PhD program should choose the MS Plan A program. Plan B requires a minimum of 30 credit hours including 18 credit hours in courses numbered 600 to 798, excluding research methods courses and BTSC 700, and 12 credit hours in courses numbered 400 to 798, excluding research methods courses and BTSC 700. All courses must be approved by the candidate's graduate program committee.

Doctoral Degree

The PhD program is designed to allow maximum flexibility for research specialization in a particular area of plant physiology, biochemistry, or cell or molecular biology. A major component of the PhD program is the completion of an original research project and dissertation. The dissertation research is expected to be a significant contribution to plant science. Formal course requirements for the PhD include selections from the PMP core and courses necessary to fulfill the minimal requirements for residence—three semesters of full-time work or the equivalent in credit hours. During the final semester, the

* Graduate Faculty

student must be registered for at least 1 credit hour of BTSC 800. Other course requirements are determined by the student's temporary or permanent graduate program committee and include at least 2 credit hours of directed research (PMP 699) to be used as part of the general examination. An oral comprehensive examination is required of all PhD students to assess general competence in general botany, cytology, anatomy, morphology, biochemistry, physiology, and specific areas as determined by the student's interest and graduate program committee.

Plant Pathology

St. John 307
3190 Maile Way
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Tel: (808) 956-8329
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E-mail: ta_avax.ctahr.hawaii.edu

Faculty

- *D. Schmitt, PhD (Chair)—nematology
- *A. M. Alvarez, PhD—bacterial diseases
- *J. J. Cho, PhD—diseases of vegetable crops, integrated pest management (Maui Branch Station)
- *S. A. Ferreira, PhD—crop protection, extension
- *J. Hu, PhD—virology
- *W. H. Ko, PhD—soil microbiology (Hawai'i Branch Station)
- C. Laughlin, PhD—nematology
- *S. C. Nelson, PhD—epidemiology
- *W. T. Nishijima, PhD—tropical fruits and nuts, forest and tree diseases, ornamental extension (Komohana Agriculture Complex)
- *J. J. Ooka, PhD—field crop and forest pathology, epidemiology (Kaua'i Branch Station)
- *K. G. Rohrbach, PhD—pineapple diseases, epidemiology
- D. Schmitt, PhD—nematology
- *B. S. Sipes, PhD—nematology
- *E. E. Trujillo, PhD—soil-borne diseases, biological control of weeds
- *J. Y. Uchida, PhD—fungal pathology

Cooperating Graduate Faculty

- D. Borthakur, PhD—molecular biology
- D. Gardner, PhD—pathology of native vegetation
- S. S. Patil, PhD—host parasite physiology
- M. Shintaku, PhD—virology (UH Hilo)

Degrees Offered: MS in botanical sciences (plant pathology), PhD in botanical sciences (plant pathology)

The Academic Program

Plant pathology (PPTH) is the study of plant diseases, microorganisms that cause diseases, host-pathogen interactions, and disease control. Plant pathologists concentrate on agricultural crops of economic importance, but the field also includes the biology and host-pathogen interactions of numerous other plant-pathogen systems. The field consists of several subdisciplines including phytomycology, plant virology, bacteriology, and nematology, as well as epidemiology, crop protection, and the molecular biology of host-pathogen interactions.

Students should have their undergraduate preparation in botany, horticulture, agronomy, or microbiology. Plant pathology has its foundation in biology and agriculture and offers wide opportunities in both basic and applied areas of biology, plant sciences, and agriculture. The plant pathology program at the University of Hawai'i offers students a unique opportunity to gain knowledge of the vast diversity of tropical crops and tropical plant pathogens.

Graduate Study

Applications for admission must include GRE scores for verbal and quantitative aptitude. Intended candidates must have or acquire adequate preparation in plant anatomy, biochemistry, ecology, genetics, physiology, and systematics. Candidates must present evidence of adequate preparation in physics, organic chemistry, statistics, and calculus.

Master's Degree

Plan A (thesis) and Plan B (non-thesis) are separate MS programs with distinct purposes. Plan A is the usual program to be taken by candidates. Plan B is offered at the discretion of the graduate faculty for students who do not intend to make research in plant pathology their profession. Plan B programs emphasize general crop protection and/or integrated pest management.

Graduates with the MS degree find employment in research, extension industry, and business. However, most students continue their studies or teach in two-year colleges.

Requirements

Plan A students must complete 12 credit hours of thesis research and a minimum of 18 additional credit hours in courses approved by a candidate's committee. Plan B students must complete 30 credit hours, 18 of these in the major field or an approved related field in courses numbered 600 and above. In addition, at least 6 credits, but not more than 9 credits, must be for directed research in aspects of plant pathology chosen by the candidate in consultation with his or her committee and must be done in two laboratories.

All students take a diagnostic examination within their first two weeks in a degree program. A requirement of all degrees is the presentation of four seminars: the first outlines the background of a research problem and the student's proposed research program; the second and third are focused on a topic; and the final, presented at the conclusion of the program, describes the research results and conclusions. At this time the student is examined by the thesis or dissertation committee.

Doctoral Degree

The dissertation is expected to be an original contribution based on independent research. It is initiated by the preparation of a critical review of the literature, which becomes the basis for a dissertation proposal. Dissertation research for the PhD degree is done in an aspect of plant pathology for which a member of the graduate faculty of the field will accept responsibility as committee chair.

Recipients of doctorates generally accept positions in university teaching and research, extension, industry, or government.

Requirements

There is no minimum credit requirement for the doctoral degree in botanical sciences (plant pathology). The student works closely with his or her advisory committee to select appropriate courses offered by the department of plant pathology and other departments in the University. A comprehensive examination and a dissertation must be successfully completed.