



**PROGRAM POLICY
STATEMENT
FOR
ONLINE
GRADUATE CERTIFICATE
IN
BIOMEDICAL INFORMATICS
AND DATA SCIENCE**

SEPTEMBER 15, 2019

I. PROGRAM HISTORY

A. RATIONALE

Modern medicine is being revolutionized by the advancement of the rapidly growing field of data science. Big data analysis, interpretation, integration, modeling and prediction hold promise to advance research on disease diagnosis and treatment and understanding of human health. Scientists have begun to systematically generate individualized profiles of health and disease by studying biomedical data at the global scales. Advances in high-throughput biotechnologies, genomic profiles, and large-scale bioscience have enabled multi-determinant relationships to customize medical treatment based on an individual's health profile. With the enormous volume of data being produced, biomedicine is becoming an increasingly quantitative science. Computational approaches, in combination with experimental methods, have become essential for generating novel hypotheses, deriving new scientific knowledge, and driving the best path to improve human health.

Biomedical Informatics and Data Science is an emerging and rapidly expanding field where biomedical research is used to compute, analyze, and interpret large scale data sets to have a substantial impact on improving human health. According to the American Medical Informatics Association (AMIA) and National Institutes of Health (NIH), the working definition of biomedical informatics and data science are as follows:

- *Biomedical Informatics*: A field that studies and pursues the effective uses of biomedical data, informatics, and knowledge for scientific inquiry, problem solving, and decision making, motivated by efforts to improve human health.
- *Data Science*: The interdisciplinary field of inquiry in which quantitative and analytical approaches, processes, and systems are developed and used to extract knowledge and insights from increasingly large and/or complex sets of data.

The University of Delaware currently does not offer an online Graduate Certificate in Biomedical Informatics and Data Science. The proposed Online BIDS-CERT in the biomedical informatics and data science discipline is essential for UD to meet industry's demand for professionals who have the ability to interpret complex biomedical data through their knowledge of data science methods and tools. The primary target audience for this new program is regional, national and international professionals working in fields ranging from genomics to pharmaceutical, health informatics, and biomedical research; having the potential to impact all areas of scientific research. A fully online Graduate Certificate program will allow us to better serve the needs of working professionals who often cite their inability to attend classes during normal working hours as the main barrier to graduate school enrollment. As such, we receive frequent inquiries for distance learning options from prospective students.

The Online Graduate Certificate program in Biomedical Informatics and Data Science (BIDS-CERT) is administered through its academic home, the Department of Computer & Information Sciences, and is coordinated by The Center for Bioinformatics and Computational Biology (CBCB). The development of new online courses in Biomedical Informatics & Data Science will further enable our faculty to enhance high-impact experiential learning, coupling lecture-based instructions with hands-on exercises and term projects with both team-based as well as individual e-learning. In

particular, we will engage team-teaching with research colleagues from Christiana Care Health Systems, Fox Chase Cancer Center, and other collaborating organizations (as UD adjunct faculty) to provide state-of-the-art course contents along with cutting-edge technologies and research applications.

The proposed Online BIDS-CERT thus offers several benefits to students:

- Earn credential from a highly reputable bioinformatics data science graduate program to advance career
- Earn graduate level college credits that can be applied towards a Master's or PhD degree program
- Gain core competency for rapidly growing biomedical informatics and data science job opportunities in fields from genomics, pharmaceuticals and health care to big data analytics
- Gain knowledge and experience ranging from genomics to pharmaceutical, health informatics, and biomedical research and practical data science skills for real-world applications
- Learn cutting-edge state-of-the-art course contents from nationally and internationally recognized researchers and practitioners in the field
- Learn in an interactive, experiential and multidisciplinary team environment that couples online instructions with hands-on exercises and term projects

B. DEGREE OFFERED

The program will offer the *Online Graduate Certificate in Biomedical Informatics and Data Science (BIDS-CERT)*.

II. ADMISSION

A. ADMISSION REQUIREMENTS

Admission to the graduate certificate program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.

The following are the admission requirements to the Online Graduate Certificate program in Biomedical Informatics and Data Science:

- A bachelor's degree at an accredited four-year college or university with a minimum grade average of 3.0 on a 4.0 system;
- Applicants must be in the last semester of undergraduate study or hold an undergraduate degree in biological, computational, or other disciplines. However, applicants are expected to have scholarly competence in mathematics, computer science and/or biology;
- GRE scores are recommended but may be waived upon application review;
- International student applicants must demonstrate a satisfactory level of proficiency in the English language if English is not the first language. The University requires an official paper-based TOEFL score of at least 550, or at least 79 on the Internet-based TOEFL. TOEFL scores more than two years old cannot be considered official;
- Two letters of recommendation are required. Ideally at least one letter is from professors,

the other letter can be from employers or others who have had a supervisory relationship with the applicant and are able to assess the applicant's potential for success in graduate studies;

- Applications must also include a resume outlining work and academic experience, as well as an application essay consisting of the answers to the following questions:
 1. What educational background and scientific research or employment experience prepare you for this bioinformatics graduate certificate program?
 2. What are your long-term professional objectives?
 3. What specific attributes of the program make you feel that this certificate is appropriate to help you achieve your professional objectives?

