



*Summer 2009 Undergraduate Research Programs
at the University of Missouri-Columbia*

Animal Sciences - open application
Biology/Biochemistry - limited application (Pending)
Plant Genomics - open application
Cell & Molecular Biology - open application

General Information: The Office of Undergraduate Research at the University of Missouri-Columbia (MU) coordinates a number of summer research programs for undergraduates enrolled at other institutions. All programs run for 9 weeks (**Sunday, May 31 - Friday, July 31**), with travel days being Saturday, May 30 and Saturday, August 1. Students selected for these programs live in on-campus, air-conditioned housing (double rooms), and receive a full meal plan, covered by the program. Summer interns also are provided with funds to cover one hour of academic/research credit, travel to and from Columbia, and a stipend of \$3400.

Funds are available for approximately 24 non-MU students in different programs (described on the following pages). An additional 50+ undergraduates from MU or in other programs will participate in all research and educational programming activities, creating a vibrant community of undergraduate researchers. Students will work on their own research project under the guidance of an MU faculty mentor and present their results at a poster Forum at the end of the summer (July 30th). Students become part of a lab team that typically includes other undergraduate students, graduate students, lab technicians, and post-doctoral researchers. With 350 faculty members, over fifteen academic departments, and eight interdisciplinary programs and centers (all focused on the life sciences), MU is a great place for undergraduates preparing for a challenging career in biomedical and life sciences research and education! Our Columbia campus includes schools and colleges of Arts & Science; Agriculture, Food & Natural Resources; Engineering; Health Professions; Medicine; and Veterinary Medicine -- all within walking distance! MU is home to the nation's largest (10MW) nuclear reactor found on a college campus. The MU Research Reactor (MURR) provides advanced research opportunities for students and faculty in the neutron-related sciences and engineering and is an excellent facility for radiochemistry research.

Summer program alumni have entered graduate programs at California-Irvine, California-San Diego, Chicago, Colorado, Indiana, Iowa State, Michigan, Missouri, Purdue, Virginia, Washington University (St. Louis), and Wisconsin.

The Campus and Community: MU, the flagship campus of the University of Missouri system, is home to over 28,000 students (6,000 in graduate and professional programs) and 2,511 faculty. Columbia, midway between St. Louis and Kansas City, is a growing community with a population of more than 89,500. Columbia offers most of the benefits of large cities (restaurants, art, theater, music, and a variety of churches) and yet maintains the atmosphere and convenience of a small, diverse college town. There are numerous trails for walking, running, and biking and a

variety of city and state parks nearby.

Eligibility: Applicants are expected to have completed at least two years of full-time college enrollment prior to June 2009 and be pursuing a major in animal sciences, biology, biochemistry, chemistry, plant sciences, or related fields. Students graduating prior to December 2009 are not eligible. **Students must be citizens or permanent residents of the U.S.** Please see the information on the individual programs for additional eligibility information.

Application Information: The deadline for applying to these programs is **Friday, February 13, 2009**. Students must complete the attached application form and provide an unofficial transcript (including fall 2008 grades); at least one letter of recommendation (two preferred); a personal statement including career plans, prior research experience (if any), and statement of research interests; and a resume. Students attending one of the MU Summer Partner Schools (Barry, Florida A&M, Grinnell, Jackson State, Medgar Evers/Kingsborough CC, Missouri State, Prairie View A&M, St. Elizabeth, Truman State, University of Arkansas-Pine Bluff, and Xavier University of Louisiana) should discuss their interest with their faculty contact at their home institution and submit their application through their faculty contact well in advance of February 13th. Completed application packets should be sent to Tina Roberts, Office of Undergraduate Research, 150 Christopher S. Bond Life Sciences Center, University of Missouri, Columbia, MO 65211. FAX: 573-884-9395. Questions can be directed to Tina Roberts (LS UROP Program Coordinator) at 573-882-5979.

