INTERDISCIPLINARY STUDIES: SPECIALIZATION IN BIOINFORMATICS (PHD)

Doctor of Philosophy in Interdisciplinary Studies, specialization in Bioinformatics
Unit: Graduate School (http://louisville.edu/graduate/) (GI)
Program Website (https://louisville.edu/graduate/futurestudents/degree-programs-1/igp/)
Academic Plan Code(s): IS_ _PHDINF

Program Information

The Interdisciplinary PhD Program in Bioinformatics (the Bioinformatics Program) trains students in bioinformatics for careers in research, education, and industry. Bioinformatics is a broad and diverse domain, ranging from management of biological research databases to computational approaches to biomedical modeling and data analysis.

The Bioinformatics Program focuses on those aspects of bioinformatics that reflect the research interests and experience of the Program's faculty. These include basic research in biostatistical methodology, computer science and mathematical modeling with applications to biochemistry, cell biology, and molecular biology. The following areas have been identified and named by the Bioinformatics Program faculty to represent the focus application areas of the Program:

- Biomedical and Natural Sciences
- Computational Sciences
- Mathematics and Statistics

Students in the Bioinformatics Program specialize in one of the three focus application areas and graduate with cutting-edge expertise in this area and working knowledge in the other two focus application areas.

To earn the Doctor of Philosophy in Interdisciplinary Studies, specialization in Bioinformatics, a student is required to successfully complete the following:

- Core coursework in the focus application areas
- Required coursework in the student's area of specialization
- Elective courses in the student's area of specialization
- Qualifying examination
- Dissertation
- Presentation and defense of a dissertation

Upon successful completion of the written and oral portions of the qualifying examination, the examination committee will recommend acceptance into PhD candidacy. Successful completion of the dissertation and its presentation and defense is established by the approval of the student's dissertation committee and the approval of the chair of the sponsoring department and the program chair.

Admission Requirements

Applicants for interdisciplinary doctoral programs must present complete admission credentials and have an approved program of study in order to be formally admitted by the Graduate School (http://louisville.edu/graduate/).

- Complete graduate application (http://louisville.edu/graduate/futurestudents/apply-materials/application/).
- A 3.25 grade point average.
- Competitive scores on the Quantitative, Verbal, Critical Thinking and Analytical portions of the Graduate Record Exam (GRE).
- Proof of a Baccalaureate Degree and official transcripts of all undergraduate and graduate course work.
- International students for whom English is not their primary language must show English language proficiency by one of the following:
  - TOEFL examination score 213 (computer-based test) or 79 (internet-based test)
  - IELTS test score of 6.5 or higher
  - Duolingo score of 105.
  - Demonstration of a degree awarded from an acceptable English language institution.
- Three letters of recommendation from individuals who are able to comment on the student's academic abilities and a potential for success in graduate studies.

Programs of Study

Course requirements for the Interdisciplinary PhD Degree Program in Bioinformatics consist of 16 core credit hours (that will be conditional based upon focus area) and 21 credit hours derived from a combination of required courses from a chosen focus area and electives from each of the three focus areas. Students with an appropriate background in the biomedical and natural sciences may petition to substitute a course in either the Computational Sciences or Mathematics and Statistics focus for the core course BIOC 545 and a corresponding course in either the Computational Sciences or Mathematics and Statistics, thus maintaining 16 core credit hours. Following acceptance into a focus area, students will be required to complete three courses totaling at least nine hours from the declared focus area. At least four additional elective courses (12 credit hours) will be selected from available elective courses, with the provision that two elective courses must be selected in each of the other two focus areas. The Program of Study will be determined by the student and approved by both an advisor residing in a declared focus area department and the Executive Committee. The following tables list the required courses for the core as well as the required and elective courses in each of the focus areas. Students must accumulate at least nine (9) credit hours of dissertation.

Good standing requires that the student maintain a minimum 3.0 grade point average. Upon successful completion of the written and oral portions of the qualifying examination, the examination committee will recommend acceptance into PhD candidacy. Successful completion of the dissertation and its presentation and defense is established by the approval of the student's dissertation committee and the approval of the chair of the sponsoring department and the program chair.

