Cell, Molecular, and Developmental Biology

View PDF of Cell, Molecular, and Developmental Biology Admissions Checklist
Prospective students should use this checklist to obtain specific admissions requirements on how to apply to Graduate School.

View PDF version of the Cell, Molecular, and Developmental Biology catalog description

<table>
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<tr>
<th>Director:</th>
<th>Dr. Bradley K. Yoder</th>
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<tbody>
<tr>
<td>Phone:</td>
<td>(205) 934-0994</td>
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<td>E-mail:</td>
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<tr>
<td>Web site:</td>
<td><a href="http://www.uab.edu/cmdb">www.uab.edu/cmdb</a></td>
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Faculty

Anupam Agarwal, M.D., Professor; Medicine; Regulation of heme oxygenase gene expression in kidney and vascular injury

G. M. Anantharamaiah, Ph.D., Professor; Medicine; Apolipoproteins, Amphipathic Helices and Atherosclerosis

Daniel Balkovetz, M.D., Ph.D., Associate Professor; Medicine; Epithelial Cell Biology; Epithelial Cell Signal Regulation; Regulation of paracellular transport across epithelial cell tight junctions

Scott Ballinger, Ph.D., Associate Professor; Molecular and Cellular Pathology; Environmental cardiology, free radical biology, mitochondrial function

Marcas Bamman, Ph.D., Associate Professor; Physiology & Biophysics; skeletal muscle mass regulation

Zsuzsanna Bebok, M.D., Associate Professor; Cell Biology; Membrane protein biogenesis in epithelial cells (CFTR as model); Unfolded protein response

David Bedwell, Ph.D., Professor; Microbiology; Mechanism of Translation Termination and Therapies to Suppress Stop Mutations

Etty Beneviste, Ph.D., Cell Biology; Understanding how the immune system and central nervous system communicate with each other.

Bakhrom Berdiev, M.D., Ph.D., Assistant Professor; Cell Biology; The CFTR Chloride Channel control of Epithelial Sodium Channel under physiological and pathological conditions

Mark Bevensee, Ph.D., Associate Professor; Physiology and Biophysics; Cellular and Molecular Physiology of Acid-base Transporters and pH Regulation

Michael Brenner, Ph.D., Professor; Neurobiology; Molecular Studies of Astrocytes in Health and Disease

Peter Burrows, Ph.D., Professor; Microbiology; Lymphocyte Development and Function

Chenbei Chang, Ph.D., Associate Professor; Cell Biology; Signaling Transduction in Development and Diseases

John Chatham, D. Phil., Associate Professor; Medicine; Cardiomyocyte function and metabolism in diabetes and ischemic heart disease
Ching-Yi Chen, Ph.D., Associate Professor; Biochemistry & Molecular Genetics; Mechanism and Regulation of Mammalian mRNA Turnover

Yabing Chen, Ph.D., Associate Professor; Pathology; Gene Regulation in the Pathogenesis of Cardiovascular diseases, Osteoporosis and Cancer

Igor Chesnokov, Ph.D., Assistant Professor; Biochemistry and Molecular Genetics; DNA Replication and Cell Cycle in Eukaryotes

Louise Chow, Ph.D., Professor; Biochemistry and Molecular Genetics; Human papillomavirus DNA replication and pathogenesis

Sarah Clinton, Ph.D., Assistant Professor; Psych – Behavioral Neurobiology; Neurodevelopmental and environmental factors that underlie susceptibility to anxiety and depression

James Collawn, Ph.D., Professor; Cell Biology; Cystic Fibrosis; Endocytosis; Protein Trafficking

Yingzi Cong, Ph.D., Assistant Professor; Medicine; Host mucosal immune response to commensal bacterial antigens and the pathogenesis of inflammatory bowel diseases

Rita Cowell, Ph.D., Assistant Professor; Psychiatry & Behavioral Neurobiology; Transcriptional regulation of early postnatal brain development: Insights into the pathology of Autism and Schizophrenia

Lawrence DeLucas, O.D., Ph.D., Professor; Optometry; Protein Crystallography/Protein Crystal Growth

Patrizia De Sarno, Ph.D., Assistant Professor, Psychiatry and Behavioral Neurobiology; the role of glycogen synthase kinase-3 (GSK3) in Experimental Autoimmune Encephalomyelitis