Educational Programming: In addition to their research work, students participate in a full series of evening workshops and brown bag lunches designed to provide them with information about research, career preparation and options, and scientific ethics. Speakers have included MU faculty, a scientist from the Stowers Medical Institute, a scientist from Pioneer Seed, a veterinary oncologist, members of the National Academy of Science, clinical oncology researchers, science teachers, directors of graduate programs, and other scientists. Weekly specialty discussions in the areas of plant genomics and radiochemistry provide opportunities for students to read articles relevant to the topics and engage in discussion with peers and faculty members. These specialty discussions are open to all students, regardless of program affiliation. A presentation on writing abstracts and designing posters is held in preparation for the poster Forum. Students also may participate in a field trip to St. Louis science facilities that may include the Danforth Plant Sciences Center, Monsanto, and the Human Genome Sequencing Center at Washington University. Social activities also provide opportunities for participants to get to know each other and other members of the MU science community. A mandatory orientation session that includes team-building activities is scheduled for Sunday, June 1st.

Faculty Mentors: Students are encouraged to read about the research interests of potential faculty mentors on the appropriate MU web sites. Students may find information on each of the faculty mentors listed below by accessing their departments' web sites. Students should list up to 8 faculty that they are interested in working with on their application, regardless of which programs they are applying to. Please note that there is overlap in programs for many of our faculty mentors. Students should check to ensure that faculty mentors they list are participating in the program(s) for which they are applying.

Website: undergradresearch.missouri.edu



Miller Summer Research Internships in Animal Sciences



The objective of the Miller Summer Research Internship program is to introduce students to animal sciences research, emphasizing food and fiber producing animals. Animal Sciences faculty research a variety of areas, including: ruminant and nonruminant nutrition; reproductive physiology; genetics and molecular biology; environmental physiology; and production and management. Each student will be working directly within a laboratory under the supervision of an internationally recognized researcher. The participant will gain an understanding of recent advances in basic science and applied animal sciences research.

Eligibility Requirements:

- ~ Applicants must meet the basic eligibility requirements.
- ~ Students are expected to have a minimum of a 3.0 gpa and have completed 2 years of college.
- ~ Selection is partially based on the applicant's potential and motivation for future graduate study (PhD level) in animal sciences.

Division of Animal Sciences Potential Faculty Mentors (PhD institution and research interests):

(animalsciences.missouri.edu)

- **Gary L. Allee**, professor, Univ of Illinois. *Swine nutrition.*
- **Gavin Conant**, asst professor, Univ of New Mexico, *Bioinformatics.*
- **Jeffre D. Firman**, professor, Univ of Maryland. *Poultry physiology and nutrition.*
- **Kevin L. Fritsche**, professor, Univ of Illinois. *Lipid nutrition, immunology.*
- **Rodney D. Geisert**, division director and professor, Univ of Florida. *Reproductive physiology-swine.*
- **Jonathan Green**, assoc professor, Univ of Missouri-Columbia. *Molecular biology.*
- **Duane Keisler**, professor, West Virginia University. *Reproductive physiology.*
- **Monty S. Kerley**, professor, Univ of Illinois. *Fermentation biochemistry.*
- **William R. Lamberson**, professor, Univ of Nebraska. *Animal breeding and genetics.*
- **David Ledoux**, professor, Univ of Florida. *Mineral metabolism.*
- **Carol Lorenzen**, associate professor, Texas A&M. *Meat science.*
- **Dennis Lubahn**, adjunct professor, Duke University. *Nutritional aspects of estrogen and hedgehog signaling in reproduction and cancer.*
- **Mathew Lucy**, professor, Univ of Florida. *Molecular endocrinology.*
- **David Patterson**, professor, Kansas State Univ. *Extension beef cattle reproduction.*
- **Randall Prather**, professor, Univ of Wisconsin-Madison. *Reproductive physiology/molecular biology.*
- **Rocio Rivera**, asst professor, Univ of Florida. *Animal molecular and cell biology.*
- **R. Michael Roberts**, professor, Oxford University. *Molecular biochemistry.*
- **Tim Safranski**, assoc professor, Univ of Missouri-Columbia. *Extension-swine breeding and genetics.*
- **Trista Strauch Safranski**, adjunct asst professor, Texas A & M University, *Nutrition/reproduction interactions.*
- **Robert Schnabel**, adjunct asst professor, Texas A & M University. *Genetics.*
- **Justin Sexten**, asst professor, Univ of Illinois-Urbana. *Ruminant nutrition.*
- **Marcia Carlson Shannon**, assoc professor, Michigan State University. *Extension-swine nutrition.*
- **Don Spiers**, assoc professor, Michigan State University. *Environmental physiology.*
- **Peter Sutovsky**, assoc professor, Czech Academy of Sciences. *Molecular/cell/development biology.*
- **Jeremy Taylor**, professor, Univ of New England, Australia. *Genomics.*
- **Kathy Sharpe Timms**, assoc professor, Univ of Tennessee. *Infertility and endometriosis.*
- **Matthew Waldron**, asst professor, Cornell University. *Dairy nutrition.*
- **Robert Weaver**, asst professor, Cornell University. *Animal breeding.*
- **Kevin Wells**, asst professor, North Carolina State University. *Genetics.*
- **Byron Wiegand**, assoc professor, Iowa State University. *Meat science.*
- **James E. Williams**, professor, West Virginia Univ. *Ruminant nutrition.*



