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 research laboratory, computational research, or clinical laboratory (after fellowship training and board certification), 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. In the summer after PIBS, students take a short course in R, which is a prerequisite for other courses.

During the second year, the curriculum focuses on core coursework in population genetics, bioinformatics, study design and analysis, ethics, 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 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 any time after passing the Qualifying Examination.

Contact Information

We would be pleased to respond to any questions you may have and look forward to your inquiry.
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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. Prerequisite: HGG 661-Introducton to R Programming.
Prerequisite: HGG 661-Introduction to R Programming.
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 variations. Where appropriate, specific examples of human disorders will be related to the variations. 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. Course includes two 1.5 hour lectures and a 1.5 hour computer lab.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

HGG 631. Genes in Populations. 3 Credit Hours.
This class is a survey of topics in population and statistical genetics. Basic concepts and methods will be covered including: Hardy-Weinberg equilibrium, sources of variation, population substructure (drift, fixation, differentiation, inbreeding and F statistics), relatedness and heritability, quantitative and qualitative trait loci, selection (natural and artificial), and molecular evolution. The course is lecture-based but will include readings from the text and primary literature.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

HGG 640. Family Studies and Genetic Analysis. 2 Credit Hours.
The focus of this course is the use of families in the study of genetic disorders and traits. Both qualitative and quantitative phenotypes will be studied. Major topics covered include: heritability, heterogeneity, segregation analysis and linkage analysis. By the end of the course, the student will be able to design and carry-out a family based mapping study. The course consists of two 1.5 hour didactic lectures and a 1.5 hour computer lab during which students will obtain practical experience in running the relevant computer programs using data from various studies.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

HGG 650. Advanced Topics in Molecular Genetics. 3 Credit Hours.
Topics will include human microRNAs, the neurobiology of aging, structural variation, modern genome technology, among others. The course structure will consist primarily of discussions and analysis of primary literature.
Components: DIS.
Grading: GRD.
Typically Offered: Spring.

HGG 660. Bioinformatics Theory and Practice. 3 Credit Hours.
In this course, we will focus on application of high throughput genomic technologies in a variety of biological contexts. The expectation would be to achieve the following course learning objectives: 1) Gain familiarity with the technologies and techniques available for high throughput genomic studies; 2) Understand the data outputs and how to store/manipulate/analyze/interpret results; 3) Work with high performance computing in the area of genomic analysis; 4) Become aware and be able to use tools for genomic data storage, annotation, and curation; 5) Critically plan and perform quality control of analysis pipelines and results; 6) Share results of genomic data through communication and visualization techniques. Prerequisites: HGG 661-Introduction to R Programming. Familiarity with basic genetics, genome structure, and the methods and approaches of molecular biology are necessary. Please ask for primers on these topics if you do not have a Biology background. In addition, basic knowledge in the Unix environment and basic operations is required. Materials will be distributed in the first week of class to address.
Prerequisite: HGG 661-Introduction to R Programming.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

HGG 661. Introduction to R Programming for the Biomedical Sciences. 2 Credit Hours.
This course provides an introduction to the R statistical programming language, with an emphasis on analysis of biomedical data. Topics will include R syntax, logic, and data types as well as statistical analyses, plotting and figures, environment management and administration, and other topics. Applications and examples will focus on biomedical data, including genetics and genomics. Familiarity with computer programming logic (i.e., boolean operations, if/then/else logic, for/while loops) is recommended, but previous experience with R is not required. Prerequisite: PIB 705 or equivalent statistical analysis course is required.
Prerequisite: PIB 705 or equivalent statistical analysis course is required. Familiarity with computer programming logic is recommended. Permission of Instructor.
Components: PRA.
Grading: SUS.
Typically Offered: Summer.

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 and includes extensive readings from the literature and online videos.
Components: DIS.
Grading: GRD.
Typically Offered: Summer.

HGG 681. Human Genetics Clinical Rotation. 1 Credit Hour.
HGG 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. This can be completed any time after passing the Qualifying Examination in Fall of Year 3, and Admission to Candidacy is achieved, and will be graded as a one-credit pass-fail course.
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 can be completed any time after passing the Qualifying Examination in Fall of Year 3, and Admission to Candidacy is achieved, 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 candida cy.
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.