Qiang Ding, Ph.D., Assistant Professor; Medicine; Molecular mechanisms of organ fibrosis

Charles O. Elson, III, M.D., Professor; Medicine; Regulation of mucosal immune responses

Charles Falany, Ph.D., Professor; Pharmacology & Toxicology; Biochemical and physiological properties of human cytosolic sulfotransferases

Michelle Fanucchi, Ph.D., Associate Professor; Environmental Health Sciences; Pulmonary cell biology and toxicology. Cell-to-cell interactions in the developing lung as well as in repair after lung injury and disease in children. The role of biochemical defense mechanisms native to pulmonary cells. Childhood lung disease and its etiology. Drug metabolism.

Stuart J. Frank, M.D., Professor; Medicine; Growth Hormone Action and GH Receptor Structure and Function

Andra R. Frost, M.D., Associate Professor; Pathology; Fibroblast-Epithelial Cell Interactions and Developmental Pathways in Breast Cancer

Kohtaro Fujihashi, D.D.S, Ph.D., Professor; Pediatric Dentistry; The Cellular and Molecular Mechanisms for Mucosal Immunity in the Elderly; Molecular and Cellular Mechanisms for the Induction and Regulation of Mucosally Induced Tolerance; A Mucosal Internet Of gd, ab T Cells and Epithelial Cells for Mucosal Immunity

Paul Gamlin, Ph.D., Professor; Vision Sciences; Studies of the Neural Bases of Vision & Eye Movements

Mark Garfinkel, Ph.D., Assistant Professor; Environmental Health Sciences; Drosophila
W. Timothy Garvey, M.D., Professor; Nutrition Sciences; molecular, metabolic, and genetic basis of type 2 diabetes mellitus, insulin resistance, and obesity

James George, Ph.D., Associate Professor; Surgery; Immune regulation of post-transplant vascular disease and allograft rejection

G. Yancey Gillespie, Ph.D., Professor; Surgery; Molecular and Viral Therapy of Malignant Primary Brain Tumors

Alecia K. Gross, Ph.D., Associate Professor; Vision Sciences; Rhodopsin trafficking in rod cells and rhodopsin-mediated retinal degenerations

Lisa Guay-Woodford, M.D., Professor; Genetics; Genetics of renal disease, particularly polycystic kidney disease

John Hablitz, Ph.D., Professor; Neurobiology; Cellular Mechanisms of Neurotransmission

John L. Hartman, IV, M.D., Assistant Professor; Genetics; Quantitative analysis of genotype-phenotype interaction networks in yeast models of human disease

Hui-Chen Hsu, Ph.D., Associate Professor; Clinical Immunology, Rheumatology; The BXD2 autoimmune mouse model of lupus and erosive arthritis

Amjad Javed, Ph.D., Associate Professor; Oral and Maxillofacial Surgery; Genetic and Molecular Signaling for Cellular Differentiation and Skeletogenesis

Kai Jiao, M.D., Ph.D., Associate Professor; Genetics; TGF-beta/Bmp signaling during cardiogenesis

Rajesh K. Kana, Ph.D., Assistant Professor; Psychology; the neural substrates of social cognition and the impact of social cognition on language, communication and other cognitive functions

Natalia Y. Kedishivli, Ph.D., Assistant Professor; Biochemistry and Molecular Genetics; Regulation of retinoic acid homeostasis

Bob Kesterson, Ph.D., Associate Professor; Genetics; Hypothalamic Control of Feeding Behavior

Jeonga Kim, Ph.D., Assistant Professor, Medicine; Cross-talk between inflammation and insulin signaling

Gwendalyn King, Ph.D., Assistant Professor; Neurobiology; Understanding the difference between pathological and non-pathological brain aging

Kevin Kirk, Ph.D., Professor; Physiology and Biophysics; The CFTR Chloride Channel

Christopher Klug, Ph.D.; Professor; Microbiology; understanding the underlying mechanisms regulating hematopoietic stem cell (HSC) self-renewal and how normal HSC developmental programs are subverted in the context of acute myeloid leukemia (AML)

