



COLLEGE OF **Tropical Agriculture and Human Resources**

Administration

Gilmore 202
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8234
Fax: (808) 956-9105
Web: www2.ctahr.hawaii.edu

Dean: Andrew G. Hashimoto
Associate Dean: Marlene M.
Hapai

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, biosystems engineering, food science and human nutrition, textiles and clothing, biotechnology, and family 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.

Through its extension activities, the college provides off-campus, noncredit 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 college promotes the advancement of agricultural sciences and applications for productive sustainable agriculture. Investigations cover plant and animal physiology; plant, insect, microbial, aquacultural, bioreactor and environmental biotechnology; diseases, insects, and parasites; agronomy; soils; food science; food processing; biosystems engineering; bioremediation; biochemistry; human and animal nutrition;

breeding and genetics; and culture, production, economics, marketing, and quality of life for individuals and families.

Degrees and Certificates Offered

Certificates: Graduate Resource Management Certificate, Environmental Studies Certificate

Please Note:

The degree requirements for the College of Tropical Agriculture and Human Resources were being revised during the publication of this *Catalog*. Students should consult the academic and student affairs office at (808) 956-8183 or (808) 956-6733 to ensure that they have the most recent requirements.

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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 entomology, BS in family resources, BS in fashion design and merchandising (textiles and clothing), 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), MS in botanical sciences (plant molecular physiology), MS in entomology, MS in food science, MS in horticulture, MS in nutritional sciences

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

New Proposed Degrees: see department listings

Advising

CTAHR Office of Academic and Student Affairs
 Gilmore 210
 3050 Maile Way
 Honolulu, HI 96822
 Tel: (808) 956-8183 or (808) 956-6733
 Fax: (808) 956-3706
 E-mail: acadaff@ctahr.hawaii.edu
 Web: www2.ctahr.hawaii.edu

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 international study. Student exchange programs are also available for those desiring short term exposure to other institutions.

Admission Requirements

Students may enter CTAHR as freshmen 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 for fashion design and merchandizing majors, 2.6 for family resources majors, and 2.8 for food science and human nutrition majors. Additional course requirements may also apply to these majors. Information on CTAHR undergraduate programs can be obtained from the CTAHR Office of Academic and Student 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 126-128 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; FAMR 380/380L Research Methodology/Lab 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, within the Department of Human Nutrition, Food and Animal Sciences, and participate in CTAHR's pre-veterinary program. A BS degree is desirable but not required for 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—Davis, Colorado State University, and the Washington, Oregon, Idaho College of Veterinary Medicine at Washington State University. Hawai'i students are also encouraged to make applications to other continental United States veterinary schools that accept nonresident students. Students should contact the Web site of the Association of American Veterinary Medical Colleges for information about the Veterinary Medical College Application Service at www.aavmc.org/vmcas/vmcas.htm and for more information about specific requirements for admission to veterinary schools. The department also sponsors the Pre-Veterinary Club of Hawai'i, which offers students opportunity to interact with other students interested in veterinary medicine and working with animals. Students seeking additional information and advising should contact the Department of Human Nutrition, Food and Animal Sciences (Agricultural Sciences Building, 1955 East-West Road, Room 216, Honolulu, Hawai'i 96822 (808) 956-8236).

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 and Student 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 Family and Consumer Sciences and then transfer to the College of Education in their junior year. Course work is taken in CTAHR's Department of Family and Consumer Sciences and Department of Human Nutrition, Food, and Animal Sciences and the College of Education. Additional information can be obtained from the Department of Family and Consumer Sciences (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 molecular 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 molecular physiology), entomology, and horticulture. Graduate programs in plant pathology and plant molecular 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 and Student Affairs, Gilmore 210, (808) 956-8183, or from departmental offices.

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

Modern laboratories as well as statewide field laboratories are an important part of undergraduate and graduate instruction. Students are able to learn the latest research methods. Classrooms are well-equipped for learning computer applications.

Student Organizations

CTAHR students are encouraged to join and actively participate in student organizations. CTAHR student organizations provide opportunities for students to gain experience in their professional field through diverse activities. Students can acquire transferable skills and competencies outside of the classroom while gaining invaluable knowledge they can utilize in the work force. Developing lasting friendships with peers and faculty are also benefits of active participation in student

organizations. Current CTAHR student organizations include:

- Innovators of Fashion
- Pre-Veterinary Club
- Food Science and Human Nutrition Council
- Horticulture Society
- Friends of the Family
- Student Mentors
- Agronomy and Soil Science Graduate Student Organization
- Agricultural and Resource Economics Graduate Student Organization
- Ka Mea Kolo (Entomology Club)
- Plant Pathology Graduate Student Organization
- Biosystems Engineering Club
- Horticulture Graduate Student Organization

Exceptional students may also be recommended for membership to honorary societies such as: Gamma Sigma Delta and Phi Upsilon Omicron.

Honors and Awards

The College of Tropical Agriculture and Human Resources and its departments provide scholarships and awards to its students. For a list of these scholarships, see the "Tuition, Fees, and Financial Aid" section of this Catalog. More information on scholarships and awards can be obtained from the CTAHR Academic and Student Affairs Office, Gilmore 211, (808) 956-8183.