NSF-REU in Biology/Biochemistry

The NSF-Research Experience for Undergraduates (NSF-REU) Program in Biology and Biochemistry is supported by a grant from the National Science Foundation and is limited to students from our partner institutions: Barry University, College of St. Elizabeth, Florida A&M University, Grinnell College, Jackson State University, Medgar Evers College/Kingsborough Community College, Missouri State University, Prairie View A&M University, Truman State University, University of Arkansas-Pine Bluff, and Xavier University of Louisiana. Students selected for the program will be placed in an appropriate research laboratory based on their research interests. MU faculty mentors have academic appointments in either the Division of Biological Sciences or the Department of Biochemistry. *Funding for the 2009 summer is pending.*

Eligibility Requirements:

- * Applicants must meet the basic eligibility requirements.
- * Students must be enrolled at one of the partner institutions and must apply through the faculty liaison at their home school (Barry, St. Elizabeth, Florida A&M, Grinnell, Jackson State, Medgar Evers/KCC, MSU, Prairie View A&M, Truman State, Arkansas-Pine Bluff, and Xavier).
- * Students must intend to pursue a PhD or combined MD/PhD in a life science discipline.

Potential Faculty Mentors for NSF-REU in Biology and Biochemistry

Department of Biochemistry (biochem.missouri.edu)

- **Lesa Beamer** - Structural biology: X-ray crystallography of medically important proteins
- **Donald H. Burke** - RNA-based HIV-1 drugs and drug resistance; Molecular engineering of RNA enzymes
- **David Emerich** - Proteomic analysis of symbiosis
- **Bill Folk** – Improvement of plant nutritional quality and adaptation to abiotic stress
- **Mark Hannink** - BTB-Kelch substrate adaptor proteins and regulated protein ubiquitination
- **Dennis Lubahn** - Finding novel molecular functions for human and mouse estrogen receptors, the female sex steroid receptors
- **Bruce McClure** - Cell-cell interactions in pollen recognition and rejection
- **Jan Miernyk** – Systems biology analysis of soybean development, protein interactions, ionomics
- **Scott Peck** – Proteomics of protein phosphorylation and protein kinases; signaling and secretion during host-pathogen interactions
- **Brenda Peculis** - Biochemical and biophysical analysis of X29, a novel nuclear decapping protein: correlating protein structure and in vitro catalysis to in vivo function
- **Frank Schmidt** - Combinatorial chemistry of RNA and antimicrobial peptides; the prebiotic RNA world
- **Grace Sun** - Biochemistry of the nervous system, how microglial cells kill neurons
- **Jay Thelen** – Proteomics and phosphoproteomics of seed development in canola, Arabidopsis, and soybean
- **Steve Van Doren** – Targeting metalloproteases that are crucial in cardiovascular disease and cancer
- **Judy Wall** – Environmental microbiology; bioremediation of toxic metal; genetics and biochemistry of sulfate-reducing bacteria
- **Gary Weisman** - Investigating the role of P2Y2

nucleotide receptors in inflammatory disorders, including Alzheimer's disease, atherosclerosis and Sjögren's syndrome