Adrienne Lahti, M.D ; Professor; Psych – Behavioral Neurobiology; Use of multimodal brain imaging techniques to study the neuropathology of schizophrenia and bipolar disorder and to evaluate the effects of psychotropic drugs on brain function and biochemistry; translational work aiming at bridging human brain imaging and postmortem studies

Jack Lancaster, Ph.D., Professor; Anesthesiology; The Biophysics and Biochemistry of Nitric Oxide

Mathieu Lesort, Ph.D., Associate Professor; Psychiatry; Pathogenesis of Huntington’s Disease: from models to
therapeutic targets

**Xiaohua Li, M.D., Ph.D.**, Associate Professor; Psychiatry & Behavioral Neurobiology; Neurobiology of mood disorders

**Yonghe Li**, Ph.D.; Medicine

**Rui-Ming Liu, M.D.**, Associate Professor; Environmental Health Sciences; Glutathione, aging, age-related diseases, fibrosis, cancer

**Farah Lubin, Ph.D.**, Assistant Professor; Neurobiology; Molecular Transcriptional Mechanisms in Learning/Memory and Neurological Disorders

**Jin-Biao Ma, Ph.D.**, Assistant Professor; Biochemistry and Molecular Genetics; Structure and mechanism of proteins-RNA recognition in small RNA biogenesis and regulation

**James Markert, M.D.**, Professor; Surgery; Engineering Herpes Simplex Viruses for the Therapy of Cancer

**Joseph L. Messina, Ph.D.**, Professor; Pathology; Insulin and Growth Hormone (GH) Action, Insulin and GH Resistance Following Trauma and Infection

**Michael A. Miller, Ph.D.**, Associate Professor; Cell Biology; Function and evolution of intercellular communication mechanisms

**John Mountz, M.D., Ph.D.**, Professor; Medicine; Gene Therapy, T-cell Aging, Immunogenetics, and T-cell Imaging

**Joanne Murphy-Ullrich, Ph.D.**, Professor; Pathology; Extracellular Matrix Control of Cell and Growth Factor Function

**Diana Noah, Ph.D.**, Research Virologist; Biochemistry/SRI; understanding of influenza virus pathogenesis, including the mechanisms utilized by the highly pathogenic avian influenza strains causing deaths throughout Asia

**Thomas T. Norton, Ph.D.**, Professor; Vision Sciences; Animal Models of Myopia – Retinal Control of Eye Size

**Susan Nozell, Ph.D.**, Assistant Professor; Cell Biology

**Michelle L. Olsen**, Ph.D.; Assistant Professor; Physiology & Biophysics; Glial potassium channels and glutamate transporters in injury and abnormal development

**Suzanne Oparil, M.D.**, Professor; Medicine; Molecular and Cellular Mechanisms of Cardiovascular Disease

**Vladimir Parpura, M.D.**, Associate Professor; Neurobiology; The role of glial cells in physiology of nervous system

**Boris Pashe, M.D., Ph.D.**, Professor; Medicine; common gene variants that impact cancer risk and other outcomes in breast and colorectal cancer patients

**Andrew J. Paterson, Ph.D.**, Assistant Professor; Medicine; the regulation of growth factor gene expression

**Ji-Bin Peng, Ph.D.**, Associate Professor; Medicine; Calcium transport proteins and their roles in health and disease

**Selvarangan Ponnazhagan, Ph.D.**, Professor; Pathology; Adeno-associated virus gene therapy

**Kirill M. Popov, Ph.D.**, Associate Professor; Biochemistry and Molecular Genetics; Regulation of pyruvate
dehydrogenase complex

Edward M. Postlethwait, Ph.D., Professor; Environmental Health Sciences; Environmental Induction of pulmonary epithelial injury

Lucas Pozzo-Miller, Ph.D., Associate Professor; Neurobiology; Neurotrophins, Ca2+ Signaling, Synapse Development and Plasticity, Mental Retardation, Rett Syndrome

Peter Prevelige, Jr., Ph.D., Professor; Microbiology; Structural Biology of Viral Assembly and Infection

Chander Raman, Ph.D., Associate Professor; Medicine; Lymphocyte activation, immune tolerance and autoimmunity tolerance and autoimmunity

Erik Roberson, M.D., Ph.D., Assistant Professor; Neurology; Neurobiology of Alzheimer's Disease and Frontotemporal Dementia