Family and Consumer Sciences

Miller 110
2515 Campus Road
Honolulu, HI 96822
Tel: (808) 956-8105
Fax: (808) 956-2239
E-mail: FCS@ctahr.hawaii.edu
Web: www2.ctahr.hawaii.edu/FCS

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
B. De Baryshe, PhD—parenting, family resilience
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
A. M. Fontes, MS—leadership and personal development
C. S. Ikeda, MEd—technology and education

- L. J. Kawamura, MPh—4-H youth development, foods and nutrition
P. Kutara, MS—consumer economics
M. I. Martini, PhD—parenting and family relationships across cultures
D. M. Masuo, PhD—consumer and family economics
M. A. Morgado, MA—fashion merchandising, fashion and culture
L. C. Nakamura-Tengan, MS—consumer food safety and resource management
C. M. Nakatsuka, MEd—community service learning, 4-H
M. U. Ohama, MS—adult consumer sciences
R. W. Saito, MS—4-H youth development
M. K. K. L. Spotkoeff, MS—youth education and coordination
R. W. Wall, PhD—family financial planning
R. M. Yoshino, MA—community services
J. S. M. Young, MA—leadership and volunteer development
S. Yuen, PhD—human and family development
H. H. Zeug, PhD—human development, family life

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

Proposed Degrees: BS in family resources, BS in apparel product design and merchandising (textiles and clothing). Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

The Academic Program

The Department of Family and Consumer Sciences 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 fashion design and merchandising (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 apparel design, apparel merchandising, and fashion promotion, or they develop individualized programs in consultation with an adviser.

Undergraduate Study

Advising

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

Textiles and Clothing
Miller 201
2515 Campus Road
Honolulu, HI 96822
Tel: (808) 956-8133

Students are encouraged to come for initial advising before registering for the first year at the University or prior to their application for admission as a transfer.

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 2.6 to be considered for admission to FAMR.

Degree Requirements

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

Textiles and Clothing Program

The textiles and clothing program prepares students for management-level positions in apparel or related industries. All students take a prescribed set of courses in clothing aesthetics, fashion theory and marketing, textiles, and historic Western and Asian costumes. Apparel and its related industries are 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

TXCL majors each work with an adviser to develop a program of study that will provide the necessary educational background for a future career. Examples of possible career focus areas are apparel design, apparel merchandising, fashion promotion, and costume history. Students may also work with an adviser to develop an individualized program that combines TXCL focus areas in design and merchandising with each other or with other UH programs.

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

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 apparel and 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 to TXCL.

A summary of degree requirements is available in Miller 201 (808) 956-8133 or Miller 110 (808) 956-8105.

General Agriculture

Gilmore 210
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8183
Fax: (808) 956-3706
E-mail: chuna@ctahr.hawaii.edu

Degrees Offered: BS in general agriculture

Proposed Degrees: BS in plant and environmental biotechnology. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

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 agri-environmental 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) 956-8183.

Undergraduate Study

BS in General Agriculture

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
 - SP 151
 - HORT 492W or AGRS 492W
- Additional requirements for the agricultural management option:
 - ANSC 201
 - BUS 312 and 315
 - FAMR 350
 - HORT 200 and 364
 - ICS 101/101L
 - SOIL 304
 - SOIL 461
 - 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
 - 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

Human Nutrition, Food, and Animal Sciences

Agricultural Sciences 216
1955 East-West Rd.
Honolulu, HI 96822
Tel: (808) 956-7095
Fax: (808) 956-4024
E-mail: hnfas@ctahr.hawaii.edu
Web: www2.ctahr.hawaii.edu/HNFAS

Faculty

- D. L. Vincent, PhD (Chair)—reproductive physiology and endocrinology
- A. C. Brown, PhD, RD—nutrition related to disease, nutrition publications
- B. A. Buckley, PhD—beef production and breeding
- J. R. Carpenter, PhD—ruminant nutrition, forage evaluation, growth physiology
- L. Y. T. Ching, BS—livestock extension education (Kaua'i Cooperative Extension Service)
- D. A. Dooley, PhD—diet and behavior, nutrition education

M. A. Dunn, PhD—nutritional biochemistry, vitamins and minerals
 M. W. DuPonte, MS—livestock extension education (Hawai'i Cooperative Extension Service)
 R. J. Early, PhD—ruminant nutrition and biochemistry, growth physiology
 G. K. Fukumoto, MS—livestock extension education (Hawai'i Cooperative Extension Service)
 A. S. Huang, PhD—food chemistry
 W. T. Iwaoka, PhD—food chemistry, food safety
 N. A. Kanehiro, MS, RD—human nutrition extension education (O'ahu Cooperative Extension Service)
 Y. S. Kim, PhD—meat science, muscle biology, animal growth
 C. N. Lee, PhD—dairy production and reproductive management
 S. R. Malecha, PhD—aquaculture production and breeding
 S. T. Nakamoto, PhD—marketing
 R. Novotny, PhD, RD—community and international nutrition
 J. S. Powley, MS—livestock extension education (Maui Cooperative Extension Service)
 A. C. Shovic, PhD, RD—dietetics
 C. A. Titchenal, PhD—sports nutrition, energy balance
 C. W. Weems, PhD—molecular endocrinology and reproduction
 H. M. Zaleski, PhD—swine production and management, reproductive physiology
 J. M. Zee, MPH, RD—human nutrition extension education (Hawai'i Cooperative Extension Service)

Graduate Faculty in Animal Sciences

R. J. Early, PhD (Chair, graduate field of study)—ruminant nutrition and biochemistry, growth physiology
 B. A. Buckley, PhD—beef production and genetics
 J. R. Carpenter, PhD—ruminant nutrition, forage evaluation, dairy production
 Y. S. Kim, PhD—meat science, muscle biology, animal growth
 C. N. Lee, PhD—dairy production and reproductive management
 S. R. Malecha, PhD—aquaculture production and breeding, pond management
 D. L. Vincent, PhD—animal physiology, reproduction and endocrinology
 C. W. Weems, PhD—molecular endocrinology and reproduction
 H. Zaleski, PhD—swine production and management, reproductive physiology

