Program Approval

I. General Information

A. Institution University of Kansas

B. Program Identification

Degree Level:	Master's
Program Title:	Computational Biology
Degree to be Offered:	Master of Science in Computational Biology
Responsible Department or Unit:	College of Liberal Arts and Sciences/ Computational Biology Program
CIP Code:	26.1104
Modality:	Face-to-Face
Proposed Implementation Date:	Fall 2026

Total Number of Semester Credit Hours for the Degree: 32

II. Clinical Sites: Does this program require the use of Clinical Sites? No

III. Justification

Computational Biology is an interdisciplinary science at the interface of biology, chemistry, medicine, mathematics, and computer science. Its goal is the 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 current need for this master's program is threefold: 1) Provide training in Kansas to prepare for predicted job market growth, 2) increase recruitment of competitive PhD students, and 3) increase support for existing students.

1) Providing training in Kansas to prepare for predicted job market growth is described in *section IV*.

2) With respect to increasing recruitment of competitive PhD students smart, self-aware students want to have plans and contingency plans. They may be excited about, and prepared for, earning a PhD. However, they are also aware that five to six years (average PhD duration) is a long commitment and that life is unpredictable. KU has not yet found another competing PhD program that does not have an off-ramp to a master's option. Though KU has world class, highly funded faculty in Computational Biology, asking students to choose our program that does not have a master's over competing programs where there is a contingency plan for a master's degree is increasingly difficult. Offering a master's degree will allow us to be competitive with other universities.

3) Finally, a master's option will increase support for existing students. PhD programs entail considerable time and challenges. Students may face various difficulties such as health or family issues or a change with their research focus prompting them to consider alternative paths. Even if they ultimately choose not to pursue a master's degree, having the option provides reassurance during challenging times.

Ultimately, this master's will be used to confer a credential to those who have already earned it to help them find suitable employment when they are unable to complete the doctoral program

IV. Program Demand:

Market Analysis

This Master's in Computational Biology will provide training in Kansas to prepare for predicted job market growth. KU commissioned a Lightcast analysis that demonstrates this.

Lightcast (2024) predicts an +8.3% growth of natural science managers over the next five years and a +7.43% growth of biological scientists over the next five years. The proposed master's program will help take advantage of this growth industry by providing training in increasingly high demand skills.

The following are skills that this program would train in (specialized skills, general skills, and software skills) that are predicted by Lightcast (2024) to be growing with respect to the market:

- Specialized skills in growth areas will include: Biology (25.7% projected skill growth), data analysis (25.8% projected skill growth), molecular biology (+16.0% projected skill growth), and data management (+19.9% projected skill growth).
- With respect to top common skills, the program will teach the following skills: research (+17.2% projected skill growth), writing (+11.8% projected skill growth), presentations (+23.0% projected skill growth), and problem solving (+11.3% projected skill growth).
- Software skills taught will include: Microsoft Power Point (+26.1% projected skill growth), and python programming (+24.5% projected skill growth).

This proposed master's program aims to attract top computational biology talent that may otherwise opt for enrollment in other Computational Biology PhD programs. Virtually all other PhD programs housed in colleges of arts and sciences at all competing universities offer terminal master's for those who wish to not complete their PhD. Even at KU, Computational Biology is the only PhD program in the College of Liberal Arts & Sciences that does not provide the option of leaving with a master's degree after completing coursework. Indeed, every other PhD program at KU-Lawrence has a master's program option. These programs increase interest in the PhD because they provide additional options for unknown futures.

It is notable that every single peer institution with a Computational Biology PhD program has such a master's degree option. This includes: University of Pittsburgh, Duke University, Brown University, and Carnegie Melon University. No other computational biology programs exist in the state or surrounding ones (Colorado, Missouri, Nebraska, Oklahoma).

This master's will support the recruitment of excellent PhD students and will give students an option that demonstrates their mastery of the subject should they decide to not continue to pursue the PhD.

