Why UC Biology?

The Department of Biological Sciences is dedicated to excellence in graduate training, offering both MS and PhD degrees. We offer competitive stipends including tuition remission. Our faculty conduct cutting-edge research to explore the natural world, spanning multiple fields, preparing students for diverse career paths. Our research includes specialties at all levels of biological organization, with research strengths organized into two foci: Sensory Biology, Behavior and Evolution (SBBE) and Environmental Change and Biological Resilience (ECBR).

ECBR: This group conducts research grounded in environmental biology and evolutionary genetics, and focuses on how organisms, populations, and ecosystems respond to the environment from a mechanistic perspective.

SBBE: This group conducts research at the intersection of neurobiology, behavior, and evolution directed at how organisms sense and respond to their environment at functional and evolutionary levels.
Why UC?

The University of Cincinnati is a top-25 public ‘research-intensive’ institution. Founded in 1819, our campus boasts award winning, modern architecture and is located close to collaborative institutions including the UC Medical campus, Cincinnati Children’s Hospital, the Cincinnati Zoo and Botanical Garden, and the Environmental Protection Agency.

Why Cincinnati?

Cincinnati is a vibrant city on the banks of the Ohio River. The region is home to year-round cultural and entertainment opportunities such as the Cincinnati Symphony Orchestra and National Underground Railroad Freedom Center, as well as numerous annual music and cultural festivals. Cincinnati is also home to two major professional sports teams, the Cincinnati Bengals and Cincinnati Reds. The city is located within the Hamilton County Parks system which provides extensive opportunities for outdoor activities.
Who are our research faculty?

**Dr. Joshua Benoit**

*Molecular physiology; Vector biology*

ECBR

Mechanisms underlying insect stress tolerance, reproductive physiology, regulation of metabolism and aging are the encompassing themes of my research, with the goal of integrating these topics under whole system studies that use molecular-, organismal- and population-based approaches. The emphasis of my lab is on producing broadly-trained biologists that have knowledge and experience in a variety of techniques, allowing proficiency in bioinformatics, laboratory techniques and field research. Although individuals within my lab are not limited to a specific insect system, there is a slant toward medically-important arthropods such as mosquitoes, tsetse flies and ticks.

**Dr. Daniel Buchholz**

*Hormonal control of development*

SBBE

The central goal in my lab is to understand the role of hormones in development and evolution. Hormones play critical roles in nearly all developmental events, including the development of many diseases. In addition, evolutionary changes in hormonal control of development underlie morphological, physiological, and behavioral differences between species. Understanding how hormones control development will illuminate avenues for disease treatment and will provide a basis for explaining species differences and biodiversity.

**Dr. Ishi Buffam**

*Landscape and ecosystem ecology*

ECBR

I am an ecosystems ecologist and aquatic biogeochemist. My training is in aquatic chemistry and biogeochemistry, with a primary focus on carbon and nitrogen transformations and hydrological transport within boreal and temperate watersheds, and a secondary focus putting freshwater carbon cycling processes into the context of landscape and regional scale carbon cycling. I use a combination of field vegetation and soil surveys, lab-based water and soil chemistry/biogeochemistry analysis, empirical modeling and GIS-based modeling to evaluate the relationship between landscape/watershed characteristics and surface water chemistry and biotic communities.
My research is driven by a deep interest in how other organisms perceive the world, and how their sensory systems have evolved to adjust to specific needs. I am particularly interested in vision, since the nature of light makes it relatively easy to understand eye design, and almost all animal eyes follow a few, relatively well understood functional plans. Once in a while though an eye is discovered that diverges fundamentally from known types. I find that there is a lot to learn from the functional organization of such exceptional eyes. In addition we are interested in how highly specialized eyes develop, and how such eyes have evolved.

In my lab, we are interested in the evolution of plant breeding systems and the interplay between the reproductive biology of a species (its pollination biology, seed production, susceptibility to herbivory, etc.) and population genetics. I incorporate both ecological and genetic approaches in my research because they both yield valuable insights into evolutionary questions. The main topics include the following: (a) Integrative Taxonomy in Camassia; (b) Invasive Ornamental Plants, Including the Callery Pear (*Pyrus calleryana*); (c) Evolution of Dioecy in the Hawaiian Genus Schiedea; (d) Population Genetics and Plant Mating Systems.
Dr. Ronald DeBry

Phylogenetic systematics; Molecular forensics

We work at the intersection of phylogenetics, evolutionary and molecular biology. We use DNA sequences to infer phylogenetic relationships of flesh flies (Sarcophagidae) and use the trees to test evolutionary hypotheses. For forensic entomology, we develop and maintain a DNA database for identification of blow fly and flesh fly larvae. We use DNA data and population genetics tools to explore species boundaries in a genus in which the pattern of DNA relationships conflicts with established morphological species boundaries, with the goal of understanding the relationship between morphology, species limits and demographic events, such as hybridization or incomplete lineage sorting.