- **Shuqun Zhang** - Genetic analysis of MAP kinase signaling in plants

Division of Biological Sciences (biology.missouri.edu)

- **Jim Birchler** - Studies of chromosome structure and function using fluorescent in situ hybridization to maize chromosomes
- **Michael Garcia** - Molecular and cellular analysis of axon-glia interactions; neurodegenerative and demyelinating diseases
- **Miriam Golomb** - Virulence genes of *Haemophilus influenzae*
- **Tim Holtsford** – Evolution and ecology of flower traits
- **M. Alejandra Jaramillo** – Plant evolution: morphological innovations and diversification
- **Mannie Liscum** – Molecular and cellular regulation of plant growth and development
- **Andrew McClellan** - Spinal cord injury & axonal regeneration, brain regions that initiate locomotor behavior, neurite outgrowth in culture
- **Chris Pires** - Functional Genomics of Polyploids
- **Ray Semlitsch** – Ecology and behavior of amphibians in modified landscapes
- **David Setzer** – DNA-protein interactions and transcriptional regulation in eukaryotes
- **Patrick Shiu** – Meiotic silencing by unpaired DNA – a new RNAi phenomenon
- **John Walker** - Molecular analysis of signaling pathways in plants
- **Troy Zars** - Molecular neurobiology of memory formation in *Drosophila*

PGI@MU

Plant Genomics Internships at MU

The University of Missouri-Columbia (MU) is a nationally recognized center for plant genetics research and has been awarded over ten grants from the National Science Foundation to fund research in plant structural and functional genomics. MU consistently ranks among the top five universities in the country for NSF funding in the area of plant genomics. MU's graduate programs in plant sciences are highly competitive and attract some of the best doctoral students and post-doctorate researchers in the country. Faculty in biological sciences, biochemistry, plant sciences, and the USDA/ARS are eager to provide training opportunities for undergraduates who wish to participate in collaborative research. Research areas include: genome organization, gene expression, signal transduction, hormone action, organelle biochemistry, disease resistance, and crop plant productivity. Genomics approaches to understanding these problems include: genetic and physical mapping, multiple methods for functional analysis, and bioinformatics.

Eligibility Requirements:

- ✓ Applicants must meet the basic eligibility requirements.
- ✓ Students must be majoring in biology, biochemistry, plant science, or a related field and intending to pursue graduate work in one of the life sciences.
- ✓ Students must be entering their sophomore, junior, or senior year in college. Freshman with previous research experience may apply.

Faculty Mentors for Plant Genomics Internship at MU (PGI@MU)

Department of Biochemistry (biochem.missouri.edu)

- **David Emerich** - Proteomic analysis of symbiosis
- **Bill Folk** – Improvement of plant nutritional quality and adaptation to abiotic stress
- **Bruce McClure** - Cell-cell interactions in pollen recognition and rejection
- **Jan Miernyk** – Systems biology analysis of soybean development, protein interactions, ionomics.

- **Scott Peck** – Phosphoproteomic approaches to understanding disease resistance mechanisms
- **Jay Thelen** – Application of quantitative proteomics of oil seed filling
- **Shuqun Zhang** - Genetic analysis of molecular signaling in plants

Division of Biological Sciences (biology.missouri.edu)

- **Jim Birchler** - Studies of chromosome structure and function using fluorescent in situ hybridization to maize chromosomes
- **Tim Holtsford** – Evolution and ecology of flower traits
- **Mannie Liscum** – Molecular and cellular regulation of plant growth and development
- **Kathy Newton** - Plant molecular genetics; mitochondrial genetics
- **Chris Pires** - Functional genomics of polyploids
- **Patrick Shiu** - Meiotic silencing by unpaired DNA: A new RNAi phenomenon
- **John Walker** - Molecular analysis of signaling pathways in plants