Code	Title	Hours
Core Course Work		**16**
BIOC 545	Biochemistry I [1,2,3]	
or BIOC 667	Cell Biology	
BIOC 667	Cell Biology [1,2,3]	
BIOC 630	Responsible Conduct of Research: Survival Skills and Research Ethics [1]	
CSE 619	Design and Analysis of Computer Algorithms	
or CSE 632	Data Mining	
CSE 660	Introduction to Bioinformatics [1]	

PHST 750	Statistics for Bioinformatics	
Focus Area & Electives (see lists below)		**21**
Focus Area (minimum three courses) [4]		
Electives (minimum four courses) [4]		
Dissertation		**9**
Minimum Total Hours		**46**

[1] All courses are required.
[2] CHEM 645 may be substituted. Students may take either the BIOC 545/BIOC 547 or CHEM 645/CHEM 647 sequence but are not allowed to take the sequence BIOC 545/CHEM 647 or CHEM 645/BIOC 547.
[3] Students with an appropriate background in the biomedical and natural sciences may petition to substitute a course in either the Computational Sciences or Mathematics and Statistics focus.
[4] Courses selected with approval of advisor and the Executive Committee
[5] At least one elective course must be selected from each of the other two focus areas other than the student's primary focus area.

Focus Area Electives

Code	Title	Hours
Elective Courses in Mathematics and Statistics		
MATH 505	Introduction to Partial Differential Equations	3
MATH 561	Probability [1]	3
PHYS 565	Advanced Computational and Numerical Methods in Physics	3
PHYS 625	Statistical Mechanics	3
MATH 636	Mathematical Modeling II	3
PHST 661	Probability [1]	3
PHST 662	Mathematical Statistics [1]	3
MATH 562	Mathematical Statistics [1]	3
MATH 681	Combinatorics and Graph Theory I	3
MATH 682	Combinatorics and Graph Theory II	3
PHST 682	Multivariate Statistical Analysis	3
PHST 691	Bayesian Inference and Decision	3
PHST 710	Advanced Statistical Computing I	3
PHST 724	Advanced Clinical Trials	3
PHST 762	Advanced Statistical Inference	3
PHST 751	High-throughout Data Analysis	3
PHST 752	Statistical Genetics	3
PHST 780	Advanced Nonparametrics	3
PHST 781	Advanced Linear Models	3
PHST 782	Generalized Linear Models	3

[1] Credit only for one: MATH 561/PHST 661; MATH 562/PHST 662

Code	Title	Hours
Elective Courses in Biomedical and Natural Sciences		
BIOL 542	Gene Structure and Function - WR (http://catalog.louisville.edu/undergraduate/general-education-requirements/)	3
BIOL 569	Evolution	3
BIOC 680	Biomolecular Interactions	2
BIOC 611	Techniques in Biomolecular Interactions	4
ASNB 614	Molecular Neuroscience	4
BIOC 647	Advanced Biochemistry II [1]	4
CHEM 647	Advanced Biochemistry II	4
BIOC 661	Molecular Mechanisms of Toxicology	3
BIOC 668	Molecular Biology	4

[1] Credit only for one: CHEM 645/BIOC 645, CHEM 647/BIOC 647. Students may take either the BIOC 545/BIOC 547 or CHEM 645/CHEM 647 sequence but are not allowed to take the sequence BIOC 545/CHEM 647 or CHEM 645/BIOC 547.

Code	Title	Hours
Elective Courses in Computational Sciences		
CSE 625	Parallel Programming	3
CSE 619	Design and Analysis of Computer Algorithms	3
CSE 622	Simulation and Modeling of Discrete Systems	3
CSE 627	Digital Image Processing	3
CSE 628	Computer Graphics	3
CSE 629	Distributed System Design	3
CSE 630	Advanced Databases	3
CSE 632	Data Mining	3
CSE 641	Medical Imaging Systems	3