Dr. Dennis Grogan

Microbiology; Genome stability

Hyperthermophilic archaea populate geothermal environments. These simple but rugged prokaryotic cells can be viewed as natural mosaics that combine uniquely archaeal proteins with ‘bacterial’ and ‘eukaryotic’ proteins; furthermore, all the enzymes in these cells are intrinsically thermostable. The Grogan lab develops genetic techniques for Sulfolobus spp. and uses them to probe critical molecular processes, including the maintenance (or under some conditions, loss) of genetic integrity in vivo at high temperature. Our studies of mutation, DNA transfer, homologous recombination, and related processes indicate that basic genetic mechanisms of Sulfolobus have unusual functional properties, with interesting implications for life in extreme environments.

Dr. Edwin Griff

Neurophysiology of vertebrate sensory systems

The overall goal of my research is to understand the physiological mechanisms that produce sensation. My current research investigates the sense of smell, olfaction. In olfaction, chemical odorants stimulate olfactory receptor neurons in the nose, which in turn stimulate neurons in the olfactory bulb of the brain called mitral cells. These cells respond to stimuli by producing nerve impulses, and the primary strategy used in my lab is to record these electrical responses using electrophysiological techniques.
The evolution of phenotypic differences between even closely-related organisms involves a complex set of genetic changes. These changes are often manifested through the altered expression, or structure, of gene products. To understand the genetic changes that accompany adaptation to extreme environments, we utilize the blind Mexican cavefish (*Astyanax mexicanus*). This species harbors two distinct morphotypes, a blind and depigmented cave-dwelling form and a surface-dwelling form. We utilize a variety of approaches including quantitative genetics, transcriptomics, and high-resolution phenotypic studies to understand the genetic differences between cave and surface forms.

**Dr. Joshua Gross**

*Cave Biology; Functional genomics*  
*SBBE; ECBR*

Our goal is to understand how individuals use sensory information during behavioral decision-making. In particular, we examine how animals use sensory cues to help guide them during movement across broad spatial and time scales. For example, using field and laboratory studies, we examine how monarch butterflies (*Danaus plexippus*) use sensory-based compass mechanisms for directionality during their seasonal long-distance migration. By studying monarchs, we aim to increase our basic knowledge on the sensory ecology of animal movement, as well as provide information that can help conserve phenomena that are threatened by climate change and habitat degradation, such as the monarch migration.

**Dr. Patrick Guerra**

*Sensory ecology; Animal movement*  
*SBBE; ECBR*
I am interested in the evolution of complex systems that involve a combination of behavior, physiology and morphology. I believe that using a comparative, functional and experimental approach combined with an ecological perspective provides the rigor necessary for studying evolutionary adaptation. Most of my research has been on different aspects of locomotion and muscle function in snakes, fishes and lizards. Major methods used in my lab are the quantitative analysis of both motion (from high-speed video images) and in vivo patterns of muscle activity (from electromyography). I have also conducted field studies of reptiles.

Dr. Bruce Jayne
**Functional morphology;**
**Vertebrate locomotion**
*SBBE*

I am a Neuroethologist. My research aims to discover how sense organs, and the neural processing of sensory information, mediate and constrain animal behavior under natural conditions. Sense organs both make possible a given behavior, and also limit its range of capacity. By spanning neural, sensory and behavioral fields I operate at an intersection of several biological, psychological and engineering disciplines. This allows collaborations that extend the competencies of the investigators involved – an exceedingly and increasingly important factor in the progress of complex biological research – and also extend bridges of understanding between frequently insular disciplines.

Dr. John Layne
**Neuroethology;**
**Animal navigation**
*SBBE*

My research interests are in paleoethnobotany and paleoecology. I have conducted field research studying indigenous groups in areas including Guatemala, Belize, Mexico, El Salvador and the US. To develop a greater understanding of how early cultures manipulated their environment through their agricultural and other land-use practices, I have examined the way in which indigenous people use plants. My work has focused on the archaeobotany of the ancient Maya and Olmec, studying the differences in dietary habits among groups of varying economic status.