Department of Computer Science

(www.cs.missouri.edu)

- **Toni Kazic** – The maize lesion network: a model system for understanding complex phenotypes by genetics and modeling

Division of Plant Sciences (plantsci.missouri.edu)

- **Heidi Appel** - How plants respond and defend themselves against insects
- **Georgia Davis** - Maize functional genomics of insect, fungal, and drought stress
- **Sherry Flint-Garcia** – Using genetics, genomics, and breeding to understand agronomic traits in corn
- **Walter Gassmann** – Molecular mechanisms of immune responses
- **Hari Krishnan** - Genetic modification of soybean seed composition; symbiotic plant-bacterial interactions in soybean
- **Melissa Goellner Mitchum** - Molecular mechanisms that regulate plant-nematode interactions
- **Henry Nguyen** - Functional genomics of plant responses to abiotic stress
- **Mel Oliver** – Functional genomics of dehydration tolerance in maize and resurrection plants
- **Jim Schoelz** - Molecular characterization of plant defenses against virus infection
- **Gary Stacey** - Functional genomics, microarray analysis & transporter characterization in plants and symbiotic bacterium



2009 Summer Research Internship Program in Cell & Molecular Biology

The MU Life Sciences Fellows Program (<http://lifescigradprograms.missouri.edu/>) is actively seeking to diversify their graduate program application pool. As part of this effort, we are offering four summer research positions for undergraduates in 2009. Preference will be given to students interested in applying to PhD programs in the life sciences at the University of Missouri-Columbia after completion of their undergraduate degree. Applicants are expected to have completed at least one year of full-time college enrollment prior to June 2009, be pursuing a major in biology, biochemistry, microbiology, or related fields, and be a citizen or permanent resident of the U.S.

Summer research interns selected for this program will conduct cell & molecular biology research with faculty mentors who are members of the NIGMS Training Grant at MU. A list of eligible faculty mentors appear below. Additional questions may be directed to Tina Roberts (RobertsTi@missouri.edu) or Dr. Mark Hannink (HanninkM@missouri.edu).

FACULTY MENTOR LIST - please see departmental websites for information on research interests

Department of Biochemistry (biochem.missouri.edu)

- **Donald H. Burke** - RNA-based HIV-1 drugs and drug resistance; Molecular engineering of RNA enzymes
- **Bill Folk** - Improvement of plant nutritional quality and adaptation to abiotic stress
- **Mark Hannink** - BTB-Kelch substrate adaptor proteins and regulated protein ubiquitination
- **Dennis Lubahn** - Finding novel molecular functions for human and mouse estrogen receptors, the female sex steroid receptors
- **Bruce McClure** - Cell-cell interactions in pollen recognition and rejection
- **Scott Peck** - Phosphoproteomic approaches to understanding disease resistance mechanisms
- **Brenda Peculis** - Biochemical and biophysical analysis of X29, a novel nuclear decapping protein: correlating protein structure and in vitro catalysis to in vivo function
- **Charlotte Phillips** - Collagen in inherited and acquired diseases of bone and kidney; matrix metalloproteinases; medical genetics
- **Michael Roberts** - Gene expression changes in human embryonic stem cells treated with growth factors
- **Grace Sun & Agnes Simonyi** - Biochemistry of the nervous system, how microglial cells kill neurons
- **Jay Thelen** - Application of quantitative proteomics of oil seed filling
- **Peter Tipton** - Enzyme mechanisms; Design and synthesis of enzyme inhibitors
- **Steve Van Doren** - Targeting metalloproteases that are crucial in cardiovascular disease and cancer
- **Gary Weisman** - Investigating the role of P2Y2 nucleotide receptors in inflammatory disorders, including Alzheimer's disease, atherosclerosis and Sjögren's syndrome
- **Shuqun Zhang** - Genetic analysis of MAP kinase signaling in plants