Tom Ryan, Ph.D.; Associate Professor; Biochemistry & Molecular Genetics; Stem cell therapies in animal models of human disease

Ralph D. Sanderson, Ph.D.; Professor; Molecular & Cellular Pathology; Molecular regulation of the tumor microenvironment

James Schafer, Ph.D., Professor Emeritus; Physiology & Biophysics; Regulation of Salt and Water Reabsorption by the Distal Nephron

David Schneider, Ph.D., Assistant Professor; Biochemistry & Molecular Genetics; Control of RNA polymerase I transcription in the model eukaryote Saccharomyces cerevisiae

Harry Schroeder, M.D., Ph.D., Professor; Medicine; The Development and Function of Lymphocyte Antigen Receptors. & Genetics of Primary Immune Deficiency Diseases

Lisa Schwiebert, Ph.D., Associate Professor; Physiology & Biophysics; Airway inflammation; lung function; asthma and exercise

Rosa Serra, Ph.D., Professor; Cell Biology; Mechanism of TGF-ß Action in Developmental and Disease Processes

Bingdong Sha, Ph.D., Professor; Cell Biology; Structural and functional studies of proteins involved in protein folding and translocations

John Shacka, Ph.D., Assistant Professor; Pathology; Regulation of Neuron Death by the Autophagy Lysosome Pathway

Anath Shalev, M.D., Professor;

Sadeep Shrestha, Ph.D., Assistant Professor; Epidemiology; Infectious Disease Epidemiology, Genetic Epidemiology

Peter Smith, Ph.D., Associate Professor; Physiology and Biophysics; The role of the membrane cytoskeleton in regulating the cell surface expression of epithelial transport proteins

Harald Sontheimer, Ph.D., Professor; Neurobiology; The Role of Neuroglia in Brain Function and Disease
Giuseppe L. Squadrito, Research Associate Professor; Environmental Health Sciences; Development, design and evaluation of dynamic multi-component molecular systems that can be used to understand

David G. Standaert, M.D., Ph.D., Endowed Professor; Medicine/Neurology; the effects of oxidants in biological systems of various degrees of complexity

David Sweatt, Ph.D., Professor; Neurobiology; Signal Transduction Mechanisms in Learning and Memory

Elizabeth Sztul, Ph.D., Professor; Cell Biology; Membrane Traffic; Protein Degradation

Anne Theibert, Ph.D., Associate Professor; Neurobiology; Role of phosphoinositides in developmental neurobiology

Sunnie Thompson, Ph.D., Assistant Professor; Microbiology; Translation initiation during viral infection, tumorigenesis, or under stress.

Jaideep Thottassery, Ph.D., Pathology; Cks1, Skp2, cell cycle, breast cancer, antiestrogen resistance, nucleosides, DNA methylation

Janusz Tucholski, Ph.D., Assistant Professor; Psychiatry & Behavioral Neurobiology; Cellular and molecular biology of neuroblastoma. Response of neuronal cells and neurons to stress

Thomas Van Groen, Ph.D., Associate Professor; Cell Biology; Amyloid angiopathy in cognitive dysfunction and Alzheimer’s disease

Jacques Wadiche, Ph.D., Assistant Professor; Neurobiology; Synaptic transmission and glutamate transporters

Linda Wadiche, Ph.D., Assistant Professor; Neurobiology; The function of adult generated neurons

Mei Wan, Ph.D., M.D., Associate Professor; Pathology; Protein degradation mechanisms of tumor suppressor Smad4/DPC4 in cancers

Qin Wang, M.D., Ph.D., Assistant Professor; Physiology & Biophysics; Regulation of GPCR cellular responses and in vivo functions

Hengbin Wang, Ph.D., Assistant Professor; Biochemistry and Molecular Genetics; Role of Histone Modification in Chromatin Function

Jianbo Wang, Ph.D., Assistant Professor; Cell Biology; Currently, we are focused on a novel signaling pathway termed planar cell polarity (PCP) pathway and how this pathway regulates morphogenesis in mammals.

