HUMAN GENETICS AND GENOMICS

http://biomed.med.miami.edu/graduate-programs/human-genetics-and-genomics

Overview
The Interdepartmental PhD Program in Human Genetics and Genomics is a multi-disciplinary program aimed at training scientists broadly in areas of human genetics and genomics relevant to human health and disease. The emerging practice of "precision medicine," whereby clinical treatment decisions are based in part on an individual's genomic profile, depends on "genomic literacy" among practitioners, researchers and patients. Human Genetics and Genomics is a multidisciplinary field that requires training in three core competencies: clinical, molecular, and statistical genetics. Individuals earning PhDs in Human Genetics and Genomics will have various career options, including clinical laboratory (after fellowship training and board certification), research laboratory or computational research in academia, healthcare, and the biotechnology industry.

During the first year PIBS curriculum, students will have the opportunity to take two introductory short courses: Variation & Disease and Family Studies & Genetic Analysis. Rotations through faculty laboratories provide students with hands-on experience in various research areas. The rotations also provide the student the background necessary to select a dissertation advisor and area of research.

During the second year, the curriculum focuses on core coursework in molecular and computational genetics, biostatistics, and seminars and journal clubs.

Also, during the second year, students choose to pursue one of two tracks within the program: molecular genetics or computational genetics. Course requirements differ slightly between these two paths: students in the molecular genetics track will take Advanced Topics in Molecular Genetics while the Computational Genetics track students take Fundamentals of Genetic Epidemiology and a second course in biostatistics.

During the second and third years of study, students formulate and defend a dissertation proposal. All students participate in a 1-credit hour clinical rotation and complete a teaching practicum during their fourth or fifth years.

Contact Information
We would be pleased to respond to any questions you may have and look forward to your inquiry.

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Applying to the Program
Admission Requirements
Applicants to biomedical programs should have a bachelor degree in a biological or related discipline (e.g., psychology, chemistry, engineering, physics). Although there are no prerequisite requirements, courses in general biology, cell/molecular biology, calculus, general physics, organic chemistry, physical chemistry, and biochemistry are encouraged. Applications are generally accepted from September to December for fall entry only. Select applicants will be offered an interview.

Competitive candidates will have the following:
• Excellent academic record
• Competitive GRE exam scores
• Research experience in a laboratory setting
• Publications of abstracts and / or papers
• Co-authorship in a peer-reviewed journal is recommended
• Strong letters of recommendation from research scientists who know the candidate well
• Motivation to pursue state-of-the-art biomedical research

Applicants must submit the following:
• Online Application
• Application Fee
• Official Academic Transcripts
• GRE General Test
• English Proficiency Exam (non-native speakers)
• Statement of Purpose
• Resume / CV

Full application instructions can be found at: biomed.med.miami.edu/apply

Doctoral Programs
• Ph.D. in Human Genetics and Genomics (http://bulletin.miami.edu/graduate-academic-programs/medicine/human-genetics-genomics/human-genetics-and-genomics-phd)

HGG 601. Seminar/Journal Club. 1 Credit Hour.
All active HGG students participate in the Seminar/Journal Club each semester. Sessions rotate between seminar, journal club, and research-in-progress. Twice per month, students attend the HGG seminar speaker series. Once per month, students present their own work in short research-in-progress talks. Once per month, students participate in a journal club, featuring student-led discussions of published papers.

Components: SEM.
Grading: SUS.
Typically Offered: Fall & Spring.
**HGG 621. Design and Analysis of Human Genomic Studies. 3 Credit Hours.**
This course covers study designs and analytic approaches commonly used in human genetic and genomic studies. Major topic areas include 1) study designs for genetic epidemiology; 2) experimental designs for assessing variation in DNA sequence, RNA expression, and epigenetic marks; 3) analytic approaches for genetic association, gene expression, and epigenetic data; 4) evaluation of epistasis, gene-environment interaction, and application of systems biology approaches to high-dimensional genomic data. Class sessions will feature a mixture of lecture, discussion of primary literature, and hands-on computational workshops.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Fall.

