

Interdisciplinary Programs

Cell, Molecular, and Neuro Sciences

Biomedical Science A-209
1960 East-West Road
Honolulu, HI 96822
Tel: (808) 956-6397
Fax: (808) 956-9530

Faculty

*T. D. Humphreys, PhD (Chair)—invertebrate immunity, evolution of animals

Cell and Cancer Biology

- *G. A. Ahearn, PhD—comparative physiology of membrane transport
*R. D. Allen, PhD—biomembrane traffic and topography
*R. Arakaki, MD—in vitro investigation of insulin receptor biosynthesis
*J. S. Bertram, PhD—neoplastic transformation
*R. V. Cooney, PhD—oxidative damage and carcinogenesis
*K. Csiszar, PhD—cell and cancer biology
*H. G. de Couet, PhD—*Drosophila* neuromuscular genes, cytoskeleton, cell motility
*A. K. Fok, PhD—biomembrane dynamics in intracellular digestion
*E. G. Grau, PhD—prolactin; stimulus-secretion coupling; osmosensitivity
*A. F. Lau, PhD—oncogene-induced cellular transformation
*S. Mooberry, PhD—molecular oncology; antimicro tubule agents; natural products
V. R. Nerurkar, PhD—pathogenesis and etiology of infectious diseases, molecular virology and epidemiology
*P. Q. Patek, PhD—cell-mediated immunology; tumor immunology
*C. Womersley, PhD—biochemical adaptations to environmental stress

Marine Cell and Molecular Biology

- *M. G. Hadfield, PhD—settlement and metamorphosis of marine invertebrate larvae
*P. C. Loh, PhD—animal virology and animal cell culture
*R. E. Moore, PhD—chemistry of marine and microalgal natural products

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Molecular Evolution

- *M. Alam, PhD—neurobiology of archaeobacteria-signal transduction in phototaxis and chemotaxis
*R. L. Cann, PhD—molecular evolution, population biology
*J. A. Hunt, PhD—molecular evolution, erythroid cell differentiation
*T. W. Lyttle, PhD—genetic control; evolution of meiosis

Molecular Genetics

- *M. Alam, PhD—neurobiology of archaeobacteria-signal transduction in phototaxis and chemotaxis
*C. D. Boyd, PhD—molecular genetics
*D. S. Haymer, PhD—molecular genetics of *Diptera*
*Y. E. Hsia, PhD, MD—thalassemia genes in Southeast Asians
*S. Kathariou, PhD—molecular biology of bacterial virulence factors
*J. F. Scott, PhD—molecular genetics; yeast DNA replication

Neurobiology and Behavior

- *D. C. Blanchard, PhD—neurobiology of aggression and defense; ethopharmacology
*R. J. Blanchard, PhD—experimental ethology; ethopharmacology
*I. M. Cooke, PhD—cellular neurobiology; peptidergic neurons in culture
*D. K. Hartline, PhD—small network neurophysiology and modeling
*M. D. Rayner, PhD—sodium channel kinetics
*S. Robinow, PhD—developmental molecular neurogenetics
*J. G. Starkus, PhD—sodium channel kinetics
*J. Stollberg, PhD—developmental neurobiology; biophysics

Plant Cell and Molecular Biology

- *A. M. Alvarez, PhD—bacterial plant pathogens; epidemiology
*D. Borthakur, PhD—genetics of tropical rhizobia
*H. M. Harrington, PhD—heat shock; calcium regulation
*J. S. Hu, PhD—molecular biology of plant viruses
*S. S. Patil, PhD—molecular genetics of plant-pathogen interactions
*J. I. Stiles, PhD—plant and fungal molecular biology
*H. Y. Yamamoto, PhD—photosynthesis; carotenoid function

Reproductive Biology

- *G. D. Bryant-Greenwood, PhD—reproductive endocrinology; parturition
*F. C. Greenwood, PhD—molecular endocrinology
*R. G. Kleinfeld, PhD—cell biology of pregnancy
*C. N. Lee, PhD—environmental effects on reproduction; gamete interactions
*D. L. Vincent, PhD—embryo-maternal interactions
*C. W. Weems, PhD—maternal recognition of pregnancy; embryo survival
*R. Yanagimachi, PhD—physiology and manipulation of gametes and zygotes

Tropical Medicine

- *S. P. Chang, PhD—immunology/molecular biology of parasitic infections
*K. Yamaga, PhD—molecular immunology

Degree Offered: PhD in a biology subdiscipline with a specialization in cell, molecular, and neuro sciences

