

# BIO 395 RESEARCH MENTOR LIST

To set up a BIO 395 research experience you should contact a faculty member whose research area interests you and discuss possible projects. When you decide on a particular mentor, and you and the mentor have agreed that you may work in the lab, you must fill out a BIO 395 Research Contract and submit it the Biology Department, 101 TH Morgan, within one month of the beginning of the semester in which you are registered for BIO 395. New contracts must be submitted each semester you register for BIO 395, even if you are just continuing the same project. Biology needs to know which lab you are in so we can request a grade at semester's end.

This list of potential mentors is organized by College and by Department and represents a cross-section of labs doing biological research across campus. This list is *NOT* inclusive; there are *many* other acceptable mentors. You may work with someone not on this list as long as the research is biological and the contract you submit is approved by the Director of Undergraduate Studies. Note that each college's and department's web address is included so you can scan other, non-listed faculty member's research areas as well.






Be sure to fill out the contract completely. The most important parts are your mentor's name and email address (so we know who to get a grade from) and the description of the research you propose to carry out. Follow the directions stating your hypothesis (the moon is made of green cheese), how you intend to test it (send a rocket containing mice to the moon and send a rocket with a mouse counter but no mice one month after the first one), and how you will interpret possible results (if there are lots of mice present after a month then the moon *could be* made of cheese and the hypothesis is supported).

The work you propose must be biological and it must be experimental. This means that you have to do actual experiments to determine whether your hypothesis is valid or not. Literature reviews and other passive reading or studying of other peoples' work does NOT qualify as research and those contracts will not be approved. If BIO 395 is not the appropriate way to get credit for your proposed work then you can consider EXP 396 (Experiential Education). Many activities that are not research can still be carried out for academic credit as EXP 396.

If you want to work with a mentor in the Biology department you should consider applying for a Ribble Undergraduate Research Scholarship. Ribble Scholarships are worth \$1,500 per year. Ribble scholars must be Kentucky residents and must do their research in a Biology department faculty member's laboratory. Further criteria are: junior or senior status when the research begins, excellent achievement and promise in biology, potential for a productive research experience as exemplified by the written research plan, and need for the scholarship to enhance your education.

## College of Arts and Sciences

Biology Department: <http://www.as.uky.edu/Biology/>

 =Plant Biology	 =Genetics, Genomics, & Bioinformatics
 =Cellular, Molecular, & Developmental Biology	 =Physiology and Behavior
 =Ecology and Evolutionary Biology	<i>All mentors are appropriate for pre-professional students.</i>



**Carol Baskin**

Department: **Biology**

Location: 120 MDR3

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**Research area and interests:**

Life cycle ecology of herbaceous plants, with particular reference to the ecology, biogeography, and evolution of seed dormancy and germination.



**Vincent Cassone**

Department: **Biology**

Location: 302 TH Morgan

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Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=cassone>

**Research area and interests:**

Chronobiology & Neuroscience.



**Robin L. Cooper**

Department: **Biology**

Location: 225 TH Morgan

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Campus phone: 257-5950

Email: [RLCOOP1@uky.edu](mailto:RLCOOP1@uky.edu)

Lab webpage: <http://web.as.uky.edu/Biology/faculty/cooper/default.htm>

**Research area and interests:**

Research goals of my laboratory are to understand the physiological mechanisms involved in synaptic plasticity among neurons in vivo and in situ. We are also interested in general comparative physiological processes.



**Philip H. Crowley**

Department: **Biology**

Location: 113 MDR3

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Campus phone: 257-1996

Email: [pcrowley@uky.edu](mailto:pcrowley@uky.edu)

Lab webpage: <http://web.as.uky.edu/biology/faculty/crowley/phil.html>

**Research area and interests:**

My students and I address a broad range of ecological topics from physiological to ecosystem levels, with animals, plants, and disease organisms, using both empirical methods (lab, field and semi-field experimentation; comparative and descriptive studies) and theoretical methods (analytical, numerical, and simulation modeling). We also use interdisciplinary approaches, such as comparative analysis of decision making, emphasizing the role of game theory. We welcome undergraduate researchers, particularly those whose interests fit with ongoing graduate-student research in the lab.



**Elizabeth Debski**

Department: **Biology**

Location: 201 MDR#3

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**Research area and interests:**

Working in the axolotl salamander, my laboratory is trying to identify the mechanisms that allow for the regeneration of the retina and restoration of vision in this animal following damage to the eye. Mammals, such as ourselves, do not have this ability and are left with permanent visual deficits after retinal injury.



**Elizabeth Duncan**

Department: **Biology**

Location: 202 THM

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Webpage: [www.emduncanlab.org](http://www.emduncanlab.org)

**Research area and interests:**

Regeneration is a remarkable phenomenon that is both ubiquitous and mysterious; although many different species of plants and animals are capable of replacing damaged and/or lost structures, many aspects of the regenerative process are unclear. For example, given that regeneration is often induced by spontaneous and imprecise tissue damage, how do cells translate such broad and sudden signals into cell-type-specific transcriptional changes? In my lab, we address such questions in the flatworm *Schmidtea mediterranea*. This planarian species has the extraordinary ability to regenerate an entirely new organism from almost any amputated fragment of the adult animal. Its incredible regenerative capacity is dependent on a large pool of stem cells, which also replace cells during normal tissue turnover and effectively make these worms “immortal”. We use various methods including RNAi, gene expression analysis, chromatin immunoprecipitation (ChIP), and imaging to study this fascinating biology.



**Scott Gleeson**

Department: **Biology**

Location: 109 MDR3

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Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=gleeson>

**Research area and interests:** Understanding of plant adaptations and their community consequences, particularly the acquisition of and competition for multiple limiting resources.



**Doug Harrison**

Department: **Biology**

Location: 300B T.H. Morgan

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Webpage: <http://web.as.uky.edu/biology/faculty/harrison/default.htm>

**Research area and interests:**

My primary research interest is in understanding how cells communicate with each other to carry out the many activities required to form a complex multicellular animal. Using the powerful genetic and molecular tools available for the fruit fly, *Drosophila melanogaster*, we focus on the roles of the evolutionarily conserved Janus kinase (JAK) signaling pathway in development.



