Genetics and Genomic Sciences

View PDF of Genetics and Genomic Sciences Admissions Checklist
Prospective students should use this checklist to obtain specific admissions requirements on how to apply to Graduate School.

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Faculty

Aissani, Brahim, Ph.D., Research Assistant Professor; Cancer control and population science

Allison, David, Ph.D., Professor; Obesity, quantitative genetics, clinical trials, and statistical and research methodology

Arnett, Donna, Ph.D., M.S.P.H., Professor; Genetic Epidemiology, Pharmacogenetics

Beasley, Mark, Ph.D., Associate Professor; Methodological problems in statistical genetics and bioinformatics

Bebok, Zsuzsanna, M.D., Associate Professor; Protein folding disorders; Cystic fibrosis; Gene expression regulation by cellular stress responses

Bedwell, David, Ph.D., Professor; Translation termination, mRNA turnover

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

Blume, Scott, M.D., Associate Professor; Specific regulation of gene expression at the translational level - through sequence-specific RNA-binding proteins and complex 5'-untranslated RNA sequences; dysregulation of gene-specific translational control mechanisms in cancer.

Bray, Molly, Ph.D., Professor; Molecular and genetic basis of obesity; genetic analysis of complex traits; gene-environment interaction; physical activity/exercise physiology; adipogenesis; genetics of response to obesity interventions

Bridges, S. Louis, M.D., Professor; Genetic Influences on Treatment Responses in Rheumatoid Arthritis, particularly in African-Americans, and pharmacogenetics of rheumatoid arthritis

Briles, David, Ph.D., Professor; Bacterial pathogenesis; virulence; immunity; pneumococcus

Brown, Elizabeth, Ph.D., Associate Professor; Immunogenetics of autoimmune disease, infectious disease and virally-associated cancers

Bullard, Daniel C., Ph.D., Associate Professor; Regulation of Inflammatory Responses, Pathogenesis of Lupus and Vasculitic Disorders

Burrows, Peter, Ph.D., Professor; Lymphocyte Development and Function
Carroll, Steven, M.D., Ph.D., Professor; The Role of Neuregulin-1 in Peripheral Nervous System Neoplasia

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

Crasto, Chiquito, Ph.D., Assistant Professor; Bioinformatics, Olfactory receptors, Protein modeling, Neurological disorders

Cui, Xiangqin, Ph.D., Research Assistant Professor; Splicing array design; Equivalence tests for large dimension data produced by microarrays

Detloff, Peter, Ph.D., Associate Professor; Mouse Models of Human Genetic Disorders

Dybvig, Kevin, Ph.D., Professor; Pathogenic mechanisms of mycoplasmas

Edberg, Jeffery, Ph.D., Professor; Genetic Polymorphisms in Wegener's Granulomatosis

Eltoum, Isam, M.D., M.B.A.; Professor; Clinical research in diagnostic cytology and surgical pathology; tumorogenesis of prostate cancer and chemoprevention; HPV infection

Fernandez, Jose, Ph.D., Associate Professor; Identification of genes contributing to racial differences in obesity, diabetes, and cancer: the genetic admixture approach

Frank, Stuart, M.D., Professor; Med – Endocrinology, Diabetes and Metabolism; Growth hormone action and GH receptor structure and function

Gross, Alecia, Ph.D., Associate Professor; Rhodopsin-mediated retinal degeneration, mechanisms of photoreceptor membrane biogenesis

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

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

Higgins, Patrick, Ph.D., Professor; Genetic and Biochemical Studies of Chromosome Dynamics

Hollingshead, Susan, Ph.D., Professor; Mechanisms of Variation in Microbial Pathogenesis

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

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

Kaslow, Richard, M.D., Professor; Epidemiology of Infection and Immunity

Kesterson, Robert A., Ph.D., Associate Professor; Hypothalamic Control of Feeding Behavior

Kimberly, Robert, M.D., Professor; Autoimmunity, Molecular Mechanisms and Genetic Risk

Klug, Christopher, Ph.D., Professor; Hematopoietic stem cell development

Korf, Bruce, M.D., Ph.D., Professor; Neurofibromatosis Type 1

Lefkowitz, Elliot J., Ph.D., Associate Professor; Viral and Microbial Genomics, Evolution, and Bioinformatics
Lesort, Matheiu, Ph.D., Associate Professor; Pathogenesis of Huntington’s disease

Limdi, Nita, Ph.D., Associate Professor; Genetic and environmental regulation of warfarin and other drug responses

Liu, Nianjun, Ph.D., Associate Professor; genetic linkage and association analysis, disequilibrium mapping, population genetics, bioinformatics, machine learning methods and longitudinal data analysis and their applications in genetics and bioinformatics

Lothrop, Clint, Ph.D., Professor; Allograft rejection, novel therapies for blood disorders

Messiaen, Ludwine, Ph.D., Professor; Molecular genetics testing in hereditary disorders; molecular dissection of the variant forms of NF1

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

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

Norton, Thomas T., Ph.D., Professor; Juvenile eye development, mechanisms leading to myopia or hyperopia

Olsen, Michelle, Assistant Professor, Physiology & Biophysics; Glial potassium channels and glutamate transporters in injury and abnormal development

Pasche, Boris, M.D., Ph.D., Professor; TGF-beta in cancer development and progression, biological effects of amplitude-modulated electromagnetic fields, role of variants of the adiponectin pathway in cancer development.