V. Projected Enrollment for the Initial Three Years of the Program

Year	Total Headcount Per Year		Total Sem Credit Hrs Per Year	
	Full- Time	Part- Time	Full- Time	Part- Time
Implementation	1	0	15	0
Year 2	1	0	15	0
Year 3	1	0	15	0

VI. Employment

Graduates with a Master's Computational Biology have Lightcast-predicted growth skills and unique expertise in both molecular biology and computational techniques, positioning them for a variety of specialized roles in Kansas, particularly within growth sectors like healthcare, research, and biotechnology. Some potential career options include:

1. **Computational Biologist** – Computational biologists apply mathematical and computational approaches to biological data, often to understand complex biological systems. They can find roles in Kansas with research institutions, pharmaceutical companies, and agricultural biotechnology firms.
2. **Bioinformatics Engineer** – In this role, professionals design and implement software tools to manage and interpret biological data. Bioinformatics engineers are in demand in biotech companies, universities, and hospitals working on genomic research, drug discovery, and precision medicine.
3. **Proteomics Data Scientist** – Proteomics specialists analyze protein data to understand protein structure and function. This expertise is valuable in biomedical research, pharmaceutical development, and biotech firms focusing on drug discovery or biomarker research.
4. **Systems Biologist** – Systems biologists study interactions within biological systems, integrating molecular biology and computational techniques to understand complex processes in cells or ecosystems. Research institutions and biotechnology companies in Kansas may hire systems biologists for projects on human health, plant biology, or microbiology.
5. **Biopharmaceutical Scientist** – In the pharmaceutical industry, these scientists contribute to the development of new drugs by analyzing molecular data and conducting computational simulations. Kansas-based pharmaceutical companies and research organizations may hire for this role.
6. **Biomedical Research Technician** – In academic labs, hospitals, or biomedical companies, research technicians work on projects involving molecular biology and genetics, supporting research that may include analyzing DNA, RNA, or protein samples. With computational skills, they can also contribute to managing and analyzing data, which is highly valuable in precision medicine and genomics research.

These careers allow graduates to apply their specialized knowledge of molecular biology and computational analysis to address critical issues in healthcare, research and biotechnology, directly benefiting Kansas industries and communities.

VII. Admission and Curriculum

A. Admission Criteria

Accepted students must fulfill standard admission requirements of the College of Liberal Arts & Sciences Graduate Office:

- Proof of a bachelor's degree (and any post-bachelor's coursework or degrees) from a regionally accredited institution, or a foreign university with substantially equivalent bachelor's degree requirements
- Proof of English proficiency for non-native or non-native-like English speakers

- Additional requirements of the program:
  - Overall undergraduate GPA: ~ 3.5 (out of 4.0)
  - Personal statement about candidate's career goals
  - Bachelor's degree in natural sciences, mathematics, engineering, or another relevant field
  - Three letters of recommendation
  - English proficiency scores according to the College Graduate Office requirements for non-native speakers.

B. Curriculum

The program accepts students with a variety of backgrounds (expertise in chemistry, biology, computer science, or math), interests (algorithm development or algorithm implementation), and skills (those gifted in communication or coding), so ideal curriculum varies from student to student. Each student's curriculum is custom-tailored by the student in collaboration with their advisor to address any deficits from their undergraduate work and to prepare them to succeed as a scientist. Below is a sample semester-by-semester plan for the degree:

Year 1: Fall **SCH = Semester Credit Hours**

Course #	Course Name	SCH = 9
BINF 701	Computational Biology I	5
BIOL 636	Biochemistry I	4

Year 1: Spring

Course #	Course Name	SCH = 8
BINF 702	Computational Biology II	5
	Elective	3

Year 1: Summer

Course #	Course Name	SCH = 1 or 3
CHEM 816 or BIOL 817	Careers in Biomedical Sciences or Rigor, Reproducibility and Responsible Conduct of Research	1 or 3

Year 2: Fall

Course #	Course Name	SCH = 7
BINF 709	Topics in Computational Biology	1
	Electives	6

Year 2: Spring

Course #	Course Name	SCH = 7
BIOL 638	Biochemistry II	4
	Elective	3

Total Number of Semester Credit Hours ……. 32-34

VIII. Core Faculty

Note: * Next to Faculty Name Denotes Director of the Program, if applicable
FTE: 1.0 FTE = Full-Time Equivalency Devoted to Program