Andrew B. West, Ph.D., Assistant Professor; Neurology; Genetic and biochemical mechanisms in neurological disorders

C. Roger White, Ph.D., Associate Professor; Medicine/Cardiovascular Disease; Oxidant Stress and Endothelial Dysfunction

Scott Wilson, Ph.D., Assistant Professor; Neurobiology; Mouse Models of Neurodegeneration

Jianming Wu, D.V.M., Ph.D., Assistant Professor; Medicine; Molecular Immunology and Genetics of Human Autoimmune Diseases
J. Michael Wyss, Ph.D., Professor; Cell Biology; Neuroplasticity in aging and neuro cardiovascular control

Eddy Yang, M.D., Assistant Professor, Radiation Oncology; the targeting of DNA repair pathways to enhance the therapeutic ratio

Qinglin Yang, M.D., Ph.D., Associate Professor; Nutrition Sciences; exploring molecular mechanisms underlying the development and progression of heart failure

Yang Yang, M.D., Ph.D., Assistant Professor; Molecular & Cellular Pathology; Targeting heparan sulfate for myeloma therapy

Bradley Yoder, Ph.D., Professor; Cell Biology; Cilia Signaling and Dysfunction in Development and Disease

Nabiha Yusuf, Ph.D., Instructor; Dermatology; environmental influences such as chemical carcinogens and ultraviolet light on the skin and on the immune system

Majd Zayzafoon, M.D., Ph.D., Assistant Professor; Pathology; The Role of Calcium Signaling in the genetic and epigenetic pathogenesis of disease

Jianhua Zhang, Ph.D., Assistant Professor; Pathology; cell and molecular mechanisms, and mouse models of autophagy in development, neurological and psychiatric diseases

Theme Information

Objectives
The Cell, Molecular, and Developmental Biology (CMDB) graduate theme is part of an umbrella graduate program in Biomedical Sciences that focuses on basic process in cell, molecular and developmental biology and how defects in these processes result in human diseases and birth defects. CMDB students will receive comprehensive training and instruction in cell, molecular, and developmental biology using modern tools and approaches as well as a wide range of model organisms and cell culture systems. The overall goal of the theme is to develop well-rounded scholars with expertise applicable to multiple fields pertinent to a productive research and teaching career in academic science centers, research institutions, and industry.

Admission Requirements
Students are admitted into UAB Graduate Biomedical Sciences (GBS) umbrella program and indicate a theme preference. Applicants to the UAB Graduate School are reviewed by the GBS Admissions Committee and will be evaluated on the basis of their undergraduate performance (both the curriculum and grade point average), letters of recommendation, GRE scores, a personal statement of research interests, performance in other graduate programs or research activities and, if possible, a personal interview. Although students select a theme on admission into the GBS program, they may change theme affiliation at anytime; however changes that occur late in the doctoral program may require additional fundamental course work related to the specific theme.

Acceptance into CMDB requires a bachelor's degree including undergraduate coursework in calculus, general and organic chemistry, and at least one introductory course in zoology or biology by the time of entrance. The CMBD theme invites applications from individuals committed to obtaining a graduate education in biomedical sciences. Once accepted into GBS, students must complete the GBS core curriculum and three scientific research rotations in GBS laboratories. CMDB students will then begin course work in areas related to his/her research interests and training needs determined through the advice of faculty mentors and staff.

Overview of the CMDB Theme
The CMDB theme is comprised of over 60 primary and secondary faculty members with appointments in many of the academic departments and Centers at UAB including Cell Biology, Genetics, Biochemistry, Neurobiology, Medicine, Oral and Maxillofacial Surgery, Nutrition Sciences, Cardiovascular Disease, Clinical Immunology, Rheumatology, Pathology, Environmental Health Sciences, Physiology and Biophysics, Psychiatry & Behavioral Neurobiology, Vision Sciences and Optometry. The scientific interests of the faculty are very diverse and interdisciplinary in nature. As such, the CMDB theme can provide students an individually tailored, comprehensive training program in cell, molecular, and developmental biology using modern tools and approaches in a wide range of model organisms. The research conducted by CMDB faculty addresses fundamental cellular and molecular questions that provide the basis for understanding and treating human disease.

In the first semester, all students accepted into the GBS program will complete a 14-week core course covering fundamentals in biochemistry, metabolism, genetics, molecular and cellular biology. After completion of the core GBS curriculum, CMDB students will complete a course entitled Cell Signaling.

