GENOMICS DATA SCIENCE, CERTIFICATE IN (GRADUATE CERTIFICATE)

The mission of the VCU Department of Biostatistics is to improve human health through methodological research, the education of graduate students and health science researchers in biostatistical methods and applications, and collaborative health sciences research.

Program goal

With the advent of sequencing technologies, genomic data science became a broad and interdisciplinary field with multiple points of entry, including biology, genetics and genomics, computer science, informatics, statistics and biostatistics, and others. As such, entry into the field can be confusing, especially for those looking to pursue further training, education or careers in this field. The purpose of the graduate Certificate in Genomics Data Science is to serve as a single point of entry for those interested in the field of genomics data science, which is defined as four domains: 1) biological principles of genomic science, 2) data analysis/statistical training, 3) principles of sequencing and bioinformatics and 4) computational principles and software tools.

The knowledge and skills acquired as a part of this certificate program will enable graduates to have better opportunities to be employed in medical centers and hospitals, data science-oriented departments in colleges and universities and government jobs. This training program is designed to be completed over two semesters covering 10 months.

Student learning outcomes

The purpose of the Certificate in Genomics Data Science is to train graduate students on the biological, DNA sequencing, bioinformatics and data analysis principles and procedures associated with applied genomics research and prepare them to apply those procedures to real data. Graduates will achieve the following learning outcomes:

1. Utilize the basic principles and methodologies of molecular biology and genetics, focusing on gene structure and function, epigenetics, gene expression, biochemical genetics and inborn errors of metabolism for therapeutic diagnostic decision-making
2. Receive training in the use of genomic technologies and software tools for data processing widely used in bioinformatics, and using the R programming language to learn computational methods and data manipulation principles, clustering, data visualization, and machine learning algorithms
3. Acquire the ability to use software packages to perform data analysis procedures and interpret the results, including descriptive statistics, tests of hypotheses and confidence intervals, analysis of variance, correlation and linear regression analysis, and quality control
4. Apply the knowledge and skills acquired in many high-demand areas, including genomic medicine, health care, pharmaceutics and medical manufacturing, and government

VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (http://www.graduate.vcu.edu/) and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

Visit the academic regulations section for additional information on academic regulations for graduate students. (http://bulletin.vcu.edu/academic-regs/)

Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the academic regulations section for additional information on graduation requirements. (http://bulletin.vcu.edu/academic-regs/grad/graduation-info/)

Apply online today. (https://www.vcu.edu/admissions/apply/graduate/)

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Certificate	Fall	July 1	

All successful applicants to this graduate certificate program are required to meet the admission requirements of the VCU Graduate School (http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/) and are expected to:

- Have earned an undergraduate degree in an area related to biology, bioinformatics, computer sciences, computational biology, applied mathematics, statistics or in another relevant discipline
- Have computing/technology skills that allow the student to learn and use several statistical software packages

Applicants must submit the following materials to VCU graduate admissions:

- Application form and application fee
- Three letters of recommendation, professional and/or academic

- Official transcripts from all undergraduate and graduate schools attended
- A statement of purpose outlining career goals
- A resume stating relevant work experience

Additionally, international applicants must:

- Submit official transcript evaluations from a recognized foreign educational credentials evaluation service accredited by the National Association of Credential Evaluation Service or the American Association of Collegiate Registrars and Admissions Officers
- Provide proof that they can support themselves financially for the duration of the program

Additionally, applicants that are non-native English speakers must demonstrate proficiency in English by providing one of the following:

- A Test of English as a Foreign Language minimum composite score of 100 for the Internet-based test or 600 for the paper-based score
- An International English Language Testing Systems minimum score of 6.5 on the academic exam
- A passing score on the VCU English Language Program compression test

Students must take one three-credit course from each of the domains of biological principles of genomic science, data analysis/statistical training, and principles of sequencing and bioinformatics analysis; two three-credit courses in the domain of computational principles and software tools; and at least one three-credit elective course from any domain.

Curriculum requirements

Course	Title	Hours
Biological principles of genomic science		
Select one from:		3
BIOL/BNFO 540	Fundamentals of Molecular Genetics	
BIOL 516	Population Genetics	
HGEN 501	Introduction to Human Genetics	
Data analysis/statistical training		
Select one from:		3
BIOS 543	Graduate Research Methods I	
BIOS 601	Analysis of Biomedical Data I	
HGEN 651	Statistics for Genetic Studies I	
STAT 641	Applied Data Analysis	
Principles of sequencing and bioinformatics analysis		
Select one from:		3
BIOS 658	Statistical Methods for High-throughput Genomics Data I	
BNFO 601	Integrated Bioinformatics	
Computational principles and software tools		
Select two from:		6
BNFO 600	Basic Scripting Languages	
HGEN 611	Data Science I	
HGEN 612	Data Science II	
Suggested electives		
Select three credits from:		3
BIOS/STAT 513	Mathematical Statistics I	
BIOS/STAT 514	Mathematical Statistics II	
BIOS 516	Biostatistical Consulting	
BIOS 544	Graduate Research Methods II	
BIOS 602	Analysis of Biomedical Data II	
BNFO 653	Advanced Molecular Genetics: Bioinformatics	
BIOS 668	Statistical Methods for High-throughput Genomic Data II	
CMSC 610	Algorithmic Foundations of Bioinformatics	
HGEN 502	Advanced Human Genetics	
HGEN 603	Mathematical and Statistical Genetics	
HGEN 652	Statistics for Genetic Studies II	
STAT 543	Statistical Methods I	
STAT 544	Statistical Methods II	
Total Hours		**18**

The minimum total of graduate credit hours required for this certificate is 18.

A maximum of six equivalent, graduate-level transfer credit hours at the 500 level or higher may count toward the certificate. The transfer credits are evaluated on a case-by-case basis to determine course equivalency. Credits from a degree already awarded cannot be applied toward the certificate.

Students who complete the requirements for this program will receive a Certificate in Genomics Data Science.

Contact
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