**Rebecca Kellum**

Department: Biology

Location: 314A T.H. Morgan

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Campus phone: 257-9741

Email: [rkellum@uky.edu](mailto:rkellum@uky.edu)

Lab webpage: <http://biology.uky.edu/faculty/bio/index.php?name=kellum>

**Research area and interests:**

Research in the Kellum lab is focused on the roles of heterochromatin proteins in the mechanics of chromosome segregation and gene regulation in the genetically tractable model system of *Drosophila melanogaster*. Particular emphasis is on the activities of two heterochromatin proteins, the highly conserved HP1 protein and its telomeric partner (HOAP), in regulating the critical decision in the sex determination pathway of *Drosophila*.



**Catherine Linnen**

Department: **Biology**

Location: 203/204 T.H. Morgan

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Email: [Catherine.linnen@uky.edu](mailto:Catherine.linnen@uky.edu)

Lab webpage: [www.linnenlab.com](http://www.linnenlab.com)

**Research area and interests:** The central goal of research in my lab is to understand the origin of biodiversity. To do so, we collect many different types of data (genetic data, trait measurements, field observations, experimental manipulations) to try to understand: (1) how individual mutations alter gene function to change the physical appearance, behavior, or physiology (i.e., the phenotype) of an organism, (2) how these changes impact the ability of organisms to survive and reproduce in nature, (3) how natural selection and other evolutionary process (genetic drift, gene flow) shape genetic and phenotypic variation within and between populations, and (4) the circumstances under which these processes lead to the formation of new species. Our primary study organisms are pine-feeding insects that vary in all sorts of interesting traits.



**Nicholas McLetchie**

Department: **Biology**

Location: 102 MDR#3

Mail address: 101 Morgan Building

Campus phone: 257 6786

Email: [mclet@uky.edu](mailto:mclet@uky.edu)

Lab webpage: <http://wort.uky.edu/~mclet>

**Research area:** My research program focuses on elucidating the factors resulting in an entire plant species or population being dominated by one sex. Such factors include variation in offspring sex ratios and sex differences in growth, asexual reproduction, survival and sex expression.

**Possible research projects for undergraduates:** The majority of student projects deal with detecting sex differences at the whole plant level (life histories), at the physiological level (photosynthesis related traits) and, at

the morphological and molecular level (genetic variation). I try to match the project with the student interests, ongoing research and availability of resources within the lab. Students are welcome to visit the lab.



**Peter M. Mirabito**

Department: **Biology**

Location: 319 T.H. Morgan

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Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=mirabito>

**Research area and interests:**

Function of the Anaphase-Promoting Complex or Cyclosome (APC/C) in *Aspergillus nidulans*, Functional Genomics of Mitosis.



**Ann Morris**

Department: **Biology**

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Lab webpage:

[http://www.as.uky.edu/academics/departments\\_programs/Biology/Biology/faculty\\_research/faculty/morris/](http://www.as.uky.edu/academics/departments_programs/Biology/Biology/faculty_research/faculty/morris/)

**Research area and interests:**

Our laboratory studies cellular differentiation and gene expression in the vertebrate retina, the photosensitive lining at the back of the eye. The light-capturing neurons of the retina are the photoreceptors. Rod photoreceptors mediate dim light vision, whereas cone photoreceptors mediate daytime and color vision. Photoreceptor degeneration associated with ocular diseases such as retinitis pigmentosa (RP), macular degeneration, and retinal detachment is a significant cause of visual impairment and blindness, for which there is currently no cure. One promising avenue of research is to study the retinas of vertebrate animals that innately possess the capacity to regenerate retinal neurons following injury. For this reason, the zebrafish retina represents a valuable model system in which to study the mechanisms of neural progenitor proliferation, differentiation, and photoreceptor regeneration. One of the projects in my laboratory involves identifying the genetic pathways that mediate photoreceptor development and regeneration in zebrafish. A second project involves the generation of zebrafish models of human retinitis pigmentosa in which we have temporal control over photoreceptor degeneration and regeneration. Overall, our research spans several areas of interest, including developmental biology, genetics, molecular and cellular biology, and neuroscience.



**Bruce O'Hara**

Department: **Biology**

Location: 334 T.H. Morgan

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**Research area and interests:**

My laboratory uses molecular and genetic approaches to better understand sleep and circadian rhythms. We have also developed an automated method of monitoring sleep and wake in mice allowing for non-invasive and large-

scale studies in many inbred and out bred mouse populations, and also in preclinical studies of how drugs or brain injury interact with and influence sleep.

**Jeffrey L. Osborn** 

Department: **Biology**

Location: 115 T.H. Morgan (office) 205 MDR3 (lab)

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**Research area and interests:**

Our laboratory and research group focuses upon renal function and mechanisms controlling salt and water balance and blood pressure. Research projects are being conducted in several specific areas:

1. Understanding how altered mitochondrial gene expression may lead to development of hypertension. (Collett JA 2015; doi:10.1371/journal.pone.0136441).
2. Translational research focused on essential hypertension in *chlorocebus aethiops sabeus* or African Green Monkey (AGM).
3. The Caribbean invasive AGM develops spontaneous hypertension and shares significant common ancestry with *h. sapiens*. Current studies involve a role of reactive oxygen species, altered renal function, mitochondrial gene expression and development of high blood pressure.
4. The development of gestational hypertension in the AGM. Females from this species develop hypertension in the third trimester of pregnancy similar to humans. It is the only known nonhuman model of gestational high blood pressure.
5. The role of genetic variants to the APOL1 gene in the development of early age onset of end stage renal disease. This genetic variant evolved from western Africa and provides protection against African Sleeping Sickness. The expression of this gene in humans also results in renal dysfunction at an early age and we are studying this genetic variation in the AGM.