The Academic Program

The Cell, Molecular, and Neuro Sciences (CMNS) Program offers distinct tracks leading to a specialization in the “new biology” in conjunction with a number of doctoral programs in traditionally defined biology subdisciplines. These include anatomy and reproductive biology, biochemistry and biophysics, genetics and molecular biology, microbiology,

physiology, plant molecular physiology, plant pathology, psychology, tropical medicine, and zoology. CMNS is operated by a consortium of the cellular biology, molecular biology, and neurobiology scholars in these departments who come together to provide cross-disciplinary course offerings, to share the excitement of the fast-moving research and technical innovations in cellular and molecular biology, and to develop strategies for applying these concepts and approaches to research in their traditional subdisciplines.

The program expects to provide teaching or graduate assistantships from a variety of University and extramural sources for all students who are admitted to the program and who maintain a satisfactory record.

Program graduates may undertake careers in academic or research institutions or in biotechnology or pharmaceutical research and development.

For complete details on the CMNS specialization, contact the CMNS Program chair.

Admission Requirements

Applicants are expected to have at least a bachelor's degree emphasizing biological or physical sciences with courses in calculus, organic and physical chemistry, biochemistry, genetics, and cellular and molecular biology. Results of the Graduate Record Examination (GRE) General Test and TOEFL scores where necessary must be submitted with the application. Results of the subject test in biochemistry, cell, and molecular biology (B22) or biology (B24) is advisable. Three letters of recommendation from former instructors or research advisers must be submitted to the program chair.

Program Requirements

The "core" of this program is a specialized course of study during the student's first graduate year, which includes the following:

- A year-long course, The Molecular Biology of the Cell, taught by a selection of faculty from the different departments;
- Five laboratory rotations of 10 to 12 weeks each pursuing individually designed research projects in the laboratories of different CMNS faculty members. (These rotations broaden students' technical skills and introduce them to dissertation

research opportunities in the laboratories of the individual faculty members.); and

- Twelve credit hours of course work determined by the department with which the student is affiliated.
- The program additionally allows the student to focus on cellular biology, molecular biology, or neurobiology by
- Permitting students to take half of their credit hours from CMNS-designated courses irrespective of department;
 - Designing the PhD qualifying examination with at least 50 percent cellular biology, molecular biology, or neurobiology material; and
 - Organizing a dissertation research committee to include CMNS faculty members from any department when their expertise is relevant to the student's dissertation research.

Advanced course work (after completion of the "core") will be individually tailored to each student with advice from the CMNS graduate committee and the student's PhD committee. The qualifying examination will be given jointly by the CMNS faculty and the student's department. The student then must complete an original research project, write a dissertation on this research, and defend it before his or her PhD committee.

CMNS faculty and students meet for biweekly research seminars where both faculty and students present in-depth discussions of their current projects and experimental problems. These seminars provide intellectual stimulation, technical education, and mutual support to enhance the research experience of CMNS students.

Selected Courses

Cell Biology

BOT 617 Biological Electron Microscopy (3)
 BOT 674 Plant Growth and Development (3)
 HORT 614 Cellular Genetics of Crops (3)
 MICR 641 Ultrastructure of Cells (3)
 MICR 655 Advanced Virology (3)
 PMP 620 Plant Biochemistry (3)
 REPR 603 Biology of Gametes, Fertilization, and Embryos (2)

Molecular Biology

BIOC 624 Protein Interactions (2)
 BIOC 730 Phage, Plasmids, and Recombinant DNA (2)
 BIOP 633 Nucleic Acids (2)
 GENE 680 Molecular Genetics (3)
 MICR 625 Advanced Immunology (3)

MICR 661 Regulation of Gene Expressions in Microorganisms (3)
 MICR 671 Advanced Microbial Genetics (3)
 PMP 673 Organization and Expression of the Plant Genome (3)
 PMP 680 Methods in Plant Molecular Biology (3)

Neurobiology

PHRM 640 Neuropharmacology (2)
 PHYL 606 Human Neurophysiology (2)
 PHYL 607 Membrane Physiology (2)
 PHYL 615 or ZOO 615 Introduction to Axonology (3)
 PHYL 642/642L or ZOO 642/642L Cellular Neurophysiology (3)/Neurophysiology Laboratory (2)
 PSY 631 Comparative Psychology (3)
 PSY 634 Physiological Psychology (3)

