

The Department of Biology

Hallmarks of a successful biologist are the same as for a liberal arts education: seeing connections among seemingly unrelated concepts and using creativity and analytical skills to gain new knowledge. For example, electrical signals used in biological communication are generated not only by neurons, but also by cells found in a broad range of tissues and organisms, including plants, sponges, and amoebae. Insight into the generation of electrical messages raised new questions: how do signals from different cell types remain distinct, and what might be the function of electrical signaling by non-neuronal cells? Biologists who saw connections among all “excitable” cells crafted experiments to answer the new questions. The Biology Department at Oberlin encourages students to develop these skills in association with an extensive knowledge of the field. The process is fostered through intellectual collaboration with students by faculty who are committed to teaching and research.

Biology students at Oberlin are part of a long tradition of excellence. Three Oberlin College alumni have been awarded Nobel Prizes: Robert Millikan (OC 1891) for physics; Roger Sperry '35 and Stanley Cohen '45 for medicine or physiology. Among liberal arts colleges, Oberlin has produced more students who have gone on to earn Ph.D.s in the biological sciences—and in all science disciplines combined.¹ Oberlin is also only one of ten undergraduate colleges in the United States to have received the Award for the Integration of Research in Education (AIRE) from the National Science Foundation.²

Although many Oberlin biology graduates choose careers in higher education or K-12 teaching, the biology major prepares students for a broad range of vocations, e.g. the head botanist of Shenandoah National Park, investment counselor, scientist at the International Crane Foundation, and ranger at the Great Barrier Reef Park in Australia. Most of our graduates pursue further study, earning advanced degrees in fields such as molecular biology, biochemistry, pharmacology, genetics, botany, and public health or, alternatively, obtaining professional degrees in the medical or veterinary sciences.

The Biology Curriculum

The biology curriculum enables students to develop sufficient breadth and depth needed to explore new ideas and to form

connections among them. The biology major prepares students in the principles, concepts, and methods of modern biology, equipping them with the critical thinking and analytical skills necessary for advanced study in a broad range of fields.

The major requires a minimum of 27 credit hours in biology, including a three-semester core (*Organismal Biology; Genetics, Evolution, & Ecology*; and, *Cell and Molecular Biology*), and four courses drawn from Chemistry, Physics, and/or Mathematics. Courses beyond the core sequence allow students to delve into specific areas of biology and to explore a broad range of biology sub-disciplines. The departments of Neuroscience, Biochemistry, Geology, and Environmental Studies provide additional options.

We also offer courses designed specifically for non-science majors. Many of these are first year seminars, and none have prerequisites, so are accessible to students who major in the humanities, social sciences, or other natural science. Our introductory core course in *Organismal Biology* also has no prerequisites, so serves science and non-science students.

Course descriptions can be found in the Oberlin College online catalog at <http://www.oberlin.edu/>.

Faculty compliment their teaching and research by sponsoring student research through on- and off-campus projects, Winter Term internships, and private readings.

Student and Faculty Research

One of the best ways to learn science is by doing science. Consequently, Oberlin's biology program emphasizes research. Five biology laboratory units are required, and students at all levels have opportunities for independent research. The Honors research program allows highly motivated seniors to pursue extensive year-long research projects with one or more faculty members. Honors research concludes with a thesis, a public seminar, and an oral defense.

Off-campus research opportunities are also supported, with tuition scholarships available for summer study and marine and inland field stations. Students also work during summers as assistants in university research labs, hospitals, NIH, or companies, gaining experience and exploring career possibilities. Summer employment and internships information is available both in the department and through the Office of Career Services.

¹ National Science Foundation, 2004.

² NSF AIRE, 1998.

Oberlin biologists believe that being active in scientific research is essential to training students. Students are involved in literature reviews, experimental design, research, and data analysis. Students are also involved with scientific presentations through published manuscripts, and presentations at scientific conferences. Departmental members have been successful in obtaining outside support for their research. Since 1992, OC biologists have been awarded 13 grants totaling over \$1,850,000, including eight grants from the National Science Foundation and the National Institutes of Health. Most grants include support for student research assistants.