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

Pittler, Steven, Ph.D., Professor; Characterization of Photoreceptor Metabolism and Retinal Degeneration

Popov, Kirill, Ph.D., Professor; Regulation of pyruvate dehydrogenase complex

Pozzo-Miller, Lucas, Ph.D., Professor; Regulation of synaptic transmission and plasticity

Roth, Kevin, M.D., Ph.D., Professor; Molecular Regulation of Neuronal Cell Death

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

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

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

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

Anath Shalev; M.D.; Professor; Med – Encocrinology, Diabetes & Metabolism

Shrestha, Sadeep, Ph.D., Assistant Professor; Interplay of human genetics with behavioral and environmental factors in the natural history and pathogenesis of infectious diseases (HIV, HBV, HCV, HPV, HTLV) and chronic disorders such as Kawasaki disease and coronary heart disease
Sorscher, Eric, M.D., Professor; Cystic Fibrosis and Molecular Genetics; Patient Oriented Research

Standaert, David, M.D., Ph.D., Professor; Translational Research in Neurodegenerative Diseases

Steyn, Adrie, Ph.D., Associate Professor; Mechanism of Mycobacterium tuberculosis virulence

Strong, Theresa, Ph.D., Associate Professor; Identification of Tumor Antigens and Development of Cancer Vaccines

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

Szalai, Alex, Ph.D., Professor; Inflammation, innate immunity, and the acute phase proteins in health and disease

Tang, Jianming, Ph.D., Associate Professor; Genetic and Epigenetic Correlates of Infection and Immunity

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

Thompson, Sunnie, Ph.D., Assistant Professor; Translation initiation and replication of RNA viruses

Tiwari, Hemant, Ph.D., Associate Professor; Genetic Linkage Analysis, Disequilibrium Mapping, Population Genetics, Molecular Evolution, Bioinformatics, and Genetics of Infectious Diseases

Unlap, M. Tino, Ph.D., Associate Professor; Role of the Na+/Ca2+ exchanger in mediating the effects of oxidative stress in hypertension, cancer and alzheimer's disease

Wang, Jianbo, Ph.D., Assistant Professor; Metabolic diseases

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

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

Wyss, J. Michael, Ph.D., Professor; Genetic and biochemical mechanisms in neurological disorders

Yacoubian, Talene, M.D., Ph.D., Neurology; Role of 14-3-3 proteins in Parkinson's disease

Yi, Nengjun, Ph.D., Associate Professor; Development of statistical and computational methods for identifying multiple interacting genes for complex traits

Yoder, Brad, Ph.D., Professor; Cilia Signaling and Dysfunction in Development and Disease

Yother, Janet, Ph.D., Professor; Capsular polysaccharides of Streptococcus pneumoniae

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

Zhang, Kui, Ph.D., Associate Professor; Development of methodologies for linkage, disequilibrium, haplotype, and microarray analysis.

Theme Information

Objectives

The main goal of the Genetics and Genomic Sciences Graduate Program (GGS) is to provide students with an outstanding, flexible, didactic training experience to prepare them for independent and innovative careers in...
research. The Program emphasizes a broad approach to the fundamental principles of genetics and genomics, and offers a large pool of mentors with expertise in a wide variety of areas. The GGS offers close day-to-day interactions between students and faculty, both in the classroom and the laboratory.

The research interests of our program faculty span the fields of genetics, genomics, cancer, biochemistry, cell biology, and developmental biology. Modern molecular approaches are used to study gene structure, expression, and function in diverse experimental systems including humans, mice, Drosophila, C. elegans, and other organisms such as bacteria. The GGS is also designed to permit close collaborations during the Ph.D. training period between graduate students, postdoctoral fellows, and faculty, while also encouraging full participation in the larger community of biological scientists at UAB.

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 GGS requires a bachelor's degree including undergraduate coursework in calculus, general chemistry, organic chemistry, and at least one introductory course in zoology or biology by the time of entrance. Doctoral students will receive financial aid in the form of a stipend/fellowship plus full payment of tuition, fees, and their insurance premium. Current stipend/fellowships are $26,000 per year for 2011-2012 entering students.