**Julie Pendergast** 

Department: **Biology**

Location: 315 T.H. Morgan

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**Research area and interests:**

Our primary research interest is the study of mammalian circadian rhythms. These are 24-h, daily rhythms that are present at every level of biology from gene expression to complex behavior. The integrity of circadian rhythms is important for good health. For example, shift work, which chronically disrupts circadian rhythms, is associated with increased risk of obesity, cancer, suppression of the immune system and other health problems. In the lab, we use rodent models to study circadian rhythms and how disrupting these rhythms leads to poor health. Specifically, we are interested in the interplay between the circadian and metabolic systems, with a focus on how circadian disruption contributes to obesity.

**Edmund B Rucker** 

Department: **Biology**

Location: 313 T.H. Morgan

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Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=rucker>

**Research area and interests:**

Molecular Genetics and Transgenics



**Brian Rymond**

Department: **Biology**

Location: 335A T.H. Morgan

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Lab webpage: <http://biology.uky.edu/faculty/bio/index.php?name=rymond>

**Research area and interests:** Using genetic and proteomic approaches to investigate the mechanism of spliceosome assembly and the fidelity of pre-mRNA splicing; characterization of novel gene function by CRISPR-Cas9 genome editing in *Drosophila melanogaster*



**Jessica Santollo**

Department: **Biology**

Location: 211 TH Morgan

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Webpage: <http://www.i-m.mx/drjesss/jsantollo/>

**Research area and interests:**

Neuroscience, Behavior, & Physiology



**Robert Craig Sargent**

Department: **Biology**

Location: 115 MDR3

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Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=sargent>

**Research area and interests:**

My research combines original theory with laboratory and field experiments to study the ecology and evolution of reproductive and life-history strategies in teleost fishes. Most of my current research focuses dispersal and range expansion of the invasive western mosquitofish from the points of view of individual phenotype (personality, body size), assembling into groups, and collective behavior of groups. We make use of life-history theory, social network theory, and agent based models in formulating our experiments, and we explore how conflict within and between the sexes, and predation, affect individual and group behavior.



**Ashley Seifert**

Department: **Biology**

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Webpage: [www.ashleyseifert.com](http://www.ashleyseifert.com)

**Research area and interests:**

Our lab investigates the cellular and molecular mechanisms regulating tissue and organ regeneration in animals. Research projects also focus on understanding the embryological development of skin and musculoskeletal structures. The lab uses amphibians and mammals as experimental systems to test hypotheses about how some animals can regenerate damaged tissue. Projects typically involve working with live animals, animal tissue and cells. We have a limited number of undergraduate research positions available each year. Freshman and sophomores are especially encouraged to apply. See the Seifert lab website for more information ([www.ashleyseifert.com](http://www.ashleyseifert.com)).



**Jeramiah Smith**

Department: **Biology**

Location: 311 T.H. Morgan

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Email: [jsmit3@uky.edu](mailto:jsmit3@uky.edu)

Webpage: <http://biology.uky.edu/faculty/bio/index.php?name=smith>

**Research area and interests:**

The unique selective pressures and functional constraints that vertebrate lineages have experienced over deep evolutionary time have resulted in a diversity of different mechanisms that mediate recombination (meiotic and mitotic), gene duplication, and the evolution of novel functional elements and developmental mechanisms. I am generally interested in understanding how vertebrate genomes evolve at the molecular level and how these changes contribute to the evolution of development. Ongoing studies take advantage of the deep evolutionary history of key vertebrate groups (including lamprey and salamander) in order to better understand how novel genomic functions arise and contribute to an organism's biology.



**Jeremy Van Cleve**

Department: **Biology**

Location: 219 T.H. Morgan

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Webpage: <http://vanleve.theoretical.bio>

**Research area and interests:**

The lab is generally interested in quantitative and mathematical approaches to evolutionary biology and ecology. Past and current research areas include social evolution and other topics in evolutionary ecology, the evolution of phenotypic plasticity and bet-hedging, and epigenetic processes including genomic imprinting (see here for publications: <http://vanleve.theoretical.bio/publications>).

Additionally, the lab aims to be broadly interdisciplinary across complex biological systems from the molecular to metapopulation scales and welcomes applicants interested in quantitative approaches and with diverse backgrounds including (but not limited to) mathematics, physics, computer science, and economics.



**David Weisrock**

Department: **Biology**

Location: Rm 117 MDR#3

Mail address: 101 Morgan Bldg., 0225

Campus phone: 257-2249

Email: [dweis2@uky.edu](mailto:dweis2@uky.edu)

Lab web page: [http://sweb.uky.edu/~dweis2/The\\_Weisrock\\_Lab/Front\\_Page.html](http://sweb.uky.edu/~dweis2/The_Weisrock_Lab/Front_Page.html)



**Research area and interests:**

Research in the Weisrock Lab combines genetics, genomics, and evolutionary biology. Much of our research centers on using genetics to resolve the geographic boundaries of species in nature, reconstruct the relationships among these lineages, and address the mechanisms that have led to their formation.

**David F. Westneat** 

Department: **Biology**

Location: Rm 104 MDR#3

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Campus phone: 323-9499

Email: [biodfw@uky.edu](mailto:biodfw@uky.edu)

Lab Webpage: <http://web.as.uky.edu/biology/faculty/Westneat/Personal/westneat.html>

**Research area and interests:**

We study the ecology of social behavior, including dominance and aggression, social foraging, parental care, mate choice, and signaling, mostly in birds. We typically have projects for undergraduates in all semesters, including summer. These can range from working outside with free-living birds, subjects in aviaries, or lab analyses of samples. For more information, please visit the Westneat lab homepage.

**Psychology** <http://www.uky.edu/AS/Psychology/>

**Michael T. Bardo**

Department: **Psychology**

Location : 447 BBSRB

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Campus phone: 257-6456

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**Research area and interests:** Psychopharmacology, behavioral neuroscience

**Possible research projects for undergraduates :** (1). Assessment of the environmental and genetic factors that increase risk for drug abuse using rodent models. Both behavioral and neurochemical levels of analysis are being pursued. (2). Development of novel medications for the treatment of stimulant abuse, including methamphetamine and nicotine. This work is being pursued with colleagues in the College of Pharmacy.