Cooperating Graduate Faculty in Animal Sciences

E. G. Grau, PhD—fish endocrinology
 S. Atkinson, PhD—endocrinology and reproduction of marine mammals
 Y. S. Weems, PhD—reproductive endocrinology

Affiliate Graduate Faculty in Animal Sciences

J. A. Brock, DVM, MS—aquacultural diseases

Graduate Faculty in Food Sciences

C. G. Cavaletto, MS (Chair, graduate field of study)—sensory evaluation and food processing
 H. Ako, PhD—nutritional biochemistry, aquaculture, lipid metabolism
 A. M. Alvarez, PhD—bacterial disease

D. Borthakur, PhD—microbiology, biotechnology
 B. Buckley, PhD—beef production and breeding
 D. A. Dooley, PhD—diet and behavior, nutrition education
 R. J. Early, PhD—ruminant nutrition and biochemistry, growth physiology
 L. Gautz, PhD—instrumental quality evaluation
 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
 S. Kathariou, PhD—food microbiology
 Y. S. Kim, PhD—meat science, muscle biology, animal growth
 Q. Li, PhD—analytical methodology to identify environmental toxins
 J. H. Moy, PhD—food engineering, food irradiation, processing and technology
 W. K. Nip, PhD—handling and processing of seafood, tropical fruits and root crops
 R. Paull, PhD—fresh fruit and vegetable physiology and handling
 W. W. Su, PhD—bioprocess engineering
 C. S. Tang, PhD—biochemistry of natural products

Cooperating Graduate Faculty in Food Sciences

R. S. Fujioka, PhD—water resources, food microbiology
 P. Q. Patek, PhD—microbiology
 J. Seifert, PhD—toxicology
 C. S. Tamaru, PhD—live feed, aquaculture
 C. Waslien, PhD, RD—international nutrition, geriatrics

Affiliate Graduate Faculty in Food Sciences

A. Tacon, PhD—aquaculture and human nutrition

Graduate Faculty in Nutritional Sciences

R. J. Early, PhD (Chair, graduate field of study)—growth biology, protein metabolism
 A. C. Brown, PhD, RD—clinical nutrition, medical nutrition therapy
 J. R. Carpenter, PhD—protein and fiber utilization
 D. A. Dooley, PhD—diet and behavior, nutrition education
 M. A. Dunn, PhD—nutritional biochemistry, vitamins and minerals
 A. S. Huang, PhD—food chemistry
 W. T. Iwaoka, PhD—food chemistry, food safety
 S. T. Nakamoto, PhD—food marketing
 R. Novotny, PhD, RD—community and international nutrition
 A. C. Shovic, PhD, RD—dietetics
 C. A. Titchenal, PhD—sports nutrition, nutritional biochemistry, energy balance
 C. W. Weems, PhD—reproductive endocrinology, steroids

Cooperating Graduate Faculty in Nutritional Sciences

A. Franke, PhD—analytical assays, phytochemicals
 K. Glanz, PhD—nutrition behavior, workplace wellness
 R. Hetlzer, PhD—exercise physiology, sports nutrition
 D. A. Lally, PhD—exercise physiology
 L. Le Marchand, MD, MPH, PhD—epidemiology
 G. Maskarinec, MD, MPH—nutrition role in disease
 C. Waslien, PhD, RD—international nutrition, geriatrics

Affiliate Graduate Faculty in Nutritional Sciences

D. Galanis, PhD—Pacific island nutrition
 W. D. B. Hiller, MD—sports nutrition
 A. Tacon, PhD—aquaculture and human nutrition
 T. Vogt, MD—dietary intervention trials

Degrees Offered: BS in animal sciences, BS in food science and human nutrition, MS in animal sciences, MS in food science, MS in nutritional sciences

Proposed Degrees: BS in animal sciences, BS in food science and human nutrition, MS in animal sciences, MS in food science, MS in nutritional sciences. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

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 on 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 reference 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 education, and research. Those 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 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 two related disciplines. Options in the curricula include dietetics, human nutrition and food science. The human nutrition option can be directed toward nutrition education, sports nutrition, 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 the 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, extension education in nutrition, 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 sciences courses prior to entering the program. Transfer students in FSHN are required to have a GPA of 2.8 or greater and to have taken FSHN 185 with a “B” or better and CHEM 161/161L with a “C” or better.

Upon entering either program, Animal Sciences (ANSC) or Food Science and Human Nutrition (FSHN) students will be assisted by academic advisers to identify their career objectives and select an appropriate option for study.

Advising

All FSHN and ANSC majors are required to report for advising prior to registration each semester.

Undergraduate Study**BS in Animal Sciences****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.

BS in Food Science and Human Nutrition

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.

Graduate Study

The graduate program in Human Nutrition, Food and Animal Sciences offers three MS degree programs, one in animal sciences, one in nutritional sciences and one in food science. The MS in food science is an interdisciplinary / interdepartmental graduate program. Admission and degree requirements differ among the three graduate programs. All programs offer Plan A (thesis) and Plan B (non-thesis options).

MS in Animal Sciences

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 fresh water prawn and marine shrimp breeding, nutrition and pond management systems. Emphasis is on tropical animal science, aquaculture pond management; yield trials and animal management systems. Candidates wishing to specialize in nutrition, animal diseases, meat science, muscle biology, reproduction or physiology should be strong in chemistry and biochemistry with a good background in mathematics. Candidates wishing to specialize in animal breeding and genetics 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 matter (biology) scores, and (5) obtain admission clearance by the Graduate Division. An application 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 requirements may be satisfied through meeting the teaching experience requirement.