Division of Biological Sciences (biology.missouri.edu)

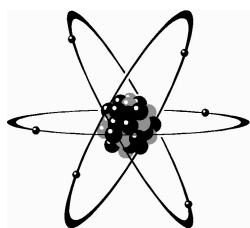
- **Steve Alexander** - Improving anticancer drugs
- **Jim Birchler** - Studies of chromosome structure and function using fluorescent in situ hybridization to maize chromosomes
- **D. Cornelison** - Functional properties of muscle stem cells
- **Michael Garcia** - Neurofilament biology and neuromuscular diseases
- **Mannie Liscum** - Molecular and cellular regulation of plant growth and development
- **Kathy Newton** - Plant molecular genetics; mitochondrial genetics
- **Chris Pires** - Functional Genomics of Polyploids
- **Change Tan** - Molecular mechanism of incomplete cytokinesis
- **John Walker** - Molecular Analysis of Signaling Pathways in Plants

Dept of Molecular Microbiology & Immunology (web.missouri.edu/~umcgradmmi)

- **Deborah Anderson** – Molecular determinants of Yersini pestis virulence
- **Brenda Beerntsen** – Host-parasite interactions in malaria
- **Karen Bennett** – Molecular genetic studies of germline development using the model organism c. elegans
- **Dongsheng Duan** – Gene therapy in animal models of human diseases
- **Marc Johnson** – Development of fluorescence based HIV assembly, budding, and infectivity assays
- **Chris Lorson** - Molecular basis of spinal muscular atrophy; RNA processing; gene therapy
- **David Pintel** – Parvovirus infection and host-cell response
- **Stefan Sarafianos** – Structure-based approaches to developing anti-HIV drugs
- **Habib Zaghouani** – Basic mechanisms of auto immune diseases

Department of Pathology & Anatomical Sciences (anatomy.missouri.edu)

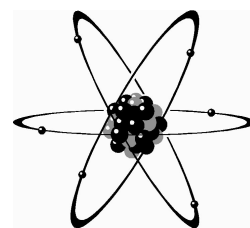
- **Sharon Stack** - Proteinase Regulation in Ovarian Carcinoma and Squamous Cell Carcinoma of the Oral Cavity



Two Summer Programs Pending Funding!

Radiochemistry

Computational Neurosciences



The University of Missouri–Columbia is awaiting word from the National Science Foundation on two REU programs for Summer 2009.

When funded, the REU Radiochemistry program will be entering its 5th summer of offering undergraduates an opportunity to work in a unique environment. MU has a 25-year history of successful and innovative radiopharmaceutical research, including the development of diagnostic and therapeutic drugs containing radioisotopes. The Radiopharmaceutical Sciences Institute at MU has been awarded \$10 million by the National Cancer Institute to establish a Cellular and Molecular Imaging Center. The goal of the center is to foster interdisciplinary research to enable development of novel radiolabeled molecular imaging agents capable of selective in vivo uptake and retention in cancer cells. MU is home to the nation's largest (10MW) nuclear reactor found on a college campus. The MU Research Reactor (MURR) provides advanced research opportunities for students and faculty in the neutron-related sciences and engineering.

The planned Computational Neurosciences summer research program will recruit undergraduates from the disciplines of engineering and biological sciences and will provide interdisciplinary research experience in neuroscience with focus primarily on computational aspects, i.e., computational neuroscience. The faculty mentors are from the Colleges of Engineering, Arts & Science, Medicine, and Veterinary Medicine. Computational neuroscience provides tools to abstract and generalize principles of brain function using mathematics, with applicability to the entire neuroscience spectrum including molecular, cellular, systems, and behavior levels.

If you are interested in either of these programs, please check our website (listed below) for updated information after February 5, 2009. Applications will be due around March 1, 2009. You may also contact Tina Roberts (RobertsTi@missouri.edu) to be put on a mailing list to receive information once we have learned about our level of grant funding for these two programs.

undergradresearch.missouri.edu/programs-jobs/programs