COMPUTATIONAL GENOMIC MEDICINE, MS

Degree: Master of Science (MS)
Field of Study: Computational Genomic Medicine

Program Overview

The Master's degree in Computational Genomic Medicine is for motivated students who wish to prepare for conducting genomics research and/or clinical genomic analyses in academic, hospital or industry settings. This program will address the growing gap between the rapid accumulation of genomics data and researchers' and clinicians' ability to exploit these data effectively to improve human health. This non-thesis MS program will provide fundamental background knowledge in genetics and genomics and hands-on learning experience in genomics data management and analysis. The culminating experience in year two will be research in a faculty member's lab in the School of Medicine or via our partner institutions at The Cleveland Clinic or University Hospitals. This experience will provide students with the ability to apply what was learned in the classroom in the real world. Upon completion of the program, graduates will be equipped with skills in bioinformatics and genomic data analytics and be prepared to enter the workforce in one of many fields in biomedical research, clinical care and the public health arena.

We offer our students a supportive and highly interactive training environment, characterized by extensive collaboration among laboratories using wide-ranging experimental approaches. Students pursuing their MS will be trained by an interdisciplinary community of researchers with primary appointments in 14 CWRU academic departments and at The Cleveland Clinic and University Hospitals. The interdisciplinary and collaborative features of the program are especially important, as students have easy access to other research groups with common interests and wide-ranging expertise in modern computational genomic approaches.

Our mission is to provide a sophisticated and engaging curriculum which affords trainees the opportunity to achieve excellence while preparing for a productive science-focused career. During the training period, our students can expect to:

- acquire core scientific knowledge in medical genetics and biostatistics.
- gain expertise in advanced computational genetics and genomics techniques.
- develop critical thinking and analysis skills.
- participate in activities to improve oral and written communication skills.
- participate in a hands-on clinically focused computational research project.
- participate in various professional development activities.

These six training objectives are integrated throughout the program, which includes rigorous graduate courses, journal clubs, a seminar program featuring student-invited outside speakers, a seminar program featuring student research presentations and hands-on research in laboratories with active, well-funded programs.

We offer our trainees research opportunities in many areas of computational genomics with a strong clinical focus. The diversity of approaches employed by the faculty provides trainees with both a wide range of exciting research projects to choose from, as well as exposure to ideas and approaches beyond their own research area. It is our conviction that the next generation of leaders in computational genetics will require knowledge in many areas, so that whatever their specific area of interest, they can effectively and easily draw on strategies, perspectives and precedents from a wide range of research approaches.

Learning Outcomes

- Students will gain fundamental background knowledge in genetics and genomics and more importantly, hands-on learning experience in genomics data management and analysis. Upon completion of the program, the graduates, well equipped with skills in bioinformatics and genomic data analytics, will enter the workforce in one of many fields in biomedical research, clinical care, and the public health arena.

Graduate Policies

For graduate policies and procedures, please review the **School of Graduate Studies** section of the General Bulletin.

Program Requirements

Code	Title	Credit Hours
Required Courses:		
GENE 500	Fundamentals and Current Topics in Genetics and Genomics Research	6
GENE 503	Readings and Discussions in Genetics	1
GENE 505	Genetics Journal Club	1
GENE 520	Computational Human Genomics and Epigenomics	4
GENE 523	Advanced Medical Genetics: Cytogenetics	1
GENE 524	Advanced Medical Genetics: Molecular Genetics	1
GENE 526	Advanced Medical Genetics: Genomics	1
GENE 530	Advanced Medical Genetics: Therapeutics	1
IBMS 500	On Being a Professional Scientist: The Responsible Conduct of Research	1
GENE 601	Research in Genetics	7
Electives		6
Total Credit Hours		**30**

Code	Title	Credit Hours
Approved Electives:		
GENE 451	A Data-Driven Introduction to Genomics and Human Health	3
GENE 525	Advanced Medical Genetics: Clinical Genetics	2-3
GENE 531	Cancer Genetics	2-3
PQHS 413	Introduction to Data Structures and Algorithms in Python	3

PQHS 431	Statistical Methods I	3
PQHS 432	Statistical Methods II	3
PQHS 452	Statistical Methods for Genetic Epidemiology	3

Sample Plan of Study

First Year		
Fall		**Credit Hours**
GENE 520	Computational Human Genomics and Epigenomics	4
GENE 523	Advanced Medical Genetics: Cytogenetics	1
GENE 524	Advanced Medical Genetics: Molecular Genetics	1
Elective		3
	Credit Hours	**9**
Spring		
GENE 500	Fundamentals and Current Topics in Genetics and Genomics Research	6
GENE 503	Readings and Discussions in Genetics	1
GENE 505	Genetics Journal Club	1
IBMS 500	On Being a Professional Scientist: The Responsible Conduct of Research	1
	Credit Hours	**9**
Second Year		
Fall		
GENE 526	Advanced Medical Genetics: Genomics	1
GENE 530	Advanced Medical Genetics: Therapeutics	1
GENE 601	Research in Genetics	4
Elective		3
	Credit Hours	**9**
Spring		
GENE 601	Research in Genetics	**3**
	Credit Hours	**3**
	Total Credit Hours	**30**