**Susan Barron**

Department: **Psychology**

Location: Kastle 208

Mail Address: Department of Psychology, Kastle Hall, 0044

Campus phone: 257-5401 (office), 257-2864 (lab)

e-mail: [sbarron@uky.edu](mailto:sbarron@uky.edu)

**Research area and interests:** Prenatal drug effects, alcohol-related neurotoxicity.

Possible research projects for undergraduates: Research projects that undergraduates are involved with examine the effects of prenatal drug exposure on behavioral outcome using a rodent model. In addition, students work on projects in which we use pharmacological manipulations to try and reduce alcohol-related damage to the CNS.

**Peter R. Giancola**

Department: **Psychology**

Location: 207K Kastle Hall

Mail Address: Department of Psychology, Kastle Hall, 0044

Campus phone: 257-4502

e-mail: [peter@uky.edu](mailto:peter@uky.edu)

**Research area and interests:** Alcohol-Related Aggression; Neuropsychological Aspects of Violence.

Possible research projects for undergraduates: Many projects are available.

**Thomas Zentall**

Department: **Psychology**

Location : Kastle Hall 202B

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**Research area and interests:** comparative cognition, social learning in animals, animal memory, concept learning in animals, timing in animals, spatial learning in animals

**Possible research projects for undergraduates:** Undergraduates take part in several research projects as part of a larger team. The projects vary a lot from semester to semester. Together with a graduate student each undergraduate selects one or two experiments as the focus of their attention during the semester.

**College of Agriculture**

**<http://www.ca.uky.edu/>**

**Thomas M. Chambers**

Department: **Veterinary Science**

Location: 443 Gluck Equine Research Center

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Campus phone: 257-4757 ex 81126

e-mail: [tmcham1@uky.edu](mailto:tmcham1@uky.edu)

**Research area and interests:** equine influenza, influenza viruses, West Nile virus

**Possible research projects for undergraduates:** viral gene nucleotide sequencing, horse vaccination efficacy studies, antibody response studies

**Charles Fox**

Department: **Entomology**

Location: Ag Science Center North room S-307B

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Campus phone: 257-7474

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**Research area and interests:** Evolutionary ecology and behavior

**Tomo Kawashima**

Department: **Plant and Soil Sciences**

Location: 321 Plant Science Building

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Webpage: <https://kawashimalab.ca.uky.edu>

**Research area and interests:** Molecular, Cell, and Developmental Biology of Plant Seeds. Although many factors involved in seed development and seed sizes/numbers have been identified, the precise mechanisms of how plants accomplish seed development and control these seed traits are largely unknown. Using the confocal microscopy real-time live-cell imaging approach, we are investigating the molecular mechanisms, cellular dynamics, and evolution of land plant sexual reproduction, especially focusing on stages from fertilization to early seed/embryo development.

**Subba R Palli**

Department: **Entomology**

Location: S225 Ag. Science N 0991

Campus Phone: 257-4962

e-mail: [rpalli@uky.edu](mailto:rpalli@uky.edu)

Webpage: <http://www.uky.edu/~rpalli/>

**Research area and interests:** Hormonal regulation of insect development and reproduction

Possible research projects: We use a variety of post-genomics technologies including RNA interference, next-generation sequencing, quantitative real-time PCR etc. to determine the function of gene products that play key roles in hormonal regulation of development, reproduction and insecticide resistance. Opportunities for training in physiology, biochemistry, toxicology, molecular biology and genome biology are available.

### College of Dentistry

<http://www.mc.uky.edu/Dentistry/>

#### **College of Dentistry Mentors**

(Additional information can be obtained from the following web site:

<http://www.mc.uky.edu/cohr>

#### **C. Brad Huang**

Department: **Dentistry Research and Graduate Studies**

Location: HSRB 161

Mail address: HSRB 161

Campus phone: 257-4427

e-mail: [chuan2@uky.edu](mailto:chuan2@uky.edu)

web page: <http://www.mc.uky.edu/COHR/huang.htm>

**Research area and interests:** Oral microbiology and immunology; Oral infection, inflammation, and HIV reactivation

**Possible research projects for undergraduates:** Oral infections associated with the gingival margin and subgingival sulcus leads to host inflammatory responses. Gingivitis is primarily a response to the bacteria in plaque. This “disease” affects nearly everyone in the population worldwide, at some time during their life. Periodontitis is a multifactorial disease that encompasses the hard and soft tissue, microbial colonization (with/without invasion), inflammatory responses, and adaptive immune responses. Gingivitis, periodontitis and caries affect as large a proportion of the global population as any modern disease known to mankind. The goal of my research is to use the newest biotechnology and techniques to study the oral infection and inflammation, and to understand the molecular pathways and mechanisms which cause these diseases. I have a lot of experience in working with Bio395 students. Current research projects include anti-carries, anti-periodontal and gingival diseases, protease inhibitors, Interaction between the oral bacteria and HIV-1 infected latent cells, and natural products.

#### **Craig S. Miller**

Department: **Oral Health Practice**

Location: MN118

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website: <http://www.mc.uky.edu/microbiology/miller.asp>

**Research area and interests:** Herpes virus latency and reactivation (see above web site for additional information)  
Salivary biomarkers in oral health and systemic disease

**Possible research projects for undergraduates:** Identification of genes important in reactivation. Identification of proteins critical for reactivation. Lab bench experience in virology, cell culture, latent infections, ELISA

#### **Richard J. Mitchell, Ph.D.**

Department: **Oral Health Practice**

Location : D630 Medical Center; College of Dentistry

Mail address: 800 Rose Street; Campus 0297

Campus Phone: 323-5495

e-mail: [rjm1@uky.edu](mailto:rjm1@uky.edu)

**Research area and interests:** : Degradation of bonding between dental filling materials and enamel or dentin; effects of restorative materials that a designed to inhibit caries on the mineralization of dentin and enamel, marginal breakdown of dental amalgam

**Possible research projects for undergraduates:** 1) the effects of storage in “aging” solutions on the bond strength of polymers to dentin; 2) demineralization of enamel and dentin adjacent to dental restorative materials when challenged by solutions designed to produce artificial caries, and 3) resistance of different types of dental amalgam to strained controlled cyclic loading. I’ll send interested students detailed information about these and several other biomaterials-related projects upon request.

