Master of Science in Computational Biology

Computational Biology Graduate Program

Computational Biology is an interdisciplinary science at the interface of biology, chemistry, medicine, mathematics, and computer science. Its goal is development and application of computational approaches to studies of life processes and improvement of human health and living conditions on Earth. In this current era of artificial intelligence and structural biology, the training of a new Master's-level cadre in computational biology is of primary importance to basic, clinical and applied science in academia, industry, and many other segments of society.

The Computational Biology Program carries out fundamental research in life sciences, develops computer modeling approaches, fosters community-wide activities in computational biology and provides education for the new generation of researchers. The Program is an academic unit with tenure track/tenured faculty appointments.

Admission to Graduate Studies

Admission Requirements

- All applicants must meet the requirements outlined in the Admission to Graduate Study (https://policy.ku.edu/graduate-studies/admission-to-graduate-study/) policy.
- Bachelor's degree: A copy of official transcripts showing proof of a bachelor's degree (and any post-bachelor's coursework or degrees) from a regionally accredited institution, or a foreign university with equivalent bachelor's degree requirements is required.
- English proficiency: Proof of English proficiency (https://gradapply.ku.edu/english-requirements/) for non-native or non-native-like English speakers is required. There are two bands of English proficiency, including Admission and Full proficiency. For applicants to online programs, Full proficiency is required.

M.S. Admission

Admission Requirements

Applicants must have a bachelor's degree in natural sciences, mathematics, engineering, or another relevant field. Applications are accepted online (https://gradapply.ku.edu/apply/).

Non-Degree Seeking Admission

Students who are interested in enrolling in graduate level coursework in the Department of Computational Biology without formal admission to a graduate program at KU are encouraged to apply for graduate non-degree seeking student status. See the department's admission webpage (http://compbio.ku.edu/apply-0/) for further details.

Computational Biology Master's Program requirements

1. Attendance at Computational Biology seminar each semester.
2. Students must pass a Comprehensive Oral Exam.
3. Students must complete and submit a research thesis for the Master's thesis defense.
4. Students must defend their Master's thesis.
5. Students must complete the degree within 4 years. Exceptions to this requirement require a recommendation for extension of study by the program's Graduate Studies Coordinator and the Director of the Computational Biology Program, and approval by the College Graduate Office.

Required courses

At least one laboratory rotation is required during the first year. In addition, each of the following courses should be completed. Waivers from these requirements will be considered on a case by case basis. The Executive Committee and the Advisor may recommend additional required coursework and may waive any requirements based on student's previous academic coursework.

Code	Title	Hours
Required Courses		
BINF 701	Computational Biology I	5
BINF 702	Computational Biology II	5
BINF 709	Topics in: _____	1-3
BIOL 636	Biochemistry I	4
BIOL 638	Biochemistry II	4
CHEM 816	Careers in the Biomedical Sciences	1-3
or BIOL 817	Rigor, Reproducibility and Responsible Conduct in Research	
Elective Courses		**12**
Given the diverse background of potential applicants the program will have a broad range of courses. Student must complete a minimum of 12 credit hours of elective coursework (generally, 6 of Biology/Chemistry and 6 of Analysis/Mathematics/Statistics). As the result of the coursework, the students are expected to master Computational Biology methodology and applications, and to be proficient in the physicochemical and biological principles of molecular systems, applied mathematical/statistical analyses and scientific software development. Other courses may be used to substitute these requirements with the approval of the thesis advisor and the Executive Committee.		
Biology/Chemistry		
BIOL 772	Gene Expression	
BIOL 750	Advanced Biochemistry	
CHEM 510	Biological Physical Chemistry	
CHEM 760	Introduction to Chemistry in Biology	
CHEM 860	Principles and Practice of Chemical Biology	
CHEM 914	Computational Methods in Physical Sciences	
Analysis/Mathematics/Statistics		
C&PE 778	Applied Optimization Methods	
MATH 526	Applied Mathematical Statistics I	
MATH 581	Numerical Methods	
MATH 590	Linear Algebra	
MATH 605	Applied Regression Analysis	
MATH 727	Probability Theory	
MATH 728	Statistical Theory	
MATH 781	Numerical Analysis I	
MATH 865	Stochastic Processes I	
EECS 649	Introduction to Artificial Intelligence	

EECS 658	Introduction to Machine Learning	
Total Hours		**32-36**

At least 50% of the coursework taken to fulfill the degree requirements must be 700 level or above.

Research proposal requirement

Students must complete and submit a research proposal for the Comprehensive Oral Examination. This proposal will be written in the format of a National Institutes of Health (NIH) or National Science Foundation (NSF) grant proposal. The proposal must develop a research topic related to the general areas of computational biology. The topic of the research proposal is decided upon by the student in consultation with the Advisor. The completion of the research proposal is required before scheduling the Comprehensive Oral Examination.