Ecology, Evolution, and Conservation Biology

Snyder 407
 2538 McCarthy Mall
 Honolulu, HI 96822
 Tel: (808) 956-4602
 Fax: (808) 956-4707

Faculty

- *R. G. Gillespie, PhD (Chair)—evolution and conservation of native Hawaiian invertebrates
- *L. Arita-Tsutsumi, PhD—behavioral ecology of insects
- *S. K. Atkinson, PhD—reproductive biology of marine animals
- *R. L. Cann, PhD—conservation genetics and molecular evolution
- *G. D. Carr, PhD—plant biosystemics, cytogenetics, hybridization and speciation
- *S. Conant, PhD—conservation biology, life history and ecology of Hawaiian birds
- *C. C. Daehler, PhD—invasive plants, plant-insect interactions
- *H. G. de Couet, PhD—developmental and molecular evolution
- *L. A. Freed, PhD—evolutionary ecology, behavioral ecology and conservation biology
- *G. H. Goldstein, PhD—physiological plant ecology and terrestrial ecology
- *J. K. Grace, PhD—behavioral/chemical ecology of isoptera and urban insects
- *M. G. Hadfield, PhD—larval biology of marine invertebrates, conservation and demography of Hawaiian tree snails
- *D. Haymer, PhD—molecular evolution
- *J. A. Hunt, PhD—molecular evolution
- *V. P. Jones, PhD—insect population ecology
- *K. Y. Kaneshiro, PhD—sexual selection and biology of small populations

- *S. C. Keeley, PhD—plant molecular systematics and evolution
- *R. A. Kinzie, PhD—aquatic ecology, coral reefs, and tropical streams
- *C. H. Lamoureux, PhD—biology of pteridophyte and tropical forest ecology
- *T. W. Suttle, PhD—population genetics and chromosome evolution
- *R. H. Messing, PhD—behavioral ecology of insect parasitoids and biological control
- *C. W. Morden, PhD—molecular systematics and evolution of plants and algae
- *J. D. Parrish, PhD—ecology of aquatic (marine) communities, fishery biology
- *M. A. Ridgley, PhD—human-environment systems analysis: modelling and evaluation of social-environmental interactions
- *G. K. Roderick, PhD—population biology, genetics and evolution
- *C. M. Smith, PhD—physiological ecology of marine macrophytes, marine ecology
- *L. E. Sponsel, PhD—human ecology in tropical forests and deforestation
- *J. S. Stimson, PhD—population ecology
- *A. D. Taylor, PhD—population ecology
- *A. Teramura, PhD—environmental stress physiology, global climate change, ecosystem analysis and biodiversity
- *L. Wester, PhD—plant geography, biogeography of islands, human-plant relationships
- *C. Womersley, PhD—environmental physiology, biochemical adaptation, parasitology
- *D. Woodcock, PhD—vegetation and climate

Affiliate Graduate Faculty

- A. Allison, PhD—systematics and population biology
- A. Asquith, PhD—insect systematics and conservation
- W. W. Au, PhD—sensory biology of cetaceans
- R. J. Cabin, PhD—experimental investigations of the ecological dynamics of alien plant species invasions and native plant restoration efforts within the Hawaiian Islands.
- E. W. Campbell III, PhD—applied and basic herpetology, invasive species management, conservation biology, and predator ecology
- R. H. Cowie, PhD—evolutionary biology and conservation of land and freshwater snails
- N. L. Evenhuis, PhD—systematics and evolution of Diptera
- J. Ewel, PhD—ecosystem processes in terrestrial communities
- K. Ewel, PhD—wetland ecology and systems ecology
- D. Foote, PhD—ecology and conservation of native Hawaiian insects
- F. G. Howarth, PhD—evolutionary biology of cave ecosystems and insect conservation
- L. L. Loope, PhD—conservation biology, plant ecology
- J. E. Maragos, PhD—human impact on marine ecosystems and coral reefs
- S. E. Miller, PhD—systematics and biogeography, especially of Lepidoptera
- D. Ragone, PhD—Pacific Island ethnobotany, especially conservation and use of traditional crops, focus on breadfruit
- B. A. Wilcox, PhD—ecosystem conservation biology

The Academic Program

The objectives of the interdisciplinary graduate specialization in ecology, evolution, and conservation biology (EECB) are to do the following: Exploit Hawai'i's unique opportunities to integrate tropical population biology and natural history studies with modern laboratory techniques; provide the interdisciplinary, conceptual, and technical training to participate in academic and research programs in ecology, evolution, and conservation biology; and foster scholarly training in research programs involving expertise in ecology, evolution, and conservation biology. Modern theories of ecology, evolution, and conservation biology share a core of concepts and techniques that span classical academic disciplines. This common core, coupled with the emergence of powerful new technologies, invites cross-disciplinary approaches, which generate many of today's most exciting scientific knowledge.