In addition, starting early in the first semester each student will obtain research experience through three laboratory rotations that will be completed by the end of the first year. Laboratory rotations are for ten weeks and are an integral part of the first year curriculum. They are the first opportunity to truly experience what graduate level scientific research is all about. These rotations are highly structured and are meant for you to become acquainted with the laboratory and the mentor and to gain practical experience in a variety of the techniques and types of scientific questions being addressed within the different theme areas. At the end of each rotation the students will present their research in the form of a poster presentation that is open to the GBS community. After completion of the rotations, students choose a mentor and laboratory for their dissertation research.

In the second semester, CMDB students must attend Methods and Scientific Logic, a journal club designed to demonstrate how to critically evaluate data and experimental design in the scientific literature and research. In addition, beginning in the second semester CMDB students will complete a series of one month modules in areas related to cell, molecular and developmental biology that are in the general research and scientific interest of the individual student. The CMDB curriculum is tailored to the student's research and scientific interests. As such, the student will be able to select from modules in the CMDB theme as well as from other GBS themes approved by the student's mentor and the CMDB theme directors. The student must complete eight modules, five of which should be listed as a CMDB course. Additional course work may be required to fill gaps in the student's knowledge based on the recommendation of the mentor and the student's thesis committee.

In the summer of the first year, all CMDB students must complete course in Biostatistics and Bioethics as well as conduct non-dissertation research in their selected laboratories.

At the beginning of the second year, students will assemble a thesis committee in consultation with their mentors. This committee will be formed by anywhere between 4 and 6 members, 3 of which should be faculty associated with the CMDB theme.

In the second year, students continue non-dissertation laboratory research and take module course work to fulfill the requirements described above. By the beginning of the third year, CMDB students must complete their qualifying examination consisting of a written dissertation research proposal in the format of an NIH style grant and an oral defense. The examination will evaluate whether the student has gained a sufficiently broad knowledge necessary for successful academic research. To help in this process, the second year curriculum will include a course in scientific writing and grantsmanship with a mock NIH grant review session. After successful completion of the exam the proposal will be submitted to a funding agency (if applicable) for possible support.

After the second semester, all students must participate in a CMDB approved Departmental Seminar Series and a
weekly journal club until completion of the doctoral degree.

The curriculum of each Ph.D. candidate usually requires five years of training and is individually tailored to the interests and needs of the student by the advisor and a graduate committee chosen by the student. The Ph.D. degree is awarded upon successful defense of your dissertation, which includes an oral presentation of original, creative scientific investigations, and a written dissertation which is expected to include published manuscripts or manuscripts in preparation. Because pursuit of the Ph.D. degree is a full-time activity, all graduate students are supported by monetary stipends and do not have any required teaching duties. The level of activity required does not permit outside jobs or excessive extracurricular activities. Continuous registration and satisfactory academic standing during all terms is required.

Additional Information

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<tr>
<th>Deadline for Entry Term(s):</th>
<th>Fall Semester</th>
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<tr>
<td>Deadline for All Application Materials to be in the Graduate School Office:</td>
<td>Domestic: April 30 (early submission is strongly encouraged for priority processing, as select applicants will interview in January and February) International: January 15</td>
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<tr>
<td>Number of Evaluation Forms Required:</td>
<td>Three</td>
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<tr>
<td>Entrance Tests</td>
<td>GRE</td>
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For detailed information see Web www.uab.edu/cmdb or contact:

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byoder@uab.edu

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Program Manager
Shelby Building, Room 120B
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205.934.1033
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Course Descriptions - Cell, Molecular and Developmental Biology

Cell Signaling - This course covers major extracellular and intracellular signal transduction cascades that regulate animal development and physiology. The class meets every day for 2 hours and consists of two exams.

Cellular Membranes and Organelles - This class will cover molecular and cellular processes that are involved in the assembly and maintenance of membranes and organelles and how defects in these processes contribute to human disease.

Cell and Molecular Aspects of Developmental Biology - The goal of this course is to provide an introduction to the fundamentals of vertebrate developmental biology. The course will consist of faculty lectures and research
paper discussion groups covering a broad range of developmental issues from fertilization to organogenesis.