Degree Requirements

Plan A

Student must complete a minimum of 30 credit hours, including

- At least 12 credits of course work numbered 600 and above, including two 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

Student must complete a minimum of 32 credit hours, including:

- At least 18 credits in course work numbered 600 and above, including ANSC 641 and excluding 699.
- 4 credits of directed research (ANSC 699)
- Remaining credits must be in course numbers 400 and above.

Candidates must be enrolled during the term in which the degree is granted; 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 a mandatory grading of S/NG but does not count toward meeting degree requirements.

Both Plan 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, 687 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 other disciplinary graduate programs in CTAHR or other related disciplines such as anatomy and reproductive biology, biochemistry, chemistry, genetics, microbiology, physiology, public health, zoology. Because of the diversity of specialization within animal sciences, specific course requirements will vary considerably among students.

A general examination is required.

MS in Nutritional Sciences

The MS in nutritional sciences is offered in areas of nutritional biochemistry and physiology, mineral nutrition, nutrition and disease, nutrition and toxicology, nutrition education, nutrition behavior, and community nutrition 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 post-graduate education.

Admission Requirements

To be considered for admission to the nutritional sciences MS program, an applicant must (1) hold a bachelor's degree (BA or BS) from an accredited institution of higher learning, (2) have taken a course in statistics and courses in biochemistry, physiology and microbiology (one of the three must include a lab), (3) arrange for two confidential letters of recommendation (utilizing departmental recommendation forms), (4) submit GRE scores, and (5) obtain admission clearance by the Graduate Division. Foreign students must obtain TOEFL

scores of 600 or above. Admission may be possible with prerequisites, in which case the student must complete deficiencies in the first year. Physics, calculus, and analytical chemistry are strongly recommended.

Degree Requirements

Plan A

Student must complete a minimum of 28 credit hours, including

- At least 18 credit hours of course work numbered 600 and above, including credits of FSHN 699 Directed Reading and Research.
- 10 credits of thesis research in FSHN 700 with at least 1 credit taken in the final semester

Plan B

Students must complete a minimum of 30 credit hours, including

- At least 18 credit hours of course work must be in courses numbered 600 or higher, including 6 to 9 credits of FSHN 699.
- Remaining credits are fulfilled by electives that are selected in consultation with the graduate adviser.

Complete description of course and other requirements are available from the department.

Interdisciplinary/Interdepartmental MS in Food Science

The Department offers an interdisciplinary/interdepartmental MS in food science. The areas of concentration are food safety and quality, food processing and engineering, food chemistry and biochemistry, food biotechnology and special area. 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.

Admission requirements

To be considered for admission to the interdisciplinary / interdepartmental MS program in Food Science, an applicant must (1) hold a bachelor's degree (BA or BS) from an accredited institution of higher learning, (2) have taken one course each in organic chemistry, microbiology, biological science (in addition to microbiology) college physics, and biochemistry, (3) arrange for two confidential academic or professional letters of recommendation, (4) submit GRE scores, and (5) obtain admission clearance by the Graduate Division. Foreign students must obtain TOEFL scores of 570 or above. Admission may be possible with prerequisites, in which case the student must complete deficiencies in the first year.

Degree Requirements

Plan A

Student must complete a minimum of 32 credit hours, including

- At least 18 credit hours of course work, at least 12 credits

* Graduate Faculty

numbered 600 – 798, excluding credits in 699 courses, Directed Research and 700 courses, Thesis Research.

- 12 credits of thesis research in 700 Thesis Research with at least 1 credit taken in the final semester
- One (1) credit in a Departmental Seminar such as FSHN 681
- One (1) credit in FSHN 701 Topics in Food Science.

Plan B

Students must complete a minimum of 29 credit hours, including

- At least 21 credit hours of course work must be in courses numbered 600 – 798, excluding 700 Thesis Research.
- 6 to 9 credits of 699 Directed Research courses.
- One (1) credit in a Departmental Seminar such as FSHN 681
- One (1) credit in FSHN 701 Topics in Food Science.

Complete description of course and other requirements are available from the department.

Honors and Awards

The department has several scholarships that are awarded to deserving students.

Molecular Biosciences and Biosystems Engineering

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jkurosaw@hawaii.edu
Web: www2.ctahr.hawaii.edu/mbbe

Faculty

- C. M. Kinoshita, PhD (Chair)—thermo-engineering, energy systems
- H. Ako, PhD—analytical biochemistry/aquaculture
- D. Borthakur, PhD—molecular genetics of rhizobia, plant-microbe interaction, biotechnology
- D. A. Christopher, PhD—plant biochemistry, chloroplast molecular biology, regulation of gene expression
- L. D. Gautz, PhD—bioproduction control, mechanical systems
- H. M. Harrington, PhD—biochemistry molecular biology of heat shock, signal transduction in plants
- P-S. Leung, PhD—production and quantitative methods
- Q. Li, PhD—environmental biochemistry
- J. Moy, PhD—food engineering, food irradiation, processing technology
- W-K. Nip, PhD—food technology
- W. W. Su, PhD—cell culture, biochemical engineering
- C-S. Tang, biochemistry of natural products

J-K. Wang, PhD—bioproduction systems engineering, aquacultural engineering

H. Y. Yamamoto, PhD—plant biochemistry, photosynthesis

P-Y. Yang, PhD—waste/wastewater engineering, bioprocess technology/engineering

Graduate Faculty in Biosystems Engineering

P-Y. Yang, PhD (Chair)—waste/wastewater engineering, bioprocess technology/engineering