The EECB program provides opportunities for students in all of the traditional subdisciplines represented at Mānoa. This intercollegiate, interdisciplinary graduate program brings together faculty members from agronomy and soil science, anthropology, biomedical sciences (genetics and molecular biology), botanical sciences, entomology, geography, horticulture, microbiology, oceanography, and zoology—with all their skills and technologies—to provide the training students need to contribute effectively to this research area.

EECB is implemented as a "specialization" within existing graduate programs of the departments whose faculty participate in this program. While the EECB program is designed primarily for a doctor of philosophy degree, it also includes a master of science degree for students who wish to pursue positions such as might be available in state and federal forestry and wildlife conservation programs or in biological resource management positions with private organizations, such as the Nature Conservancy. Students accepted to the EECB graduate specialization have already been accepted into the graduate program of the various departments participating in the EECB program. Course work in statistics, organic chemistry, biochemistry, genetics, evolution, and ecology are considered most important for admission into the EECB program. Request complete details on the EECB program from the chair of the program at the previously listed address.

Admission Requirements

All applicants will be required to submit undergraduate transcripts, statements of career goals, three letters of recommendation, and results of the Graduate Record Examination. Although a GRE advanced test score is not required for admission, applicants are advised to submit the results of an appropriate advanced test. Before he or she can be admitted, an applicant must have a faculty sponsor who is also a member of the EECB graduate faculty. Ordinarily, though not necessarily, the sponsor would become the student's graduate adviser/committee chair.

Master's Degree

The course requirements for a Plan A (thesis) master of science degree with a specialization in EECB are a total of 30 credits, including at least 18 credit hours in 400- through 700-level graduate courses (excluding 699 and 700), plus at least 8 credit hours in 699 directed research courses and/or 700 thesis research. At least 12 of the 18 credit hours of graduate courses must be in courses at the 600 and 700 level and must include at least one graduate seminar. At least 6 of the 8 credit hours of 699 and 700 must be Thesis 700. For a Plan B (non-thesis) master's degree, the course requirements are 30 credit hours in graduate-level courses, including a minimum of 18 credit hours in courses numbered 600–798 and at least one graduate seminar. No more than 9 credits of 699 can be applied to Plan B.

Doctoral Degree

While there are no specific course requirements for the PhD, candidates are expected to have the same formal graduate course background as master's candidates and may be required to enroll in courses for which they have inadequate background as determined by the EECB Graduate Education Committee. Before graduation, EECB students must have completed at least one graduate-level (600–700) course in each of the program's areas of emphasis: ecology, evolution, and conservation biology. A list of courses that meets this requirement is maintained in the program office.

Additional courses will be selected to complete the student's foundation in ecology, evolution, and conservation biology and to educate the student in his or her primary discipline. At least 10 of the credit hours will be taken from a list of courses recommended by the EECB Graduate Education Committee.

All students in the program are required to attend the weekly “evoluncheon” seminar series where students, postdoctoral researchers, faculty, and visiting scientists present reports on current research results.

Students will have available a number of courses with significant ecological and evolutionary biology content in their own and related graduate disciplines. The following courses have been identified as likely choices for students in the EECB program.

Agronomy

AGRN 480 Tropical Forestry/Agroforestry (3)
AGRN 680 Agroforest Ecosystem Analysis (3)

Agronomy and Soils

AGRS 631 Sustainable Agriculture Seminar (2)
AGRS 699 Directed Research (V)

Anthropology

ANTH 415 Ecological Anthropology (3)
ANTH 435 Human Adaptation to Forests (3)

Biology

BIOL/GEOG 410 Human Role in Environmental Change (3)
BIOL 490 Wildlife and Plant Conservation (3)