The research interests of biology faculty range from disease ecology, population genetics, systems modeling, and animal behavior to neuroanatomy, embryology, genetic engineering, hormonal regulation, and cancer immunology. Organisms and systems used in faculty and student research at Oberlin include bacteria, wasps, crayfish, nematodes, opossums, mice, fish, birds, mosquitoes, aquatic plants, invasive species, and tissue cultures of plant and animal cells.

Facilities

In October 2002, Oberlin dedicated comprehensive new science facilities that provide state-of-the-art teaching and research facilities for biology, chemistry, neuroscience, and physics, as well as a new science library and greenhouse. The \$65 million Science Center allows Oberlin to continue its traditions of excellence into the 21st century.

For More Information

The Biology Department welcomes inquiries and visits from prospective students and their parents. Copies of *The Biology Majors' Handbook* are available from the department. Members of the faculty are available to discuss the biology curriculum and career opportunities. Please visit our website for more information. <http://www.oberlin.edu/biology/>

Inquiries may be directed to Dr. Roger Laushman, Chair, Biology Department, Oberlin College, Oberlin, OH 44074-1097. Telephone: 440-775-8315 or Roger.Laushman@oberlin.edu

Biology Department Faculty

TAYLOR ALLEN, Ph.D. 1990, University of Washington. Associate Professor of Biology. **Teaching Interests:** Animal

Physiology; Cell Physiology; Folk and Traditional Medicine. **Research Interests:** Muscular Diseases, Biological Roles of Cytoskeletal Proteins. Dr. Allen is a physiologist who uses a range of molecular genetic and cell biological approaches to explore how cells re-model their shapes and migrate in response to environmental cues.

JANE BENNETT, M.S. 1976, Wright State University. Laboratory Instructor and Lecturer in Biology. **Teaching Interests:** Organismal Biology. Ms. Bennett teaches laboratory classes in the introductory courses. She trains and coordinates the consultants and teaching assistants for these courses.

MARK R. BRAFORD, Ph.D. 1971, Case Western Reserve University. Professor of Biology. **Teaching Interests:** Neuroanatomy; Introductory Neuroscience; Neurobiology of the Mind. **Research Interests:** Organization and Evolution of the Vertebrate Nervous System. Using anatomical methods, Dr. Bradford studies brain organization in different animals and attempts to interpret the results in a comparative and evolutionary context.

YOLANDA P. CRUZ, Ph.D. 1982, University of California, Berkeley. Professor of Biology. **Teaching Interests:** Organismal Biology; Developmental Biology; Bioethics. **Research Interests:** Embryo-maternal Signaling in Mammals, Fate-mapping in Marsupial Embryos. Dr. Cruz is a developmental biologist who studies cell interactions in early mammalian development, using techniques of cell and molecular biology.

MARY GARVIN, Ph.D. 1996, University of Florida. Donald R. Longman Associate Professor of Biology. **Teaching Interests:** Invertebrate Biology; Genetics, Evolution and Ecology. **Research Interests:** Ecology of Arthropod-borne Diseases, Vector Ecology, Effect of Disease on Avian Demography. Dr. Garvin's research is field intensive and systems oriented, integrating ecological and physiological studies of arthropods, vertebrates and pathogens.

MARTA J. LASKOWSKI, Ph.D. 1990, Stanford University. Associate Professor of Biology. **Teaching Interests:** Organismal Biology; Plant Biology. **Research Interests:** Molecular genetics of plant growth and development. Dr. Laskowski uses a variety of approaches, including genomics-based studies, to elucidate molecular processes involved in root development, particularly those associated with auxin-induced lateral root formation.

ROGER LAUSHMAN, Ph.D. 1988, University of Georgia. Associate Professor of Biology. **Teaching Interests:** Genetics, Evolution and Ecology; Conservation Biology; Population Biology. **Research Interests:** Population Genetics, with particular emphasis on aquatic organisms and invasive species. Dr. Laushman working on the population genetics of multi-flora rose and crayfish species of regional rivers.

CATHERINE A. MCCORMICK, Ph.D. 1978, University of Michigan. Professor of Biology. **Teaching Interests:** Vertebrate Structure and Evolution; Animal Behavior. **Research Interests:** Evolution and Anatomy of the Vertebrate Auditory and Lateral Line Systems. Dr. McCormick is particularly interested in sensory systems that use hair cells (or modified hair cells) as receptors: the mechanosensory and electrosensory lateral line systems and the auditory and vestibular systems.