Dr. David Lentz
**Historical ecology;**
**Paleoethnobotany**
*ECBR*
I am broadly interested in ecology, and I have addressed questions ranging from the production of methane by animals under anthropogenic control, to statistical ecology, and interpreting biogeographical patterns. However, my main research interests focus on spatial population and community ecology. I am interested in understanding dispersal, population extinction, and the interaction of insects with their host plants, particularly within spatial population networks. I attempt to answer these questions using theoretical, experimental, and empirical perspectives.

In the Morehouse lab, we are fascinated by the traits that males and females use to interact during reproduction. What selective pressures drive their evolution, and how do they influence each other’s evolutionary trajectories over time? We study this exciting topic using insects and spiders, with a particular expertise in visual ecology and visual communication during courtship. Current projects in the lab include investigating the role of female visual attention in the evolution of complex male displays in jumping spiders, exploring how the repeated evolution of color vision in jumping spiders has led to patterns of biodiversity in this species-rich group, and studying coevolutionary dynamics between male and female reproductive proteins in butterflies.
Dr. Kenneth Petren

*Landscape genomics; Invasive species
SBBE; ECBR*

The lab studies speciation, population divergence, dispersal and species interactions in natural populations. Much of the lab’s research is in the field of comparative landscape genetics, where molecular markers (like those used in forensics) are used to reconstruct migration, hybridization and population history. Other work explores how behavior affects ecological interactions. Research systems include the adaptive radiation of Darwin’s finches and the dynamics of lizard invasions. The lab combines molecular genetics, behavioral experiments and field research in places like the Galápagos.

Dr. Michal Polak

*Sexual selection; Insect host-parasite biology
SBBE*

Our lab has two main research foci: Sexual Selection and Host-Parasite Evolutionary Ecology. Students and post-docs in the lab pursue research in either area, and at the interface of these disciplines. We seek to understand how sexual ornaments function in assessment of genetic quality in mate selection and male competition. We are also studying how insects defend themselves against ectoparasites. We seek to understand how host organisms defend themselves against parasitic attack, and the evolution of host defensive traits.

Dr. Stephanie Rollmann

*Behavioral genomics; Chemosensation
SBBE, ECBR*

My research focuses on understanding the genetic basis of behavior by combining behavioral, molecular genetic and genomic approaches. My research centers on the following questions: What are the genes that shape the behavior? How do ensembles of genes give rise to behavior? To what extent do polymorphisms in these genes account for phenotypic variation in nature? To address these questions we examine chemosensory behavior in *Drosophila melanogaster*. We are also interested in the proximate mechanisms underlying divergence of behavior as a result of local adaptation to different environments. Here, we examine the olfaction in the cactophilic fly, *D. mojavensis*, a model of incipient speciation.
Dr. Eric Tepe

*Plant systematics; Morphology*

ECBR

Although I was originally trained in the plant sciences, it was always their ecology and environmental chemistry that intrigued me. To address these integrative areas, I expanded my program to include consideration of the entire system; plants, microorganisms, and soil. I have often focused on the remediation of contaminated soil systems. This includes research on phytoremediation (plant-based), bioremediation (microbial-based), and the manner in which the soil environment effects these processes. The approach is analytical, correlating performance by the plants and microbes to the forms, levels, and bioavailability of environmental compounds.

Dr. Annette Rowe

*Microbial ecology; Astrobiology*

ECBR

The research goals of the lab are to understand the diverse metabolisms and physiologies of microorganisms that allow them to exist in such a wide range of environmental conditions.

Dr. Rowe will be joining the faculty in January 2018.
I study animal behavior and ecology, with the goal of understanding how the environment influences the evolution of behavior. I am interested in questions about both the proximate mechanisms and selective forces involved in communication and social behaviors, including: How do animals recognize their own species? What sensory cues are used to discriminate conspecifics from similar species? How do animals detect signals from mates, prey or predators and distinguish them from environmental noise? How do animals in groups communicate with each other?

We work on modeling echolocation based navigation, flight control and foraging in bats. We use a range of simulation methods, artificial sonar systems and robots to research the sensorimotor loops underlying bat biosonar. In addition, we gather echo data in bat habitats to investigate what different environments sound like for echolocating bats, and how this can be used to navigate. As our research is very multidisciplinary in nature, we draw on insights and methods from cognitive science, biology & engineering.
What are the program requirements?