C. M. Kinoshita, PhD—thermo-engineering, energy systems

L. D. Gautz, PhD—bioproduction control, mechanical systems

P-S. Leung, PhD—production and quantitative methods

J. H. Moy, PhD—food engineering, food irradiation, processing technology

W. W. Su, PhD—cell culture, biochemical engineering

T. Liang, PhD—resource systems engineering, mechanization

S. Q. Turn, PhD—biomass energy systems, environmental engineering

J-K. Wang, PhD—bioproduction systems engineering, aquacultural engineering

I-P. Wu, PhD—irrigation engineering

Cooperating Graduate Faculty in Biosystems Engineering

M. J. Antal, PhD—alternate energy, combustion

E. D. H. Cheng, PhD—hydrology, hydraulics

Y-S. Fok, PhD—water resource systems, hydrology

C. C. K. Liu, PhD—hydrology, environmental systems engineering

S. M. Masutani, PhD—thermochemical conversion of biomass, sequestration of carbon dioxide, biological fuel cell development

C. Ray, PhD—groundwater hydrology

M. C. M. Tsang, PhD—materials handling, processing engineering

Affiliate Graduate Faculty in Biosystems Engineering

G. D. Pruder, PhD—aquacultural engineering

Graduate Faculty in Plant Molecular Physiology

D. Borthakur, PhD (Chair)—molecular genetics of rhizobia, plant-microbe interaction, biotechnology

D. A. Christopher, PhD—plant biochemistry, chloroplast molecular biology, regulation of gene expression

H. M. Harrington, PhD—biochemistry molecular biology of heat shock, signal transduction in plants

J. Hu, PhD—plant virology

Q. Li, PhD—environmental biochemistry

R. E. Paull, PhD—postharvest physiology and handling of tropical fruits, flowers, and vegetables

W. W. Su, PhD—plant cell culture, bioprocess engineering

C-S. Tang, PhD—natural products chemistry and biochemistry

H. Y. Yamamoto, PhD—plant biochemistry, photosynthesis

Cooperating Graduate Faculty in Plant Molecular Physiology

G. H. Goldstein, PhD—water relations, crops-vegetation environment interactions

Affiliate Graduate Faculty in Plant Molecular Physiology

H. Albert, PhD—plant molecular biology

M. M. Fitch, PhD—micropropagation and genetic transformation of papaya

F. Meinzer, PhD—plant physiology, water relations

P. H. Moore, PhD—sugar cane physiology

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

Proposed Degrees: BS in biosystems engineering, MS in biosystems engineering, MS in molecular biosciences and bioengineering, PhD in molecular biosciences and bioengineering. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

The Academic Program

The Department of Molecular Biosciences and Biosystems Engineering features a multidisciplinary faculty having a broad spectrum of interests in biotechnology, molecular biology, biochemistry, biosystems engineering, and food science. The department's strong basic and applied research programs and its active, internationally recognized faculty combine to provide students with exciting learning opportunities.

Undergraduate Study

BS in Biosystems Engineering

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 241, 242, 242L, 243, and 244
 - 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

MS in Biosystems Engineering

The 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.

MS in Botanical Sciences (Plant Physiology)

Plan A

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.

Plan B

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.

PhD in Botanical Sciences (Plant Physiology)

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 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.

Natural Resources and Environmental Management

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E-mail: nrem@ctahr.hawaii.edu
Web: www2.ctahr.hawaii.edu

Faculty

- S. A. El-Swaify, PhD (Chair)—natural resource degradation, erosion, conservation, water quality
- R. L. Bowen, PhD—natural resource policy, economics, sustainable agriculture
- C. Chan-Halbrendt, PhD—community and resource economics
- C. Ching, PhD—policy and production economics
- L. J. Cox, PhD—community economic development
- R. de la Peña, PhD—crop management, root crops
- C. I. Evensen, PhD—natural resource management, environmental quality
- C. A. Ferguson, PhD—natural resource and environmental policy
- J. B. Friday, PhD—tropical forestry/agroforestry extension
- J. H. Fownes, PhD—forest ecology
- P. V. Garrod, PhD—marketing and production economics
- C. Gopalakrishnan, PhD—natural resource and environmental economics and policy
- P. S. Motooka, PhD—weed science, forest/pasture weed control
- S. Y. Nagano, MS—4-H youth program, county extension
- G. R. Vieth, PhD—resource management, nonmarket valuation
- D. Ward, MS—4-H development program
- J. F. Yanagida, PhD—product economics, price analysis, international trade

Graduate Faculty in Agricultural and Resource Economics

- S. A. El-Swaify, PhD(Chair)—natural resource management, conservation and restoration
 R. L. Bowen, PhD—natural resource policy, economics of sustainable agriculture
 C. Chan-Halbrendt—community and 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
 P. V. Garrod, PhD—marketing and production economics
 C. Gopalakrishnan, PhD—natural resource economics, environmental economics
 P. S. Leung, PhD—production, fisheries, and aquaculture economics
 T. Liang, PhD—systems engineering
 S. T. Nakamoto, PhD—marketing
 G. R. Vieth, PhD—resource management, non-market valuation
 J. K. Wang, PhD—production systems design and aquacultural engineering
 J. F. Yanagida, PhD—production economics, price analysis, international trade and development