MAUREEN PETERS, Ph.D. 2001, Harvard University. Assistant Professor of Biology. **Teaching Interests:** Cell and Molecular Biology; Genetics; Genomics. **Research Interests:** Biological clocks, rhythms, cell-cell communication, and signaling. Dr. Peters studies the molecular and cellular basis of biological rhythms in the nematode, *Caenorhabditis elegans*, using a variety of genetic, genomic and *in vivo* imaging techniques.

ANGELA J. ROLES, B.S. 2000, Wake Forest University. Visiting Instructor. **Teaching Interests:** Evolution and Population Biology.

LAURA ROMBERG, Ph.D. 1997, University of California, San Francisco. Assistant Professor of Biology. **Teaching Interests:** Cell and Molecular Biology and Microbiology. **Research Interests:** Bacterial cell division, cell movement and structure, protein dynamics. Dr. Romberg's research examines the dynamics of a bacterial protein that assembles into a ring at the future site of cell division. This ring then constricts to divide the bacteria in two. A drug that inhibits ring assembly or constriction could be a new antibiotic. She is using biochemical techniques to study the factors that regulate the protein's assembly.

KEITH A. TARVIN, Ph.D. 1998, University of South Florida. Assistant Professor of Biology. **Teaching Interests:** Behavioral Ecology; Ornithology; Evolution; Selfishness or Altruism? The Evolution of Sociality in Humans and Other Animals. **Research Interests:** Ecological and Genetic Influences of mating systems, social organization, and life

history strategies. Dr. Tarvin is a behavioral ecologist who uses field and laboratory techniques to study the evolution of behavioral strategies in birds. He is especially interested in sexual selection and mate choice in American Goldfinches.

JANICE THORNTON, Ph.D. 1983, University of Wisconsin. Associate Professor of Biology. **Teaching Interests:** Neuroendocrinology; Cell and Molecular Biology; Behavioral Neuroscience; Experimental Methods. **Research Interests:** Effects of Hormones on the Brain, Hormonal Control of Reproduction, Sex Differences and Behavior. Dr. Thornton's research examines how hormones exert their effects on the brain, and she uses a variety of techniques from behavioral analysis to molecular biological.

ROBIN S. (TREICHEL) SALTER, Ph.D. 1981, University of Wisconsin. Associate Professor of Biology. **Teaching Interests:** Human Biology; Immunology; Virology; Mammalian Cell Culture Laboratory. **Research Interests:** Cancer Immunology, particularly natural killer cells. Dr. Salter is an immunologist who explores the immune mechanisms by which cancer cells are recognized and killed, as well as cancers that have developed resistance to anticancer drugs.

Recent Publications of the Faculty

(Student co-authors are identified by a bolded asterisk.)

Burkeen*, A.K., S. Maday*, J. Sulcove*, J. Ward, K. Rybicka, M.M. Huang, R. Barstead, C. Franzini-Armstrong, and **T. StC. Allen**. 2004. Functional and structural disruption of muscle caused by mutation of troponin I of *Caenorhabditis elegans*. *Biophysical Journal* 86: 991-1001.

Cui S., N. Griffith*, K. Nanayakkara, **Y. Cruz**, L. Selwood. 2002. Developmental targets for fertility control in the brushtail possum. Pp. 1-6 in *Report of Conference held under the auspices of the National Strategy Committee for Possum & Bovine Tb Control, 2-4 April 2001*, New Zealand Ministry of Agriculture and Forestry, ISBN 0-478-07652-5.

Cruz, Y.P., H. Morton, L. Selwood, S.D. Wilson*, M. Sasaki*. 2006. Early pregnancy factor in marsupials, *Mondelphis domestica* (Didelphidae). *Australian Journal of Zoology* 54: 211-215.

Edwards J, Whitaker D, *Klionsky S, **Laskowski MJ**. 2005. A record-breaking pollen catapult. *Nature* 435:164.

*Erickson KB, *Hiland B, *Pilzer S, **Allen T**. 2006. Interactions made by myosin and by troponin T: genetic suppressor analysis. *Biophys J* 90: 2038-pos.

Garvin M.C., Schoech SJ. 2006. Hormone levels and infection of *Haemoproteus danilewskyi* in free-ranging blue jays (*Cyanocitta cristata*). *J Parasitol* 92: 659-662.