Comprehensive oral examination

Once master's students have successfully completed the required formal courses, research proposal requirement, the Comprehensive Oral Examination will be scheduled. This examination must be held in the same semester as the final semester of coursework. Exceptions to this deadline require approval by the student's Executive Committee and the Graduate Studies Coordinator. The exam is given by the Comprehensive Oral Exam Committee. The student's Advisor must be a member of the Committee. At least two Computational Biology Program core faculty members must be on the Committee. The Committee must be chaired by a member who is a core faculty member of the Computational Biology Program, but not the student's Advisor. After the exam, the committee members will decide whether or not the student passed.

The Graduate Program Assistant will forward this decision to the College Graduate Office. The exam must be scheduled with the College Graduate Office at least two weeks before the exam actually takes place. This means that, after receiving approval from the Advisor and Comprehensive Oral Exam Committee, the student must notify the Graduate Program Assistant to get scheduling assistance (date, time, location) and complete the Do-All form to send to the College Graduate Office.

Exam Format - The committee will examine the student with respect to more general subject areas associated with the student's research, formal coursework and scientific literature of the discipline. Performance on the examination will be rated as "Honors," "Satisfactory" or Unsatisfactory" and this rating will be submitted to the College Graduate Office. If the student receives a rating of "Unsatisfactory" on the first Comprehensive Oral Exam, he/she may retake the exam no earlier than one (1) month, but no later than five (5) months after the date of the first exam. If the student does not retake the exam by the five-month time limit, he/she will not be allowed to complete the Master's program. If there are unusual circumstances, the student may, with approval from the mentor and the Comprehensive Oral Exam Committee, petition the Executive Committee of the Program to retake the oral comprehensive examination after the five-month time limit. Under no circumstances the student will be allowed to take the Comprehensive Oral Examination more than twice. If the student fails to receive a rating of at least "Satisfactory" after the second attempt, he/she will not receive a master's degree.

Master's thesis defense

Once master's students have successfully completed the required formal courses, research proposal requirement, the Master's thesis defense will be scheduled. This defense must be held in the same semester as the final semester of coursework. Exceptions to this deadline require approval by the student's Executive Committee and the Graduate Studies Coordinator. The defense is given by the Master's Thesis Defense Committee. The student's Advisor must be a member of the Committee. At least two Computational Biology Program core faculty members must be on the Committee. The Committee must be chaired by a member who is a core faculty member of the Computational Biology Program, but not the student's Advisor. The Master's Thesis Defense Committee may be the same or different from the Comprehensive Oral Exam Committee. The Master's thesis must be describe completed research done by the student that is either experimental/computational or research on existing literature in the computational biology field. The student must provide each committee member with a final copy of the thesis at least 3 weeks before the exam takes place. After the exam, the committee members will decide whether or not the student passed.

The Graduate Program Assistant will forward this decision to the College Graduate Office. The defense must be scheduled with the College Graduate Office at least two weeks before the exam actually takes place. This means that, after receiving approval from the Advisor and Master's Thesis Defense Committee, the student must notify the Graduate Program Assistant to get scheduling assistance (date, time, location) and complete the Do-All form to send to the College Graduate Office.

The student will defend his/her research to the Master's Thesis Defense Committee.

Defense Format – The student will orally present their thesis to the committee and the committee will examine the student on the research presented in their Master's Thesis. The defense may be scheduled for the same day or a different day from the Comprehensive Oral Examination. Performance on the defense will be rated as "Honors," "Satisfactory" or Unsatisfactory" and this rating will be submitted to the College Graduate Office. If the student receives a rating of "Unsatisfactory" on the first Master's Thesis Defense, he/she may retake the defense no earlier than one (1) month, but no later than five (5) months after the date of the first defense. If the student does not retake the defense by the five-month time limit, he/she will not be allowed to complete the Master's program. If there are unusual circumstances, the student may, with approval from the mentor and the Master's Thesis Defense Committee petition the Executive Committee of the Program to retake the Master's Thesis Defense after the five-month time limit. Under no circumstances the student will be allowed to take the Master's Thesis Defense more than twice. If the student fails to receive a rating of at least "Satisfactory" after the second attempt, he/she will not receive a master's degree.

Year 1

Fall	Hours	Spring	Hours
BINF 701	5	BINF 702	5
BINF 709	1	BIOL 636	4
Elective Course	3		
	9		**9**

Year 2

Fall	Hours	Spring	Hours
BIOL 638	4	BIOL 817 or CHEM 816	3
Elective Course	3	Elective Course	3
Elective Course	3		
	10		**6**

Total Hours 34

At the completion of this program, students will be able to:

- Understand general concepts in computational biology in current knowledge in the student's specific research area.
- Develop the ability to apply research methods and design experiments.
- Interpret results and formulate testable hypotheses.
- Have awareness of broader significance and effective communication to a wide audience.