Rensselaer

COMPUTATIONAL BIOLOGY B.S. – FALL 2023

Computational biology is the study of biological systems through computational and statistical modeling of large data sets. Students gain knowledge in biology, computer science, and information technology. This program trains next-generation biologists who can harness the ever-rising computational power and tools to solve crucial biological problems to change the world.

FIRST YEAR

Fall			Spring		
Number	**Course**	**CR**	**Number**	**Course**	**CR**
BIOL 1010	Introduction to Biology[1]	3	BIOL 2120	Introduction to Cell & Molecular Biology[1]	3
BIOL 1015 **or** BIOL 1016	Introduction to Biology Laboratory **or** Intro to Computational Biology Lab[2]	1	BIOL 2125	Intro to Cell & Molecular Biology Lab	1
CHEM 1110	Chemistry I with Advanced Lab	4	CHEM 1200	Chemistry II	4
MATH 1010	Calculus I	4	CSCI 1100	Computer Science I[4]	4
	HASS Core Elective[3]	4	MATH 1020	Calculus II	4

SECOND YEAR

Fall			Spring		
Number	**Course**	**CR**	**Number**	**Course**	**CR**
CHEM 2250	Organic Chemistry I	3	CHEM 2260	Organic Chemistry II	3
CHEM 2230	Organic Chemistry Lab I	1	CHEM 2240	Organic Chemistry Lab II	1
PHYS 1100	Physics I	4	PHYS 1200	Physics II	4
BIOL 2500	Genetics and Evolution	4	BIOL 4620	Molecular Biology	4
	HASS Core Elective[3]	4		HASS Core Elective[3]	4

THIRD YEAR (WITH 3RD YEAR FALL SEMESTER AWAY)

The Arch Summer Semester			Spring		
Number	**Course**	**CR**	**Number**	**Course**	**CR**
BCBP 4760	Molecular Biochemistry I	4		Focus Elective[6]	4
BIOL 4200	Biostatistics	4		Focus Elective[6]	4
	Elective	4		Elective	4
	HASS Core Elective[3]	4		Elective	4

FOURTH YEAR (WITH 3RD YEAR FALL SEMESTER AWAY)

Fall			Spring		
Number	**Course**	**CR**	**Number**	**Course**	**CR**
	Advanced Laboratory[5]	6		Senior Research Thesis [7]	4
	Focus Elective[6]	4		Focus Elective[6]	4
	HASS Core Elective[3]	4		Focus Elective[6]	4
	Elective	2		Elective	4

THIRD YEAR (WITH 3RD YEAR SPRING SEMESTER AWAY)

The Arch Summer Semester			Fall		
Number	**Course**	**CR**	**Number**	**Course**	**CR**
BCBP 4760	Molecular Biochemistry I	4		Advanced Laboratory[5]	6
BIOL 4200	Biostatistics	4		Focus Elective[6]	4
	Elective	4		Focus Elective[6]	4
	HASS Core Elective[2]	4		Elective	2

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FOURTH YEAR (WITH 3RD YEAR SPRING SEMESTER AWAY)

Fall			Spring		
Number	Course	CR	Number	Course	CR
	Focus Elective[6]	4		Senior Research Thesis [7]	4
	Focus Elective[6]	4		Focus Elective[6]	4
	HASS Core Elective[3]	4		Elective	2
	Elective	4		Elective	2

This curriculum requires a minimum of 128 credit hours.