**Developmental Neuroscience** - The course will utilize the scientific literature and faculty lectures to cover a broad range of topics related to the mechanisms of building a brain. The topics covered range from neural induction in early development, to axonal guidance and synapse formation, to neuro-gial interactions in the adult nervous system. Grades will be based on two exams and student participation in class discussions.

**Stem Cell Biology** - This course will explore the derivation, manipulation, and differentiation of embryonic, fetal, and adult stem cells in both mice and humans. Topics to be discussed include stem cell self-renewal, teratoma formation, hematopoietic stem cells, neural stem cells, trans-differentiation, nuclear transfer, and reproductive and therapeutic cloning. The course will be a mixture of instructor lectures and interactive journal club style presentations from the current stem cell literature by the students. Students will be evaluated based upon their journal article presentations, participation in class discussions, quizzes, and attendance.

**Development and Evolution** – This course will cover the developmental mechanisms that drive evolutionary change and how body plans evolve through natural selection. The course consists of lectures and scientific literature discussions that will demonstrate developmental biology principles.

**Skeletal Development and Disease** - The primary goal of this course is to introduce graduate students to the basic and translational knowledge about development, maintenance and homeostasis of the mineralized tissues. Lectures in this course will focus on approaches and techniques that are utilized for understanding cellular and molecular mechanisms essential for the normal development, remodeling and patho-physiology of skeleton.

**Cell and Matrix Interactions in Disease & Development** - This course will cover a combination of basic mechanisms underlying extracellular matrix interactions with cells, and how these go wrong in several disease processes. It will be a series of seminars, followed in the final week with oral student presentations on the disease of their choice and submission of a one-page summary.

**Mechanisms of Birth Defects** - This class will provide an overview of the mechanisms of common birth defects. A review of the development of each organ system is followed by a discussion of molecular mechanisms leading to alterations in normal development. Genetic and environmental mechanisms are discussed. A recent paper on each topic is presented as part of the class. Depending on the number of students enrolled, each student will be required to present one or two papers.

**Grantsmanship and Scientific Writing** – The objective of the course is to teach students how to effectively write grant proposals. This course will provide hands on training in the preparation of a grant application and demonstrate effective strategies for assembling a successful proposal. With guidance from the faculty, the students will write a NIH style proposal on their dissertation research topic. After the proposal is complete, each grant will be reviewed in a mock NIH study section. Based on the comments from the study section, the student will revise the application and submit the proposal to his/her thesis committee as part of the qualifying examination for admittance into candidacy.

**Laboratory Rotations**. Concurrent with the first year of course work, each student will perform laboratory research with mentors of his/her choosing in any of the GBS themes. Laboratory rotations are meant help students become acquainted with the laboratory and the mentor and to gain practical experience in a variety of the techniques and types of scientific questions being addressed within the different theme areas. Laboratory rotations last approximately ten weeks and each student will complete three rotations by the end of their first year. At the end of each rotation the students will present their research in the form of a poster. The performance in the laboratory and the poster presentation will be graded by the mentor of the laboratory and by two GBS faculty members.
respectively. A passing grade is required for all laboratory rotations. 1-6 hours.

**Non-Dissertation Research.** Laboratory research performed prior to admission to candidacy. 1-12 hours.

**Dissertation Research.** Prerequisite: Admission to candidacy. 1-12 hours.

**CMDB Approved Seminar Series** – All CMDB students must attend one of the weekly departmental based seminar series within the scientific interest of the student. The seminar series feature prominent speakers from both inside and outside of UAB and attendance is mandatory. Current approved seminar series include: Cell Biology, Neuroscience, Genetics, and Biochemistry. Additional seminar series may be included upon approval of CMDB and the mentor.

**CMDB Journal Clubs** - In the beginning of the second year until completion of the thesis defense, all CMDB students must participate in a journal club related to the student’s research interests and to the CMDB theme. The purpose of the journal club is to give students valuable experience in critical assessment of the scientific literature and to keep up-to-date on the research activities emerging from CMDB related research. Current journal clubs associated with the CMDB theme are: Autophagy and Cell Death, Cell Biology, Cell-Matrix Interactions, Cancer and Developmental Biology, and Stem Cell Biology. Additional journal clubs may be included upon approval of CMDB and the mentor.