### College of Health Sciences

<http://www.mc.uky.edu/HealthSciences/>

#### **Brian Noehren**

Department: **Physical Therapy and Rehabilitation Science**

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Phone: 859-218-0581

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**Research area and interests:** I am a researcher in the division of Physical Therapy who specializes in the understanding of lower extremity injury biomechanics and muscle function. I am interested in injuries such as knee pain, total joint replacements, ACL reconstructions, and Osteoarthritis. In my lab we look at the alterations in movement mechanics and muscle function that maybe related to the development of these injuries. We also develop and test new and novel treatment interventions. The lab uses 3D models created from motion capture cameras (like the video games). From these models we can measure the joint angles and forces during many activities such as running and walking. We have several ongoing studies and many more in development and are always looking for individuals who may be interested in helping out in the lab.

### College of Pharmacy

<http://www.mc.uky.edu/pharmacy/>

#### **E. Penni Black**

Department: **Pharmaceutical Sciences**

Location: 343 BioPharm Building

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website: <http://pharmacy.mc.uky.edu/faculty/EstherBlack.php>

**Research area and interests:** Targeting therapies in lung cancer using genomic signatures of response; mining genomic signatures of response to understand the underlying biology.

**Possible research projects for undergraduates:** We use genomic signatures of response to therapy to understand the underlying biology of the response in lung cancer. We use cell culture model systems for investigating the roles of genes comprising the signature in lung cancer. Cell culture systems are amenable to ectopic expression and characterization of genes of interest as well as RNA interference technology to transiently inhibit gene expression for characterization purposes.

#### **Robert A. Lodder, Ph. D.**

Department: **Pharmaceutical Sciences, College of Pharmacy**

Location: Biopharmaceutical Complex

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Campus phone: 955-0845

e-mail: [Lodder@uky.edu](mailto:Lodder@uky.edu)

**Research area and interests:** (see <http://www.pharm.uky.edu/> for details).

Astrobiology, In vivo chemical analysis and high resolution imaging of atherosclerotic plaques  
Near Infrared and Infrared imaging analysis of lipid metabolism and energy

Expenditure, spectrophotometric and electrophoretic analysis of carotid plaque lipoproteins  
Lipoprotein determination in single cells by near infrared spectromicrography  
Computerized assignment of near IR absorbances to molecular motions of proteins and peptides.

**Possible research projects for undergraduates:**

Astrobiology  
Astrotoxicology and Pharmacology  
Energy transfer model of living organisms  
General purposes biosensor/chemical sensor  
Lab on a chip  
PH sensitive reporter gene NPF  
Prediction of blue mold outbreaks using satellite images  
MARENIR for glucose determination in diabetes  
Magnetoelastic antibody sensor  
Fluorescence based phosphate sensor  
Electrorheological fluid microfluidics  
Tin oxide array sensors for gas analysis  
IR NSOM imaging of superconducting films

## College of Medicine

### Anatomy and Neurobiology

<http://www.mc.uky.edu/neurobiology/>

**Dr. Marilyn J. Duncan**

Department: **Anatomy and Neurobiology**

Location : HSRB 424 and 426

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Campus phone: 3-4718

e-mail: [mjdunc0@uky.edu](mailto:mjdunc0@uky.edu)

**Research area and interests:** circadian rhythms and aging and serotonin

**Possible research projects for undergraduates:** Specific projects vary over time, but may involve the following topics and methods:

- 1) Effects of age on serotonergic regulation of gene expression in brain regions regulating circadian rhythms (project involves administration of drugs to hamsters, monitoring of circadian rhythms of wheel running, tissue sectioning, in situ hybridization and image analysis)
- 2) Interactions between the circadian pacemaker and neurons regulating reproduction (project involves monitoring circadian rhythms of wheel running and reproductive state, preparing tissue sections, conducting immunohistochemistry and/or in situ hybridization and image analysis)
- 3) Neurochemical identification of the neurons in the hamster brain that possess specific serotonin receptors or estrogen receptors (project involves immunohistochemistry using dual antibodies)

**Greg A. Gerhardt, Ph.D.**

Department: **Anatomy and Neurobiology, Neurology and Psychiatry, Neurosurgery**

Location : MN 206

Mail address: 800 Rose Street

Campus phone: 323-4531

e-mail: [gregg@uky.edu](mailto:gregg@uky.edu)

**Research area and interests:** Parkinson's disease, Normal Aging, Attention Deficit Hyperactive Disorder (ADHD), Brain machine interfaces, Microelectrode development for brain recording.

Dr. Gerhardt's laboratory focuses on studies of the dopamine neurotransmitter system in animal models of Parkinson's disease. For these studies, his lab uses both the 6-hydroxydopamine-lesioned rat model and the MPTP-lesioned primate model of Parkinson's disease. Using his microsensor techniques, Dr. Gerhardt's lab has

investigated the release and uptake of dopamine in the striatum of the normal and parkinsonian brain. A major finding for these studies is that there is a severe disruption of dopamine regulation in the parkinsonian brain. This disruption of the control of dopamine may relate to some of the movement problems seen in this CNS disease. His laboratory is currently investigating the use of growth factors, such as GDNF, to restore function to damaged dopamine neurons.