FOOTNOTES

1. Students who apply Advanced Placement credits in place of BIOL 1010 and BIOL 1015 may take BIOL 2120 and BIOL 2125 in its place.
2. Students must take 1 of the following Laboratory courses alongside BIOL 1010 Introduction to Biology: BIOL 1015 Introduction to Biology Laboratory ***OR*** BIOL 1016 Introduction to Biology Computational Laboratory. Biology, Biochemistry and Biophysics, Biological Neuroscience majors, and/or students seeking a hands-on wet-lab experience are recommended to register for BIOL 1015. Computational Biology majors, Non-biology students, and/or students who seek to enhance their skills in data analysis are recommended to register for BIOL 1016. Students cannot get credit for both BIOL 1015 and 1016.
3. **Humanities and Social Sciences (HASS) Core Electives:** A total of 24 credits of HASS Core Electives should be taken. Students should take an Inquiry course during their first year. For a listing of HASS Inquiry courses go to: https://info.rpi.edu/hass-inquiry. In addition, students should take a HASS Communications Intensive course during their first three semesters.
4. May be taken in another semester depending on individual student schedule. If Computer Science I not taken in Spring semester of First Year, student would take a HASS Course or Free Elective in Spring semester of first year.
5. Advanced Lab option: BIOL 4720 Molecular Biology Laboratory or BIOL 4320: Microbiology Laboratory. The Advanced Lab Option fulfills the Communication Intensive and Culminating Experience requirements.
6. Focus courses. Students must choose a focus, among 1. Biomolecular Systems 2. Ecological Systems and must complete 20 credits of course work within the focus, including required and elective courses (see below).
7. Senior Research Thesis (BCBP 4990 or BIOL 4990) is recommended; however, students may substitute any additional 4000-level elective course from either concentration (see below).

FOCUS 1: BIOMOLECULAR SYSTEMS (20 CREDITS TOTAL)

REQUIRED COURSES

BCBP 4550	Molecular Modeling	BIOL 4630	Molecular Biology II

BIOMOLECULAR ELECTIVES (CHOOSE AT LEAST ONE)

BCBP 4660	The Biology of Systems	CHEM 6250	Glycochemistry, Glycobiology, and Glychotechnology
BIOL/BCBP 4770	Molecular Biochemistry II	CHEM 6510	Computational Chemistry
BCBP 4800	Methods in Biophysics	BMED 2100	Biomaterials Science and Engineering
BCBP 4870	Protein Structure Determination	BMED 4200	Modeling of Biomedical Systems
CHEM 4300	Medicinal Chemistry	BMED 4450	Drug and Gene Delivery
CHEM 4310	Bioorganic Mechanisms	BMED 4500	Advanced Systems Physiology

COMPUTATIONAL ELECTIVES (CHOOSE AT LEAST ONE)

BIOL 4220	Machine Learning for Env. Biology	CSCI 4350	Data Science
BIOL 4550	Sequence Analysis	CSCI 4370	Data and Society
CSCI 1200	Data Structures	CSCI 4390	Data Mining
CSCI 2300	Introduction to Algorithms	CSCI 4800	Numerical Computing
CSCI 4100	Machine Learning from Data	MATH 4720	Mathematics in Medicine and Biology
CSCI 4150	Introduction to Artificial Intelligence	MATH 4910	Data Analytics Research

Focus 2: Ecological Systems (20 Credits Total)

Required Courses

BCBP 4220	Machine Learning for Env. Biology	BIOL 4850	Principles of Ecology
BIOL 4880	The Global Environment		

Ecological Electives (Choose At Least One)

BIOL 4870	Lake George Liminology/Underwater Ecology (BLUE)	ENVE 4710	Groundwater Hydrology
BIOL 4961	Human Population	ERTH 4190	Environmental Measurements
CHEM 4810	Chemistry of the Environment	ERTH 4500	Earth's Climate: Past, Present, Future
ECON 4260	Env. and Resource Economics	IENV 4700	One Mile of the Hudson River

Computational Electives (Choose At Least One)

BIOL 4550	Sequence Analysis	CSCI 4390	Data Mining
CSCI 1200	Data Structures	CSCI 4800	Numerical Computing
CSCI 2300	Introduction to Algorithms	MATH 4720	Mathematics in Medicine and Biology
CSCI 4100	Machine Learning from Data	ERTH 4750	Geographic Info. Sys. in Sciences
CSCI 4150	Intro to Artificial Intelligence	MATP 4600	Probability Theory and Applications
CSCI 4350	Data Science	MATP 4910	Data Analytics Research
CSCI 4370	Data and Society		