Affiliate Graduate Faculty in Agricultural and Resource Economics

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

Graduate Faculty in Agronomy and Soil Science

- M. Habte, PhD(Chair)—soil microbiology—biochemistry
 D. Borthakur, PhD—biotechnology, rhizobium
 J. S. Brewbaker, PhD—crop breeding, tree legumes
 R. S. de la Pena, PhD—crop management, root crops
 S. A. El-Swaify, PhD—soil and water conservation, water quality and salinity
 C. I. Evensen, PhD—water quality extension, environmental education
 J. H. Fownes, PhD—forest ecology, agroforestry
 N. V. Hue, PhD—soil chemistry
 H. H. Keyser, PhD—soil microbiology, rhizobium
 S. C. Miyasaka, PhD—alternative crops, nutrition
 J. A. Silva, PhD—soil fertility, statistics
 P. Singleton, PhD—legume BNF
 C. S. Tang, PhD—biochemistry of crops and soils
 G. Uehara, PhD—systems simulation in international agriculture
 R. S. Yost, PhD—expert systems in soil management, fertility

Affiliate Graduate Faculty in Agronomy and Soil Science

- K. C. Ewel, PhD—wetland ecology
 L. D. Swindale, PhD—international agricultural research and development, soil pedology

Degrees and Certificates Offered: BS in agricultural and resource economics, BS in agronomy and soil science, MS in agricultural and resource economics, MS in agronomy and soil science, PhD in agricultural and resource economics, PhD in agronomy and soil science, Environmental Studies Certificate, Graduate Resource Management Certificate

Proposed Degrees and Certificates: BS in natural resources and environmental management, MS in natural resources and environmental management, PhD in natural resources and environmental management, Environmental Studies Certificate, Graduate Resource Management Certificate. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

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 resources 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 their 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.

Agronomy and soil science (AGRS/AGRN) is the study of food, fiber, feed, and fuel crops, 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 by applying 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 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 have the opportunity to be 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, and in international institutions and organizations, as well as in farm-based agricultural industries. The department is one of only a few in

the nation which have a special commitment to international linkages with the developing world, and the only department fully dedicated to crops and soils of the tropics.

Undergraduate Study

BS in Agricultural and Resource Economics

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 advisers will develop appropriate plans of study.

Requirements

- ACC 201
- AREC 210 or MATH 241
- ECON 300 and 301
- ENG 209
- 18 upper division AREC credit hours, including AREC 310 and at least one 400-level AREC course

BS in Agronomy and Soil Science

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.

Requirements

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

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

(List continued in next column.)

- 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

Environmental Studies Certificate

For information, see the “Colleges of Arts and Sciences” section within this *Catalog*.

Graduate Study

Agricultural and resource economics 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 molecular biosciences and the department of molecular biosciences and biosystems engineering.

The program maintains close relationships with the University of Hawai‘i 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.

Agronomy and soil science offers MS and PhD degrees in two areas of concentration: 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.

The program is offered jointly with the Department of Tropical Plant and Soil Science.

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

MS in Agricultural and Resource Economics

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 410 (or 627); ECON 425 (or AREC 626); ECON 604 (or 606); and ECON 605 (or 607).

MS in Agronomy and Soil Science

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.

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 course credit hours. A majority of these must be agronomy and soil science courses, with 8 of these credit hours from courses numbered 600 or above. Of the remaining credit hours, 4 credits must be in courses numbered 600 or above. No more than 2 credit hours of directed research (AGRS 699) may be 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 are required to 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 more information.)

Doctoral Degree in Agricultural and Resource Economics

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, 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.

Doctoral Degree in Agronomy and Soil Science

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 pre-doctoral 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 field.

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

Requirements

For all AGRS 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 the 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 which combine logically under the minor name designated by the candidate and approved by the candidate's committee. Minor courses will be predominantly those offered in other fields. 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 after most courses in the candidate's program have been taken, the candidate must take written and oral comprehensive examinations covering all subjects considered relevant to the chosen concentration and minor. A final oral examination which includes a public defense of the dissertation is required of all candidates.

Graduate Resource Management Certificate

For information, see the "Interdisciplinary Programs" section within this *Catalog*.

Plant and Environmental Protection Sciences

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3050 Maile Way
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Faculty

K. G. Rohrbach, PhD (Chair)—pineapple diseases, integrated pest management
A. M. Alvarez, PhD—bacterial diseases
B. M. Brennan, PhD—pesticide regulation and use

J. J. Cho, PhD—diseases of vegetable crops, integrated pest management (Maui Agricultural Experiment Station)
R. H. Ebesu, MS—extension education (Kaua'i Cooperative Extension Service)
S. A. Ferreira, PhD—crop protection, extension education
M. L. Goff, PhD—acarology, medical and forensic entomology
J. K. Grace, PhD—urban entomology, termite and social insect biology and control, insect behavior
R. T. Hamasaki, MS—fruit and vegetable crops extension education (O'ahu Cooperative Extension Service)
A. H. Hara, PhD—horticultural entomology, post-harvest insect control, regulatory entomology (Hawai'i Agricultural Experiment Station)
J. Hu, PhD—virology
M. W. Johnson, PhD—biological control, insect pest management
M. Kawate, PhD—pesticide registration
W. H. Ko, PhD—soil microbiology (Hawai'i Agricultural Experiment Station)
R. F. L. Mau, PhD—agricultural entomology, entomology extension education, insect biology
E. F. Mersino —Ornamental crops extension education (O'ahu Cooperative Extension Service)
R. H. Messing, PhD—insect ecology and biological control (Kaua'i Agricultural Experiment Station)
N. M. Nagata, MS—urban horticulture, cut flowers and fruits extension education
S. C. Nelson, PhD—epidemiology, extension education
R. K. Nishimoto PhD—weed science
W. T. Nishijima, PhD—tropical fruits and nuts, forest and tree diseases, ornamental extension education (Hawai'i Agricultural Experiment Station)
J. J. Ooka, PhD—diseases of coconuts, and, field, root and medicinal crops; disease suppressive composts (Kaua'i Agricultural Experiment Station)
D. M. Sato, MS—extension education (Hawai'i Cooperative Extension Service)
S. H. Saul, PhD—insect genetics
D. Schmitt, PhD—tropical nematology, nematode ecology and management
J. Seifert, PhD—biochemical toxicology
K. T. Sewake, MS—extension education (Hawai'i Cooperative Extension Service)
R. Shimabuku, MS—vegetable crops production and disease management extension education (Maui Cooperative Extension Service)
B. S. Sipes, PhD—nematology, alternative control methods
E. E. Trujillo, PhD—soil-borne diseases, biological control of weeds
J. Y. Uchida, PhD—fungal pathology, biological control of diseases, environmental impacts
J. R. Yates III, PhD—urban pest management, termite biology and control