Another area of research in his laboratory involves studies of movement abnormalities in aging. Such studies are performed in the cerebellum and striatum of young and aged Fischer 344 rats, and in young and aged nonhuman primates. His recent studies have shown that, dopamine and norepinephrine synapses change in their ability to regulate neurotransmitter release through changes in the monoamine transporters. This lack of regulation or change in the regulation of neurotransmitter signaling may account for some of the motor abnormalities that are seen in aged animals and humans.

A major focus of Dr. Gerhardt's laboratory is the dynamics of neurotransmitter function in the central nervous system. In order to perform such studies, his lab develops microsensors (5-30 microns) and instrumentation for the rapid, sensitive, and spatially resolved measurement of neurotransmitters and neuromodulators, such as dopamine, norepinephrine, serotonin, nitric oxide, and glutamate. A major goal of these studies is to understand neurotransmitter signaling in biological systems. This forms the basis for the Center for Sensor Technology.

**Possible research projects for undergraduates:** Microelectrode recordings in D4 knockout mice, freely moving measures of dopamine, glutamate and choline in animal models of Parkinson's disease, Development of new recording technologies for measures of neurotransmitters in the brains of mice and rats, Effects of GDNF on dopamine systems in young and aged rats.

### **Barnstable Brown Diabetes Research Center**

<https://ukhealthcare.uky.edu/barnstable-brown-diabetes-center>

**Iuliana Popescu, Ph.D. and Dr. John Fowlkes, Ph.D.**

Department: **College of Medicine**

Location: 900 S. Limestone, CT Wethington Building, Room 469-471.

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**Research area and interests:** Pancreas regeneration in type 1 and type 2 diabetes; developmental biology of the pancreatic islet; beta-cell physiopathology; mechanisms of alpha and beta-cell differentiation and dedifferentiation in diabetes; pharmacology, diabetes pharmacotherapy; obesity, metabolic syndrome.

**Technologies:** animal models of diabetes; cell culture; cell biology (cell viability/apoptosis, proliferation, cytotoxicity, transient transfections,...); immunohist (cyto)chemistry and immunofluorescence; biochemistry (hormone assay by ELISA; ROS, ATP assay; glucose up-take; enzymatic assays); molecular biology (genotyping, RNA extraction, RT-qPCR, Western Blot); LCM; electrophysiology

### **Microbiology and Immunology**

<http://www.mc.uky.edu/microbiology/>

**Sarah E.F. D'Orazio, Ph.D.**

Department: **College of Medicine/Microbiology, Immunology, & Molecular Genetics**

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web page: <http://www.mc.uky.edu/microbiology/dorazio.asp>

**Research area and interests:** Immune responses against intracellular bacterial pathogens

**Possible research projects for undergraduates:** The goal of our research is to understand the type of immune responses that can protect individuals from developing life-threatening infections with *Listeria monocytogenes*. Some of the projects in the lab are focused on understanding the bacterial factors that trigger

innate immune responses. Other projects focus on the differential susceptibility of T cells isolated from either inbred mouse strains or human peripheral blood to rapidly secrete the pro-inflammatory cytokine interferon-gamma after *Listeria monocytogenes* exposure. Undergraduates working in the lab could gain experience with molecular cloning techniques, protein expression, transfection of mammalian cells, and cellular assays to test immune functions.

## **Molecular and Cellular Biochemistry**

<http://www.mc.uky.edu/biochemistry/>

### **Trevor Creamer**

Department: **Molecular and Cellular Biochemistry**

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web page: [http://http://www.mc.uky.edu/biochemistry/dept\\_personnel/faculty/creamer.asp](http://http://www.mc.uky.edu/biochemistry/dept_personnel/faculty/creamer.asp)

**Research area and interests:** The Role of Intrinsic Disorder in the Regulation of Calcineurin

**Possible research projects for undergraduates:** The goal of our research is to understand how the phosphatase calcineurin is regulated. Calcineurin is of wide interest because it is involved in neuronal signaling, cardiac development and activation of T cells in the immune system. Calcineurin is activated when the calcium-sensing protein calmodulin binds to a regulatory domain. This domain of calcineurin is disordered (i.e. devoid of stable structure). We are also interested in other proteins involved in calcineurin regulation, including CHP, which is structurally similar to calmodulin but has the opposite effect (i.e. inhibits calcineurin), and Rcan1, which also inhibits and is itself a completely disordered protein. Some of the methods we use include molecular biology for the expression of proteins and mutants thereof, standard protein purification techniques, fluorescence spectroscopy, circular dichroism, NMR spectrometry and analytical ultracentrifugation. Undergraduates in the laboratory would primarily be involved in characterizing interactions between calcineurin and its regulating proteins using fluorescence and circular dichroism. Molecular biology and protein purification are also possibilities.

### **Robert Dickson**

Department: **Molecular and Cellular Biochemistry**

Location : 210 Combs

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**Research area and interests:** Part of my research effort focuses on understanding which signal transduction pathways control aging and life-span. Another part of my research focuses on signal transduction pathways that govern cell growth in both normal and abnormal states including cancer. Finally, we study how cells protect themselves against stresses including high temperature and high salt. In all of these research areas we aim to understand how the signaling pathways work and what cellular processes they regulate. We use a variety of molecular, biochemical, genetic and immunological techniques in the laboratory.

**Possible research projects for undergraduates:** Would be happy to discuss possible projects with students

### **Tianyan Gao**

Department: **Molecular and Cellular Biochemistry, Markey Cancer Center**

Location: BBSRB B367

Mail address: 741 S. Limestone Rd.

Campus phone: 323-3454

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**Research area and interests:** Our lab focuses on elucidating the functional importance of a novel family of protein phosphatase, PHLPP, in regulating tumorigenesis. We use colon cancer as a model system to study how PHLPP functions in suppressing cancer development and progression. Normal physiological functions of our body are controlled by cellular signaling proteins. Anything that disturbs the activity balance of these proteins contributes to human diseases such as cancer. Tumor suppressor proteins play critical roles in balancing cell growth and survival

signals in which they function to prevent the formation and progression of tumors. PHLPP is one of these tumor suppressor proteins that help our body to fight off cancer. Recently, we have found that loss of PHLPP expression is commonly associated with colon cancer and re-introduction of PHLPP into colon cancer cells inhibits tumorigenesis. The long-term goal of my lab is to understand the physiological function of PHLPP and the molecular mechanisms underlying PHLPP-mediated regulation in cancer. In addition, we have developed PHLPP knockout mouse models in our lab to further investigate the physiological role of PHLPP. The results from our studies will aid in developing novel therapeutic strategies in cancer treatment by using PHLPP as a target.