The GGS theme invites applications from individuals committed to obtaining a graduate education in fields related to genetics or genomics. We recommend that applicants take prior courses covering basic concepts in genetics and biochemistry if possible; however, this is not required for admission. Applications are strongly encouraged from individuals with previous research experience, a master's degree in related area, or a professional degree such as the M.D. or D.V.M. Once accepted into GBS, students must complete the GBS core curriculum and three scientific research rotations in GBS laboratories. GGS 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 GGS Program
The GGS theme is comprised of over 80 primary and secondary faculty members with appointments in many of the academic departments and Centers at UAB including Genetics, Cell Biology, Microbiology, Biochemistry, Neurobiology, Medicine, Pathology, Epidemiology, Biostatistics, Nutrition Sciences, Vision Sciences, and others. The scientific interests of the faculty are very diverse and interdisciplinary in nature. As such, the GGS theme can provide students an individually tailored, comprehensive training program in genetics and genomics through use of modern tools and approaches in a wide range of model organisms. The research conducted by GGS 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, GGS students will then take the Principles of Genetics course that will cover Mendelian and nonmendelian inheritance mechanisms, cytogenetics and chromosome disorders, and basic epigenetic concepts. Students are also expected to attend a weekly journal club and seminar series, such as those offered by the
Department of Genetics, during all years of their graduate training. These weekly events generally start in September and run through May of each academic year.

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 highly structured and allow the student to become acquainted with the laboratory and the mentor, gain practical experience in a variety of the techniques, and to learn about the different scientific questions being investigated within the GGS theme. 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 all three rotations, students choose a mentor and laboratory for their dissertation research.

In the second semester, GGS students will complete a series of one month modules that cover a wide variety of subjects including genome structure and function, linkage and association analyses, bioinformatics, and model systems for genetic analyses. In the summer of the first year, all GGS students must complete course in Biostatistics and Bioethics and conduct non-dissertation research in their selected laboratories.

During the subsequent years of the program, GGS students will focus on their laboratory research, as well as take a small number of specialized courses related to genetics and genomic sciences, or their specific areas of investigation. At the end of the second year of graduate training, students will assemble a thesis committee in consultation with their mentors. This committee will contain 4-6 faculty members, 3 of which should be faculty associated with the GGS theme. By the midpoint of the third year, GGS 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 third year fall 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 passing the qualifying exam and the necessary advanced coursework, GGS students are accepted to candidacy for the Ph.D. 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. The pursuit of the Ph.D. degree is a full-time activity, therefore 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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<th>Deadline for Entry Term(s):</th>
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| Deadline for All Application Materials to be in the Graduate School Office: | Domestic Applications: April 30 (early submission is strongly encouraged for priority processing)  
International Applications: Jan 15 |
| Number of Evaluation Forms Required: | Three |
| Entrance Tests | GRE or MCAT |

For detailed information, contact:
Course Descriptions for Genetics and Genomic Sciences

Required Courses

GBS 720: Genome Structure & Function. This course will cover a wide variety of topics related to this topic, including genetic variation and polymorphisms, alternative splicing, microRNAs, and novel sequencing and microarray technologies.

GBS 721: Genetic Epidemiology. Lectures for this course will focus on basic and advanced concepts in population genetics, linkage, genome-wide association analyses, admixture, genotype/phenotype correlation, and other related topics.

GBS 722: GGS Bioinformatics. This course will cover a wide variety of different bioinformatics applications, which will be taught through use of available on-line bioinformatics resources. The topics covered will include: introductions to large-scale, generic databases at NCBI, European Bioinformatics Institute, SwissProt, PDB, UniProt and Ensembl; Sequence analysis systems such as BLAST, ORF-Finder and GENSCAN, Multiple Sequence Analysis, gene identification in DNA and an introduction to the Human Genome Project; resources that are used in Microarray Data Analysis; Protein sequence analysis using Pfam, Prosite, Prints, Blocks, Protein structure analysis using SCOP, CATH; structural bioinformatics, secondary structure calculation, homology modeling, structure prediction, protein folding, protein-ligand docking and molecular dynamics.

GBS 723: Model Systems for Genetic and Epigenetic Analysis. The course will provide students with an in-depth knowledge of the different animal models used for analyses of gene function and genetic pathways. Topics include transgenic and knockout mouse technologies and strategies, large scale genetic screens in C. elegans and Drosophila, and modeling human genetic diseases in zebrafish.

MGE 707: Grant Proposal 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.

**Elective Courses (Can be taken for advanced course credit)**

**MGE 725: Advanced Medical Genetics.** This course will focus on the medical application of advances in genetics and genomics. Topics include chromosome structure and function and major types of chromosomal abnormalities, cancer genetics and cytogenetics, inborn errors of metabolism, current strategies for detection of mutations associated with genetic disorders, genetic risk assessment and population genetics, and genomic approaches to diagnosis and risk stratification.

**Systems Biology.** Lectures will consider systems biology approaches in the context of the human genome project, and with an emphasis on simple model systems. Technologies, biological concepts, and the underlying motivation for this emerging area will be discussed using examples available in the literature. The central focus of systems biology is to acquire a more global and quantitative understanding of how living organisms function as complex genetic systems, and how this might provide a more complete understanding of phenotypic traits.

**Other GGS Educational Activities**

**Department of Genetics Seminar.** The Department of Genetics Seminar series meets once a week from September through May of each academic year. This is a forum in which invited speakers from other institutions, as well as UAB faculty members, postdoctoral fellows, and advanced graduate students present and discuss their research.

**Medical Genetics Journal Club.** Faculty, students, and postdoctoral fellows meet once a week and present papers on a wide variety of topics related to genetics and genomics.