Botany

BOT 411 Morphology and Evolution of Land Plants (4)
BOT 430 Mycology (4)
BOT 450 Natural History of the Hawaiian Islands (3)
BOT 453 Plant Ecology & Environmental Measurements (4)
BOT 454 Vegetation Ecology (4)
BOT 455 Analysis of Biological Data (3)
BOT 460 Hawaiian Ethnobotany (2)
BOT 461 Principles of Plant Systematics (3)
BOT 462 Plant Evolution (3)
BOT 480 Algal Diversity and Evolution (4)
BOT 482 Adaptations of Plants to Marine Environment (3)
BOT 610 Botanical Seminar (1)
BOT 612 Advanced Botanical Problems (V)
BOT 650 Ecology Seminar (2)
BOT 662 Advanced Systematics (4)
BOT 663 Plant Cytotaxonomy (2)
BOT 675 Molecular Systematics and Evolution (3)
BOT 680 Marine Macrophytes Seminar (2)
BOT/ZOOL 690 Conservation Biology (3)
BOT 699 Directed Research (V)

Entomology

ENTO 462 Systematic Entomology (3)
ENTO 633 Insect Genetics (3)
ENTO 671 Insect Ecology (3)
ENTO 699 Directed Research (V)

Genetics and Molecular Biology

GENE 604 Evolutionary Genetics (2)
GENE 625 Advanced Topics in Genetics (2)
GENE 650 Population Genetics (3)
GENE 654 Genetics Seminar (1)
GENE 680 Molecular Genetics (3)
GENE 699 Directed Research (V)

Geography

GEOG 402 Agricultural Climatology (3)
GEOG/BIOL 410 Human Role in Environmental Change (3)
GEOG 411 Human Dimensions of Global Environmental Change (3)
GEOG 412 Environmental Impact Assessment (3)
GEOG 455 Resource Management (3)
GEOG 699 Directed Research (V)
GEOG 752 Research Seminar: Resource Management (3)
GEOG 758 Research Seminar: Conservation (3)

Horticulture

HORT 420 Plant Propagation (3)
HORT 440 Tissue Culture (3)
HORT 453 Plant Breeding (3)
HORT 481 Weed Science (3)
HORT 603 Experimental Design (4)
HORT 615 Quantitative Genetics (3)
HORT 699 Directed Research (V)

Microbiology

MICR 485 Microbes and Their Environments (3)
MICR 485L Microbe and Their Environments Lab (2)
MICR 671 Advanced Microbial Genetics (3)
MICR 680 Advances in Microbial Ecology (3)
MICR 699 Directed Research (V)

Oceanography

OCN 621 Biological Oceanography (3)
OCN 621L Biological Oceanography Lab (1)
OCN 627 Ecology of Pelagic Marine Animals (4)
OCN 674 Paleoceanography (V)
OCN 699 Directed Research (V)

Zoology

ZOOL 439 Animal Ecology (3)
ZOOL 439L Laboratory in Animal Ecology (2)
ZOOL 450 Natural History of the Hawaiian Islands (3)
ZOOL 460 Avian Biology (3)
ZOOL 480 Animal Evolution (3)
ZOOL 606 Principles of Animal Behavior (2)
ZOOL 606L Principles of Animal Behavior Lab (1)
ZOOL 620 Marine Ecology (3)
ZOOL 621 Evolutionary Ecology (4)
ZOOL 623 Quantitative Field Ecology (3)
ZOOL 631 Biometry (4)
ZOOL 632 Advanced Biometry (4)
ZOOL/BOT 690 Conservation Biology (3)
ZOOL 691 Seminar in Zoology (1)
ZOOL 710 Topics in Biometry (V)
ZOOL 714 Topics in Animal Behavior (V)
ZOOL 719 Topics in Systematics & Evolution (V)

Resource Management

Social Science 415
2424 Maile Way
Honolulu, HI 96822
Tel: (808) 956-8164

Certificate Offered: Graduate Resource Management Certificate

The Graduate Resource Management Certificate is a cooperative program primarily involving the College of Social Sciences (anthropology, economics, geography), the College of Tropical Agriculture and Human Resources (agronomy and soil science, agricultural and resource economics), and the East-West Center (Program on Environment, Program on Resources: Energy and Minerals). Because of its diverse topical components, multidisciplinary faculty, and practical application throughout Asia and the Pacific, the program is ideal for students who are pursuing graduate studies in traditional disciplines and also seeking expertise in environmental resource management.

This program provides students with specialized training in an area that augments their primary field and develops their pragmatic problem-solving and decision-making skills through analysis of real-world problems. Any student who has previously been admitted as a classified graduate student at the University of Hawai'i at Mānoa is eligible to apply for admission to this certificate program. Interested applicants should contact their adviser or any representative of the program in the collaborating departments and institutions.

To earn this certificate, students are expected to complete 15 credit hours, at least 9 of which are at the graduate level. For more information, contact the program office.