Graduate Faculty in Entomology

- M. L. Goff, PhD—acarology, medical and forensic entomology
 J. K. Grace, PhD—urban entomology, termite and social insect biology and control, insect behavior
 A. H. Hara, PhD—horticultural entomology, post-harvest insect control, regulatory entomology (Hawai'i Agricultural Experiment Station)
 M. W. Johnson, PhD—biological control, insect pest management
 R. F. L. Mau, PhD—agricultural entomology, entomology extension education, insect biology
 R. H. Messing, PhD—insect ecology and biological control (Kaua'i Agricultural Experiment Station)
 S. H. Saul, PhD—insect genetics
 J. R. Yates III, PhD—urban pest management, termite biology and control

Cooperating Graduate Faculty in Entomology

- L. Arita-Tsutsumi, PhD—insect behavior, honeybee ecology (UH Hilo)
 B. M. Brennan, PhD—pesticide regulation and use
 K. Y. Kaneshiro, PhD—systematics, evolution, insect behavior
 J. Seifert, PhD—biochemical toxicology

Affiliate Graduate Faculty in Entomology

- J. W. Armstrong, PhD—commodity quarantine treatments, fruit fly control (USDA-ARS, Hilo)
 N. Evenhuis, PhD—systematics of *Diptera* (Bishop Museum)
 P. A. Follett, PhD—commodity quarantine treatments, tropical tree fruit IPM (USDA-ARS, 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, Hilo)
 D. O. McInnis, PhD—insect genetics (USDA-ARS)
 N. J. Reimer, PhD—ant biology and control, biological control of weeds (Bishop Museum)
 R. I. Vargas, PhD—ecology, mass-rearing techniques (USDA-ARS, Hilo)

Graduate Faculty in Plant Pathology

- K. G. Rohrbach, PhD (Chair)—pineapple diseases, integrated pest management
 A. M. Alvarez, PhD—bacterial diseases
 D. Borthakur, PhD—molecular biology
 J. J. Cho, PhD—diseases of vegetable crops, integrated pest management (Maui Agricultural Experiment Station)
 S. A. Ferreira, PhD—crop protection, extension education
 J. Hu, PhD—virology
 W. H. Ko, PhD—soil microbiology (Hawai'i Agricultural Experiment Station)
 S. C. Nelson, PhD—epidemiology, extension education
 W. T. Nishijima, PhD—tropical fruits and nuts, forest and tree diseases, ornamental extension education (Hawai'i Agricultural Experiment Station)
 J. J. Ooka, PhD—diseases of coconuts, and, field, root and medicinal crops; disease suppressive composts (Kaua'i Agricultural Experiment Station)

- D. Schmitt, PhD—tropical nematology, nematode ecology and management
 B. S. Sipes, PhD—nematology, alternative control methods
 E. E. Trujillo, PhD—soil-borne diseases, biological control of weeds
 J. Y. Uchida, PhD—fungal pathology, biological control of diseases, environmental impacts

Cooperating Graduate Faculty in Plant Pathology

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

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

Proposed Degrees: BS in entomology, BS in plant and environmental protection sciences, MS in botanical sciences (plant pathology), MS in entomology, PhD in botanical sciences (plant pathology), PhD in entomology. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

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 management 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 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

BS in Entomology

Requirements

- General Education Core requirements
- CTAHR core requirements
- ENTO 363
- 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

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.

MS in Botanical Sciences (Plant Pathology)

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 phytopathology, 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.

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.

MS in Entomology

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.

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

PhD in Botanical Sciences (Plant Pathology)

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.

PhD in Entomology

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.

Tropical Plant and Soil Science

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Web: www2.ctahr.hawaii.edu

Faculty

- R. E. Paull, PhD (Chair)—plant growth and development, postharvest handling
- A. S. Arakaki, BS—junior extension agent, fruit and vegetable production
- R. Arce, BS—junior extension agent, community development, agricultural production
- H. C. Bittenbender, PhD—coffee, kava and tropical fruit physiology and management
- J. L. Brewbaker, PhD—plant breeding, biochemical genetics
- C. G. Cavaletto, MS—sensory evaluation, food processing
- I. S. Campbell, PhD—crop management, information systems
- C. L. Chia, PhD—tropical fruits
- R. A. Criley, PhD—floriculture, flowering physiology, plant propagation
- J. DeFrank, PhD—weed science
- K. D. Fleming, PhD—agribusiness management
- S. K. Fukuda, MS—extension agent, vegetable production
- M. Habte, PhD—soil microbiology-biochemistry
- J. M. Halloran, PhD—marketing and agribusiness management
- C. S. Hashimoto, MS—extension agent, fruit production
- A. S. Hodgson, PhD—food technology extension, food safety and quality
- N. V. Hue, PhD—soil chemistry
- K. D. Kobayashi, PhD—fruit physiology and computer modeling
- B. A. Kraty, PhD—vegetable physiology and management
- A. R. Kuehnle, PhD—ornamental breeding and genetics
- J. T. Kunisaki, MS—tissue culture
- K. L. Leonhardt, PhD—floriculture