Students entering the program should be familiar with the fundamental principles of biological science. Usually students have majored in biology or one of its subdisciplines. Majors in chemistry, mathematics, computer science, or physics are acceptable, with a minor or concentration in biology.

Students should have completed:

• Chemistry through organic or biochemistry
• One year of physics
• One year of mathematics through calculus

How do I apply?

Applications are due January 1 for admission beginning Fall Semester. Applications for Spring Semester will be considered on a continuing basis.

More information can be found at: http://www.artsci.uc.edu/departments/biology/graduate.html
Where are some of our recent graduate students?

Joseph Fackler, MS, 2015  
Xinyu Cong, MS, 2015  
Elizabeth Kozack, MS, 2015  
Haoyuan Chen, MS 2016  
Ryan Jorgensen, MS, 2017

R&D Microbiologist, Q Laboratories, Inc.  
Research Assistant, UC College of Medicine  
Animal Trainer, Petsmart  
Instructor, UC  
Toxicology Technician, Abbive Pharmaceuticals

Susan Jaonis, PhD, 2015  
Bethany Stahl, PhD, 2015  
Brian Carlson, PhD, 2015  
Sunita Yadav, PhD, 2015  
Jeremy Alberts, PhD, 2016  
Megan Lamkin, PhD, 2016  
Elizabeth Brown, PhD, 2017  
Rachel Gilbert, PhD, 2017  
Mark Mitchell, PhD, 2017

Postdoc, CISR Australia  
Postdoc, Florida Atlantic University  
Visiting Assistant Professor, College of Wooster  
NASA Fellow  
Regional Manager, Environmental Solutions Inc.  
Interim Director of Undergraduate Research, UC  
Postdoc, Florida Atlantic University  
Postdoc, NASA  
Visiting Assistant Professor, Heidelberg University
Have questions?

Should I contact potential faculty mentors?
Yes! We highly recommend contacting faculty members with whom you would be interested in working. Faculty members play an integral role in the admissions process. Our program is a research graduate program, and all entering students are assigned a faculty advisor with whom they will begin research. Therefore, faculty evaluations of potential graduate students are important for decisions about admissions. Our website includes email addresses, phone numbers and links to the research web pages of faculty. If you have any questions concerning selection of a faculty mentor or focusing your research interests, please contact the Director of Graduate Admissions at biology.admissions@uc.edu.

How are graduate students supported?
Most graduate students are fully supported by the University of Cincinnati. The majority of graduate students in our department receive a University Graduate Scholarship, which pays tuition and fees. Students can receive additional support as a Graduate Assistant. GAs, under the guidance of faculty members, teach in undergraduate classes and laboratories. Students may be supported on individual faculty research grants.
What are some of the additional UC fellowship & stipend opportunities available to graduate students?

- **Graduate Research Fellowship for Outstanding Incoming PhD Students.** The Department of Biological Sciences at the University of Cincinnati, offers a fellowship for outstanding incoming PhD students. In addition to a one year fellowship, a research grant will be awarded to successful candidates. All applicants to the PhD program automatically compete for this fellowship. Underrepresented minority students are especially encouraged to apply.

- **Wieman Wendell Benedict Award.** Research grants are available on a competitive basis to all graduate students in the Department of Biological Sciences.

- **Graduate Student Governance Association Student Award.** This university program provides grants for travel to professional conferences on a competitive basis.

- **Yates Scholars Program.** The goal of this program is to enrich the educational environment for all graduate students by supporting the recruitment and retention of underrepresented ethnic minorities who are U.S. citizens or permanent residents with high potential for academic success.

- **University Research Council Graduate Student Research Fellowships.** This program provides summer stipend support to outstanding graduate students on a competitive basis.
Have more questions?

Questions regarding the application process:
Graduate Program Manager
Department of Biological Sciences
University of Cincinnati
P.O. Box 210006
Cincinnati, OH 45221-0006
Email: biograd@uc.edu

Questions regarding the graduate program:
Director of Graduate Admissions
Department of Biological Sciences
University of Cincinnati
P.O. Box 210006
Cincinnati, OH 45221-0006
Email: biology.admissions@uc.edu

Website: http://www.artsci.uc.edu/departments/biology.html