**HGG 630. Variation and Disease. 2 Credit Hours.**
This course provides an overview of the science of genetics, including historical and modern approaches, with emphasis on the underlying mechanisms of human genomic variation and their relation to human disease. After taking this course the student will be able to list the different types of human genomic variation, explain the mechanism by which each occurs, and discuss the consequences of the variation. Where appropriate, specific examples of human disorders will be related to the variation. Topics include: chromosomal, biochemical, and DNA sequence variation, mitochondrial genome variation and epigenetic effects. The course structure consists of a combination of lectures and discussion of primary literature.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.

**HGG 631. Genes in Populations. 3 Credit Hours.**
The course explores the relevant history and principals governing the behavior of genes in human populations. Topics include Hardy-Weinberg equilibrium; Mendelian, complex and quantitative traits; principals of selection and change in populations, neutral theory; and molecular evolution of gene families. The course is lecture based with supplemental readings.

**Components:** LAB.
**Grading:** GRD.
**Typically Offered:** Fall.

**HGG 640. Family Studies and Genetic Analysis. 2 Credit Hours.**
This course will cover the analysis of genetic data in family based data sets. Topics include: heritability, segregation analysis and linkage analysis. This course includes a computer lab component in which students will learn to use the relevant analytic programs.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Fall.

**HGG 650. Advanced Topics in Molecular Genetics. 3 Credit Hours.**
Topics include human microRNAs, the neurobiology of aging, structural variation, modern genome technology, among others. The course structure consists of disc ussions and analysis of primary literature.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.

**HGG 660. Bioinformatics Theory and Practice. 3 Credit Hours.**
This course covers a gradient of basic to advanced bioinformatics theory, data mining, and analysis. Each class will include a lecture to explain the concepts, followed by a hands-on lab session with worksheets and exercises. Early lectures will cover in-depth searching of the major databases, alignments, and motif discovery. These themes will recur with the applications of these and other algorithms to gene expression analysis, next generation sequencing data and its analysis, and analysis of variation. Freely available web resources will be used wherever possible, and the students will learn how to use Python for some bioinformatics applications.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Spring.

**HGG 680. Genome Ethics and Public Policy. 3 Credit Hours.**
This course will explore current and future applications of human genetics as they pertain to the health and identity of individuals and society. Topics will include the ethical dilemmas facing clinicians, researchers, and the public pertaining to the use of genetic information in healthcare; the role of the media and other extemporaneous factors in influencing the use of human genetic information, and responsible conduct of research specifically with regard to issues unique to genetics. The emphasis will be on real examples and experiences, with a primary goal of helping students explore how their role as a researcher and/or citizen will influence and be influenced by genetic information. The course is largely discussion based, but will include extensive readings from the literature and online videos.

**Components:** LEC.
**Grading:** GRD.
**Typically Offered:** Summer.

**HGG 681. Human Genetics Clinical Rotation. 1 Credit Hour.**
The HGG graduate students participate in medical genetics clinic post clinical rounds, metabolic-sign out and journal clubs. During clinic students observe clinical evaluations and counseling, and participate in weekly didactic sessions with faculty and residents.

**Components:** CLN.
**Grading:** SUS.
**Typically Offered:** Fall & Spring.

**HGG 689. Human Genetics and Genomics Teaching Practicum. 1 Credit Hour.**
HGG students serve one semester as a teaching assistant for a core course. This experience will include giving at least one lecture, leading small group discussions, and holding regular office hours to discuss student questions. This will generally take place in the student’s third or fourth year, and will be graded as a one-credit pass-fail course.

**Components:** PRA.
**Grading:** SUS.
**Typically Offered:** Fall, Spring, & Summer.

**HGG 830. Doctoral Dissertation- Pre Candidacy.. 1-12 Credit Hours.**
1 - 12 credit course for Doctoral candidates working on pre-candidacy dissertation.

**Components:** THI.
**Grading:** SUS.
**Typically Offered:** Fall, Spring, & Summer.

**HGG 840. Doctoral Dissertation - Post Candidacy. 1-12 Credit Hours.**
1-12 credit course for Doctoral Candidates working on dissertation post candidacy.

**Components:** THI.
**Grading:** SUS.
**Typically Offered:** Fall, Spring, & Summer.
HGG 850. Research in Residence. 1 Credit Hour.
Used to establish research in residence for Ph.D, after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.

Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.