**Possible research projects for undergraduates:** The research conducted in my lab is currently funded by NCI. The lab is located on the 3rd floor of BBSRB and it is a part of the cancer research group supported by the Markey Cancer Center. We combine molecular biological, biochemical, and genetic approaches in our research. The PI has previous experience training graduate and undergraduate students. Once an undergraduate student joins the lab, he/she will be involved in one of the ongoing research projects in the lab and supervised by PI herself. We will provide the necessary training for the student to gain research experience in cancer biology and scientific findings and results generated by the student can be used in future publications.

### **Elizabeth Head**

Sanders Brown Center on Aging

Department: Molecular and Biomedical Pharmacology

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**Research Interests:** The goals of our research are to identify interventions that may prevent the onset and/or progression of Alzheimer's disease and thus promote healthy brain aging. To do this, our lab tests hypotheses using an animal model of human brain aging. Our focus is on testing combinations of treatments, each targeting different pathological pathways associated with aging or Alzheimer's disease. Aging canines naturally develop learning and memory impairments, as well as similar types of brain pathology as humans. Our studies are multidisciplinary and range from magnetic resonance imaging (MRI) to testing cognitive function (learning and memory) and neurobiological studies (anatomical, genomics and proteomics). In parallel with work in animal model systems, our laboratory is also following learning and memory changes with aging in adults with Down syndrome <http://www.uky.edu/DSaging/>. People with Down syndrome are at a high risk for developing Alzheimer's disease because they have an extra copy of chromosome 21 and the overexpress beta-amyloid protein. Our study participants undergo neuropsychological tests, a neurological and physical examination and magnetic resonance imaging. In addition, blood samples are drawn and a variety of protein levels are being measured. In the future, we hope that treatments developed in the canine model can be translated to people with Down syndrome to slow or prevent the development of Alzheimer's disease.

### **Louis Hersh**

Department: **Molecular and Cellular Biochemistry, College of Medicine**

Location: Med Sciences 607

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Campus phone: 35549

e-mail: [lhersh@uky.edu](mailto:lhersh@uky.edu)

**Research area and interests:** Alzheimer's disease, gene regulation

**Possible research projects for undergraduates:** Expression and purification of recombinant proteins. Analysis of their properties.

**Nutritional Sciences**

**<http://www.mc.uky.edu/nutrisci/>**

### **Analia S. Loria**

Department: **Pharmacology and Nutritional Sciences**

Location (Lab): Wethington Room 557



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web page: <http://pharmns.med.uky.edu/users/alo243>

**Research area and interests:** Effect of early life stress in cardiovascular and metabolic function.

**Possible research projects for undergraduates:** My principal interest is the study of origins of adult disease. My research has focused on the effects of early life stress (ELS) on adult vascular and renal phenotype. We use maternal separation, a model of ELS, which is a novel and promising model regarding the study of susceptibility to cardiovascular and renal diseases. My current research area expands our current knowledge on the mechanisms by which ELS induces a hyper-reactive response to stressors in adult life, specifically, modulating the renin-angiotensin system and sympathetic nervous system. In addition, my research as an independent scientist involves the examination of mechanisms by which a high fat diet increases insulin resistance in rats exposed to ELS. This is an original approach to model the increasing epidemic of children with high dietary fat content in addition to exposure to an adverse environment.

#### **Kevin J. Pearson**

Department: **Department of Pharmacology and Nutritional Sciences**

Location: Wethington Room 591

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Campus phone: 859-218-1371

e-mail: [Kevin.pearson@uky.edu](mailto:Kevin.pearson@uky.edu)

**Research area and interests:** The main focus of my laboratory is to investigate the role of maternal diet and exercise during pregnancy on the health and disease progression in offspring. Specifically, using mice and rats as models, our goal is to find ways to improve the health of the next generation through interventions during pregnancy. We have several large projects in the laboratory where we can integrate and train students. Students will gain experience both at the bench (western blotting and real-time PCR) and in animal handling (glucose and insulin tolerance and body composition measurements) which should be an excellent first step toward a career in science.

#### **Changcheng Zhou, Ph.D.**

Department: **Pharmacology & Nutritional Sciences**

Saha Cardiovascular Research Center

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**Research area of interest:** The main focus of my lab is to investigate molecular mechanisms of cardiovascular disease and metabolic disorders.

**Possible research projects:** Despite enormous research efforts and advances in treatments over the past few decades, atherosclerotic cardiovascular disease is the leading cause of death worldwide. Accelerated atherosclerosis is also the critical manifestation of macrovascular disease in type 2 diabetics and the major etiology of morbidity and mortality in these individuals. The goal of our research project is to use in vitro and in vivo approaches including molecular biology, cell culture and animal models to characterize the role of several key signaling pathways in atherosclerosis and metabolic diseases.

**Pharmacology**

**<http://www.mc.uky.edu/pharmacology/>**

#### **Rolf Craven**

Department: **Pharmacology and Nutritional Sciences**

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**Research area and interests:** Cancer signaling and experimental therapeutics

**Possible research projects for undergraduates:** The goal of our research is to understand the pathways that control tumor cell survival and spread. Our laboratory uses a combination of cell lines and mouse model systems to study the role of signaling pathways in tumor growth. Some of the methods we use to study tumor growth include molecular biology (such as RNAi), biochemical and immunohistochemical techniques, as well as more sophisticated methods such as lentiviral expression vectors and mouse xenograft systems for modeling tumor metastasis. Undergraduates working in the lab will gain experience with molecular biology (recombinant DNA research), protein analysis (such as western blot analysis and cell staining), reviewing the scientific literature and building hypotheses.