Garvin M.C., Szell CC, Moore FR. 2006. Blood parasites of nearctic-neotropical passerine birds during spring trans-Gulf migration: Impact on host body condition. *J Parasitol* (In Press).

Garvin M.C., **Tarvin K.A.**, Smith J, Ohajaruka OA, Grimes SD. 2004. Patterns of West Nile Virus infection in Ohio blue jays: Implications for initiation of the annual cycle. *Amer J Trop Med Hygiene* 70: 566-570.

Laskowski, M.J., Gehring, M*, Dreher, K*, Abel, S., Gensler, A*, and Sussex, I.M. 2002. FQR1, a novel early auxin-response gene, encodes an FMN-binding quinone reductase. *Plant Physiol.* 128 (2) 578-590.

Margalit DN, **Romberg L**, Mets RB, Hebert AM, Mitchison TJ, Kirschner MW, RayChaudhuri D. 2004. Targeting cell division: small-molecule inhibitors of FtsZ GTPase perturb cytokinetic ring assembly and induce bacterial lethality. *Proc Natl Acad Sci U S A*. 101:11821-6.

McCormick, C.A. 2006. Central connections of anamniote auditory otolith endorgans. *J Acoust Soc Amer* 119: 3432.

McCormick, C.A. and **Braford, M.R. Jr.** Evolution of the auditory system in anamniotes. *Springer Encycl. Ref. Neur.*, eds. Windhorst U, Binder M, Hirokawa N.; Springer-Verlag, New York. (In Press)

Romberg, L. and P.A. Levin. 2003. Assembly dynamics of the bacterial cell division protein FtsZ: Poised at the edge of stability. *Annual Review of Microbiology* 57: 125-54.

Romberg, L. and T.J. Mitchison. 2004. Rate-Limiting Guanosine 5'-Triphosphate Hydrolysis during Nucleotide Turnover by FtsZ, a Prokaryotic Tubulin Homologue Involved in Bacterial Cell Division. *Biochemistry* 43: 282-8.

*Rosen RF, **Tarvin K.A.** 2006. Sexual signals of the male American goldfinch. *Ethology* (In Press)

Sen J, Harpavat S, **Peters M.A.**, Cepko CL. 2005. Retinoic acid regulates the expression of dorsoventral topographic guidance molecules in the chick retina. *Development* 132 (23):5147-59.

*Scheidler LC, *Dunphy-Daly MM*, *White BJ, *Andrew DR, *Mans NZ, **Garvin M.C.** 2006. Survey of *Ochlerotatus triseriatus* (Diptera: Culicidae) for LaCrosse encephalitis virus and West Nile virus in Lorain County, Ohio. *J Med Entomol* 43:589-593.

Szabo, T.M., **C.A. McCormick** and D.S. Faber. 2006. Otolith endorgan input to the Mauthner neuron in the goldfish*. */2006 Abstract Viewer/Itinerary Planner./ Washington, DC: Society for Neuroscience, 2006. Online.

Tarvin K.A. 2006. Polymorphic microsatellite loci from the American goldfinch (*Carduelis tristis*) and their cross-amplification in a variety of passerine species. *Mol Ecol Notes* 6: 470-472.

Tarvin, K.A., M. S. Webster, E. M. Tuttle, and S. Pruett-Jones. 2005. Genetic similarity predicts the level of extra-pair paternity in splendid fairy-wrens. *Animal Beh* 70: 945-955.

Treichel, R., M. Bunuan, N. Hahn, and K. Wee. 2004. Altered conjugate formation and altered apoptosis of multidrug-resistant human leukemia cell line affects susceptibility to killing by activated natural killer (NK) cells. *Int. Journal of Cancer* 108: 78-85.

Wallace*, A.C. and **C.A. McCormick**. 2005. Otolith endorgan input to auditory projection in neurons in the goldfish: A confocal microscopic analysis. Program No. 182.2. /2005 Abstract Viewer/Itinerary Planner./ Washington, DC: Society for Neuroscience, 2005. Online.

*White BJ, *Andrew DR, *Mans NZ, Ohajaruka OJ, **Garvin M.C.** 2006. West Nile virus in mosquitoes of northern Ohio. *Amer J Trop Med Hygiene* (In Press)

Revised 8/2006