Faculty Name	Rank	Highest Degree	Tenure Track Y/N	Academic Area of Specialization	FTE to Proposed Program
Joanna Slusky	Professor	PhD	Y	Computational biology—protein docking	0.10
Ilya Vakser*	Professor and Director	PhD	Y	Computational docking—protein design	0.20
Erik Holmstrom	Assistant Professor	PhD	Y	RNA structure and protein interactions	0.10
Roberto De Guzman	Professor	PhD	Y	Nuclear magnetic resonance spectroscopy of proteins	0.10

Number of graduate assistants assigned to this program **…… 0**

IX. Expenditure and Funding Sources

A. EXPENDITURES	First FY	Second FY	Third FY
Personnel – Reassigned or Existing Positions			
Faculty	$68,219	$137,328	$137,328
Administrators *(other than instruction time)*	$0	$0	$0
Graduate Assistants	$0	$0	$0
Support Staff for Administration (*e.g., secretarial*)	$0	$0	$0
Fringe Benefits *(total for all groups)*	$21,830	$43,945	$43,945
Other Personnel Costs			
Total Existing Personnel Costs – Reassigned or Existing	$90,049	$181,273	$181,273
Personnel – New Positions			
Faculty	0	0	0
Administrators *(other than instruction time)*	0	0	0
Graduate Assistants	0	0	0
Support Staff for Administration (*e.g., secretarial*)	0	0	0
Fringe Benefits *(total for all groups)*	0	0	0
Other Personnel Costs	0	0	0
Total Existing Personnel Costs – New Positions	0	0	0
Start-up Costs - One-Time Expenses			
Library/learning resources	0	0	0
Equipment/Technology	0	0	0
Physical Facilities: Construction or Renovation	0	0	0
Other	0	0	0
Total Start-up Costs	0	0	0
Operating Costs – Recurring Expenses			
Supplies/Expenses	0	0	0
Library/learning resources	0	0	0
Equipment/Technology	0	0	0
Travel	0	0	0
Other	0	0	0
Total Operating Costs	0	0	0
GRAND TOTAL COSTS	$90,049	$181,273	$181,273

B. FUNDING SOURCES *(projected as appropriate)*	Current	First FY (New)	Second FY (New)	Third FY (New)
Tuition / State Funds		$16,269	$16,269	$16,269

Student Fees		$150	$150	$150
Other Sources				
GRAND TOTAL FUNDING		$16,419	$16,419	$16,419
C. Projected Surplus/Deficit (+/-) (Grand Total Funding *minus* Grand Total Costs)		-$73,630	-$164,854	-$164,854

X. Expenditures and Funding Sources Explanations
Costs of reallocated personnel expenditures are listed; however, these expenses are already incurred for the doctoral program which averages ten majors annually.

A. Expenditures
Personnel – Reassigned or Existing Positions
KU will use existing infrastructure including faculty and staff time. Director Ilya Vakser will be responsible for reviewing and maintaining the academic catalog, updating and submitting assessment materials, and advising on academic requirements for students who have been counseled or have chosen to switch to the master's.

The Computational Biology program will not be creating new materials, as this degree would only be used for students who are recruited to the existing Computational Biology PhD program who decide that they would like to leave after having completed their coursework but before defending their dissertation. All of the courses in the master's degree are already being taught, but we included the instructional costs in the expenditures even though they will be incurred for the PhD program regardless of whether we add the master's degree.

Personnel – New Positions
No new faculty, staff hires, recruitment materials, facilities, or equipment will be necessary to offer this master's degree.

Start-up Costs – One-Time Expenses
No new faculty, staff hires, recruitment materials, facilities, or equipment will be necessary to offer this master's degree.

Operating Costs – Recurring Expenses
There are no recurring operating expenses.

B. Revenue: Funding Sources
The Master's in Computational Biology degree will be funded through standard tuition and fee revenue for students admitted to the doctoral program. 2024-2025 standard tuition for Lawrence Campus graduate students is $453.30 per credit hour for resident students and $1,084.60 per credit hour for non-resident students. Non-resident tuition rates were used for these calculations. Student fees were calculated based on the $10 per credit hour course fee for CLAS effective Fall 2024.

C. Projected Surplus/Deficit
Year 1: -$71,441
Year 2: -$147,341
Year 3: -$147,341

XI. References
Lightcast Report. Program Overview; Data Analytics. Lightcast Q3 2024 Data Set. September 2024.