### **Rina Plattner**

Department: **Molecular and Biomedical Pharmacology**

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**Research area and interests:** Abl family of nonreceptor tyrosine kinases, cellular signaling, cancer research

**Physiology**     <http://www.mc.uky.edu/physiology/>

### **Steve Estus**

Department: **Physiology**

Location: 332 Sanders-Brown Bldg.

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Campus phone: 218-3858

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**Research area and interests:** Molecular biology of neuronal death in development and disease.

### **Lu-Yuan Lee**

Department: **Physiology**

Location: MS-511A Medical Center

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web page: <http://www.mc.uky.edu/physiology/people/lee.asp>

**Research area and interests:** Role of TRPV channels in the regulation of airway function.

**Possible research projects for undergraduates:** The main objective of this research project is to investigate the mechanisms underlying the sensitizing effect of hyperthermia on vagal bronchopulmonary C-fiber sensory nerves. Our hypothesis is that the hyperthermia-induced hypersensitivity is primarily mediated through the temperature-sensitive transient receptor potential vanilloid type (TRPV) ion channels that are expressed on C-fiber neurons. Using a well-established animal model of asthma, the proposed studies will further test the hypothesis that chronic airway inflammation induced by allergen sensitization causes the lung temperature to increase and also up-regulates the sensitivity and/or expression of TRPV channels; together, they enhance the sensitizing effect of hyperthermia on pulmonary C fibers. In a parallel study, experiments are conducted in human subjects and asthmatic patients in collaboration with Dr. Mehdi Khosravi, Assistant Professor of Medicine. In summary, the students working with me on this project will learn how to identify the important questions and to perform experiments in the study of the

mechanisms underlying the airway inflammation-induced hypersensitivity of these sensory nerves in the airways, and the role of TRPV channels in regulating the sensitivity and function of these neurons.

**Sandra J. Legan**

Department: **Physiology**

Location: MS601 UKMC

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**Research area and interests:** Neuroendocrine and circadian control of luteinizing hormone (LH) release and effects of prenatal exposure to opioids on the hypothalamic-pituitary-adrenal axis.

Possible research projects for undergrads: The overall goal of the major project in my laboratory is to elucidate the neuroendocrine and circadian mechanisms controlling the preovulatory LH surge, and answer the question: what is the mechanism that controls the circadian timing of the preovulatory LH surge? Current experiments are investigating the role of circadian phase advances and of circadian clock genes in control of the LH surge and the identification of the neurotransmitters that constitute the output signal from the suprachiasmatic nuclei (SCN) to the gonadotropin releasing hormone (GnRH) neurons. The second project in my laboratory is focused on the mechanisms whereby prenatal exposure to opiates permanently alters the response to stress. We are investigating the effects of prenatal oxycodone on the neuropeptides and neurotransmitters that control the HPA axis, and how these are differentially affected by sex hormones. Students will have the opportunity to learn advanced neuroendocrinology, neuroanatomy, and circadian biology. Techniques that they will learn or assist with include: jugular cannulation, stereotaxic surgery, anesthesiology, collecting and processing blood samples, radioimmunoassay for determination of plasma hormone concentrations, and immunohistochemistry for localization of clock genes and the neuropeptides mediating control of LH and ACTH secretion.

**Tim McClintock**

Department: **Physiology**

Location: MS535/MS585 Medical Center

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e-mail: [mcclint@uky.edu](mailto:mcclint@uky.edu)

Research area and interests: Molecular biology, genomics and epigenetics of olfaction, especially the control of odorant receptor gene expression, the function of odorant receptors, and adult neurogenesis in the olfactory epithelium. Undergraduate research projects: undergraduates choose projects supporting the main objectives of ongoing research projects. These may range from bench work in molecular biology to computational analyses of large genomics data sets.

**Spinal Cord and Brain Injury Center** <http://www.mc.uky.edu/scobirc/>

**Randal Voss**

Department: **Neuroscience**

Location: B453 BBSRB

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**Research area and interests:**

I am interested in understanding how and why some organisms can regenerate their limbs and spinal cord, while others, including humans, cannot. I am studying salamanders because they show the greatest regenerative potential of all vertebrates. I also study the genetic basis of species differences, especially differences that are thought to have arisen through the evolutionary process of natural selection.

## Surgery

<http://www.mc.uky.edu/surgery/>

### **Cherry Croft**

Department: **Surgery, Cardiothoracic**

Lab Location: MA1A

Office Location: MN 265

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**Research area and interests:** Chronic lung diseases are now the third leading cause of death in America, claiming the lives of over 400,000 annually with a cost of \$154 billion[1]. As chronic lung disease reaches end stage, lung transplantation becomes the only choice for effective treatment. With the scarcity of suitable donor lungs, however, the average time on the waiting list is 12.4 months with 14% of patients dying on the waiting list. A narrow window of opportunity exists for lung transplantation in any patient who is sick enough to benefit from the operation, but healthy enough to survive the months of waiting for a donor lung and subsequent surgery. Thus, there is a critical need for a respiratory support strategy which can serve as a bridge to lung transplantation. Unfortunately, no suitable long-term ambulatory bridge to lung transplantation exists. Recent success in the use of ambulatory ventricular assistance has stimulated research toward the development of a device to serve as a bridge to lung transplantation. In this application, a new artificial lung (AL) will be developed for long-term respiratory support. The fibers in the new AL will be coated with an ultra-thin PTFE membrane layer which will result in better gas exchange performance and lower blood resistance. The new AL will also have an even blood flow pattern to eliminate blood stagnancy, thereby reducing the occurrence of thrombosis. The significance of this project is that a new AL will be developed that will provide long-term ambulatory respiratory support for bridge to lung transplant use. Furthermore, completion of this research will also result in an AL prototype ready for clinical testing.