SYSTEMS & SYNTHETIC BIOLOGY, BACHELOR OF SCIENCE

College of Biological Sciences

The Major Program

The Systems & Synthetic Biology major provides students with a broad understanding of these two related and interdisciplinary fields. Systems Biology aims to understand how complex organismal properties and structures arise from simple components and interactions, and to identify design principles common to many types of biological regulation. Synthetic Biology focuses on the modification (or, ultimately, de novo construction) of organisms to generate novel pathways and processes. This major emphasizes integrative, computational and quantitative approaches to solving biological problems and engineering new biological outcomes.

The Program

In the freshman and sophomore years, students majoring in Systems & Synthetic Biology build a broad scientific background, taking courses in chemistry, biology, physics, and mathematics as well as an introduction course to computing for biologists. As juniors or seniors, students can enroll in courses that introduce them to the fundamental principles in mathematics, computer science, systems theory and application, and biological engineering.

Career Alternatives

The biotech workforce has a growing demand for biologists that are fluent in different merging disciplines that are covered by the Systems and Synthetic Biology Major. This combination of skills will allow graduates to work at the interface between biologists and engineers found in new emerging industries related to the pharmaceutical, biomedical, bioenergy, agricultural, nutrition, and microbiome industries. The program is also an excellent background for students wishing to enter graduate or other professional schools, including medicine, law, journalism or policy Honors & Honors Programs. Refer to the Academic Information section and the appropriate College section for Dean's Honors List information.

Faculty Advisor

Siobhan Brady, Ph.D.

Code	Title	Units
Preparatory Subject Matter		
Biological Sciences		17
BIS 002A & BIS 002B & BIS 002C	Introduction to Biology: Essentials of Life on Earth and Introduction to Biology: Principles of Ecology & Evolution and Introduction to Biology: Biodiversity & the Tree of Life	
BIS 015L	Introduction to Data Science for Biologists	
Chemistry		21-27
CHE 002A & CHE 002B & CHE 002C	General Chemistry and General Chemistry and General Chemistry	
OR		
CHE 004A & CHE 004B & CHE 004C	General Chemistry for the Physical Sciences & Engineering and General Chemistry for the Physical Sciences & Engineering and General Chemistry for the Physical Sciences & Engineering	
AND		
CHE 008A & CHE 008B	Organic Chemistry: Brief Course and Organic Chemistry: Brief Course	
OR		
CHE 118A & CHE 118B & CHE 118C	Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences and Organic Chemistry for Health & Life Sciences	
Mathematics		8-12
MAT 017A & MAT 017B & MAT 017C	Calculus for Biology & Medicine and Calculus for Biology & Medicine and Calculus for Biology & Medicine	
OR		
MAT 021A & MAT 021B & MAT 021C	Calculus and Calculus and Calculus (Recommended)	
Physics		12
PHY 007A & PHY 007B & PHY 007C	General Physics and General Physics and General Physics	
Preparatory Subject Matter Subtotal		58-68
Depth Subject Matter		
Statistics		8
STA 100	Applied Statistics for Biological Sciences	
STA 101	Advanced Applied Statistics for the Biological Sciences	
Genetics		4
BIS 101	Genes & Gene Expression	
Biochemistry, Bioenergetics, & Metabolism		3-6
BIS 102 & BIS 103	Structure & Function of Biomolecules and Bioenergetics & Metabolism	
or BIS 105	Biomolecules & Metabolism	
Cell Biology		3
BIS 104	Cell Biology	
Systems Biology		2
BIS 134	Systems Biology: From Biological Circuits to Biological Systems (Discontinued)	
Biomolecular Systems Engineering		4
BIM 143	Biomolecular Systems Engineering: Synthetic Biology	
Systems & Synthetic Biology		5
BIS 185L	Systems & Synthetic Biology Lab	
Restricted Electives		
Choose three or more upper division courses not used to satisfy another requirement; 9 unit minimum:		9
BIS/MAT 107	Probability & Stochastic Processes with Applications to Biology	

	BIS 180L	Genomics Laboratory
	BIS 183	Functional Genomics
	MIC 102	Introductory Microbiology
	MIC 103L	Introductory Microbiology Laboratory
	MIC 115	Recombinant DNA Cloning & Analysis (Discontinued)
	MIC 117	Analysis of Molecular Genetic Circuits (Discontinued)
	MIC 170	Yeast Molecular Genetics
	MCB 120	Molecular Biology & Biochemistry Laboratory Associated Lecture
	MCB 120L	Molecular Biology & Biochemistry Laboratory
	MCB 121	Advanced Molecular Biology
	MCB 123	Behavior & Analysis of Enzyme & Receptor Systems
	MCB 124	Macromolecular Structure & Function
	MCB/PLB 126	Plant Biochemistry
	MCB 160L	Principles of Genetics Laboratory
	MCB 164	Advanced Eukaryotic Genetics
	MCB 182	Principles of Genomics
	EBS 161	Kinetics & Bioreactor Design
	BIM 105	Probability & Data Science for Biomedical Engineers
	BIM 117	Modeling Strategies for Biomedical Engineering
	BIM 140	Protein Engineering
	BIM 140L	Protein Engineering Laboratory
	BIM 152	Molecular Control of Biosystems
	BIT 150	Applied Bioinformatics
	BIT 160	Principles of Plant Biotechnology
	BIT 161B	Plant Genetics & Biotechnology Laboratory
Depth Subject Matter Total		38-41
Total Units		**96-109**