R. M. Manshardt, PhD—tropical fruit breeding and genetics
 S. C. Miyasaka, PhD—alternative crops, plant nutrition
 M. A. Nagao, PhD—development physiology, growth regulation
 M. S. Nishina, MS—associate extension agent, tropical fruit production
 Y. Sagawa, PhD—developmental morphology, cytogenetics, tissue culture
 D. Sato, MS—educational specialist, urban horticulture
 T. Sekioka, PhD—vegetable breeding and genetics
 J. A. Silva, PhD—soil fertility and soil chemistry, statistics
 P. Singleton, PhD—crop physiology, nutrient management
 V. E. Smith, MS—assistant extension agent, fruit and ornamental production
 K. Y. Takeda, PhD—solanaceous crops
 G. I. Teves, BS—junior extension agent, ornamentals production
 G. Uehara, PhD—systems simulation in international agriculture
 H. R. Valenzuela, PhD—vegetable physiology and management
 W. K. Wong, PhD—extension agent, landscaping and nursery management
 R. M. Yamakawa, MS—associate extension agent, ornamentals production
 R. S. Yost, PhD—expert systems in soil management, fertility

Graduate Faculty in Agronomy and Soil Science

M. Habte, PhD(Chair)—soil microbiology-biochemistry
 J. L. Brewbaker, PhD—plant breeding, biochemical genetics
 N. V. Hue, PhD—soil chemistry
 S. C. Miyasaka, PhD—alternative crops, plant nutrition
 J. A. Silva, PhD—soil fertility and soil chemistry, statistics
 P. Singleton, PhD—crop physiology, nutrient management
 G. Uehara, PhD—systems simulation in international agriculture
 R. S. Yost, PhD—expert systems in soil management, fertility

Cooperating Graduate Faculty in Agronomy and Soil Science

D. Borthakur, PhD—biotechnology, rhizobium
 R. S. de la Pena, PhD—crop management, root crops
 S. A. El-Swaify, PhD—soil and water conservation, salinity
 C. I. Evensen, PhD—water quality extension, environmental education
 J. H. Fownes, PhD—forest ecology
 Q. Li, PhD—environmental biochemistry
 C. S. Tang, PhD—biochemistry of crops and soils

Affiliate Graduate Faculty in Agronomy and Soil Science

K. C. Ewel, PhD—ecology

Graduate Faculty in Horticulture

R. E. Paull, PhD (Chair)—plant growth and development, postharvest handling
 H. C. Bittenbender, PhD—coffee, kava and 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, flowering physiology, plant propagation
 J. DeFrank, PhD—weed science

K. D. Fleming, PhD—agribusiness management
 J. M. Halloran, PhD—marketing and 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. L. Leonhardt, PhD—floriculture
 R. M. Manshardt, PhD—tropical fruit breeding and genetics
 M. A. Nagao, PhD—development physiology, growth regulation
 Y. Sagawa, PhD—developmental morphology, cytogenetics, tissue culture
 T. Sekioka, PhD—vegetable breeding and genetics
 K. Y. Takeda, PhD—solanaceous crops
 H. R. Valenzuela, PhD—vegetable physiology and management

Cooperating Graduate Faculty in Horticulture

S. C. Furutani, PhD—horticultural crop physiology
 M. K. Kawate, PhD—pesticide registration/weed science
 R. K. Nishimoto, PhD—weed science
 W. S. Sakai, PhD—ultrastructure, physiological plant anatomy
 M. J. Tanabe, PhD—in vitro propagation, turf management, plant propagation

Affiliate Graduate Faculty in Horticulture

H. Albert, PhD—plant biotechnology, gene regulation
 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
 P. Moore, PhD—plant development, sugar metabolism
 R. R. G. Ming, PhD—plant genomics, plant breeding
 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 agronomy and soil science, BS in tropical horticulture, MS in agronomy and soil science, MS in horticulture, PhD in agronomy and soil science, PhD in horticulture

Proposed Degrees: BS in tropical plant and soil sciences, MS in tropical plant and soil sciences, PhD in tropical plant and soil sciences. Currently enrolled students may continue in their existing degree program or they may switch to a new degree program once the program has been approved.

The Academic Program

Advising

Tropical Plant and Soil Sciences
 St John Hall Room 102
 3190 Maile Way
 Honolulu, HI 96822-2279
 Tel: (808) 956-8351
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Undergraduate students are advised by the department's undergraduate advisers. Undergraduate options are detailed in the following section. Each student may identify a faculty member to act as a mentor in the student's area of interest and specialization. All students must receive approval of their program of courses from their advisers prior to registration each semester.

Graduate students are advised initially by an adviser or by the department's graduate program chairman.

Agronomy and Soil Science

The agronomy and soil science program is offered jointly by the Department of Natural Resources and Environmental Management and the Department of Tropical Plant and Soil Science. For information, see the Department of Natural Resources and Environmental Management within this section of the *Catalog*.

Horticulture

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.

Undergraduate Study

BS in Tropical Horticulture

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 363
- 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 363
- 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

MS in Horticulture

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.

PhD in Horticulture

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.