B. APPLICATION

Application to the Online Graduate Certificate program in Biomedical Informatics and Data Science (BIDS-CERT) will be submitted using the on-line graduate admission application that includes transcripts from all previous college or university study, letters of recommendation, resume, application essay, and official GRE scores and TOEFL scores (if applicable). If any part of an application is missing, evaluation of the application cannot begin. The applicant will apply to the Center for Bioinformatics and Computational Biology.

B.1. APPLICATION DEADLINES

Admission decisions are made on a rolling basis as and when applications are complete. The central graduate admissions office continues to process applications and transcripts throughout the year and follows the stated two (2) week processing timeline for all materials received in the office.

The application deadlines are:

- Fall Semester: July 1st
- Spring Semester: December 1st

B.2. CHANGE OF CLASSIFICATION

Students currently matriculated in other graduate degree programs on campus at University of Delaware who are interested in a bioinformatics graduate certificate program will be encouraged to consider the existing on-campus Graduate Certificate in Bioinformatics (BINF-CERT). They will be permitted to seek approval to enter the Online Graduate Certificate program in Biomedical Informatics and Data Science (BIDS-CERT) only in exceptional cases and will require a case-by-case review. Students matriculated in other online graduate degree programs at University of Delaware may apply to the online BIDS-CERT program.

C. ADMISSION STATUS

Students may be admitted into the Online Graduate Certificate program in Biomedical Informatics and Data Science (BIDS-CERT) with regular status or provisional status.

Regular. Regular status is offered to students who meet all of the established entrance

requirements, who have a record of high scholarship in their fields of specialization, and who have the ability, interest, and maturity necessary for successful study at this graduate level program.

Provisional. Provisional status is offered to students who are seeking admission to the program but lack one or more of the specified prerequisites. All provisional requirements must be met within the deadline given before regular status can be granted. Students who file an application during the final year of undergraduate work and are unable to supply complete official transcripts showing the conferral of the degree will be admitted pending conferral of the degree if their records are otherwise satisfactory and complete.

III. ACADEMIC

A. DEGREE REQUIREMENTS

Online BIDS-CERT: Degree Requirement	
Biomedical Informatics and Data Science Core	12 Credits

B. COURSE CURRICULUM

The tables below list the course curriculum of the Online Graduate Certificate program in Biomedical Informatics and Data Science.

Online BIDS-CERT: Course Curriculum
Data Science Core (6)
BINF601: Introduction to Data Science (3)*
BINF610: Applied Machine Learning (3)*
BINF611: Introduction to Data Science with Online Competitions (1)*
BINF620: Big Data Analytics in Biomedicine and Health (3)*
Biomedical Informatics Core (6)
BINF644: Bioinformatics (3)
BINF694: Systems Biology (3)
BINF640: Database for Bioinformatics (3)
BINF690: Programming for Bioinformatics (3)

**Permanent course proposal in progress*

COMMITTEE AND DIRECTOR

The development, administration and progress assessment of the Online Graduate Certificate program in Biomedical Informatics and Data Science will be guided by the Bioinformatics Graduate Committee and the Director of the Online Graduate Certificate program in Biomedical Informatics and Data Science.

The Graduate Committee will be responsible for admission, advising, and progress assessment of the students in the Online Graduate Certificate program. The Director will be responsible for the overall implementation, quality and progress of the degree program. The Assistant Director of the Graduate Education and Outreach at the Center for Bioinformatics and Computational Biology will provide day-to-day program management and assist with student recruitment, admission, advising, progress assessment, and career planning.

C. SATISFACTORY PROGRESS

C.1. ACADEMIC LOAD

The course curriculum of the Online Graduate Certificate in Biomedical Informatics and Data Science consists of four graduate level courses that can be taken in any order. Each course will be offered annually during either Fall or Spring semester. At least two courses will be offered each semester so that the Certificate program can be completed in as little as one year.

C.2. TRANSFERABILITY

Prior to admission to the Online Graduate Certificate program in Biomedical Informatics and Data Science, a prospective student from another institution can be approved by the Bioinformatics Graduate Committee to take up to 6 graduate credits that, if/when admitted to the program, would be applied to the Graduate Certificate. Students who complete graduate credits with the classification of CEND (Continuing Education Non-degree) at the University of Delaware may use a maximum of 6 graduate credits earned with this classification toward their Graduate Certificate.

All requests for transfer credit should be directed to the academic program, Center for Bioinformatics and Computational Biology, using a "Request for Transfer of Graduate Credit" Form. Transfer credits will be accepted provided that such credits: (i) were earned with a grade of no less than B, (ii) are approved by the Bioinformatics Graduate Committee, (iii) are in accord with the Program Policy Statement of the Online Graduate Certificate program in Biomedical Informatics and Data Science, (iv) are not older than five years, (v) are graduate level courses, and (vi) were completed at an accredited college or university. Graduate courses counted toward a degree received elsewhere may not be transferred into a degree at UD. Credits from institutions outside of the United States are generally not transferable to UD.

C.3. GRADE REQUIREMENTS

Each certificate program course must be completed with a grade no lower than a B-; the overall GPA of the Certificate program in Biomedical Informatics and Data Science courses must be no lower than 3.0. Students receiving a C or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Bioinformatics Graduate Committee for approval to retake the course and remain in the program if the appeal is approved.