BIOTECHNOLOGY, BS

Program Directors

Ramesh Raina
(Executive Director of Biotechnology Program)
464 Life Sciences Complex
raraina@syr.edu

Surabhi Raina
(Director of Biotechnology Graduate Programs)
462 Life Sciences Complex
sraina@syr.edu

Allison Oakes (Advisor)
436 Life Sciences Complex
adoakes@syr.edu

Contact

114 Life Sciences Complex
315-443-9154
biotech@syr.edu (https://coursecatalog.syracuse.edu/undergraduate/arts-sciences/biotechnology-bs/biotech@syr.edu)

Faculty

Yasir Ahmed-Braimah, Abrar Aljiboury, David M. Althoff, Jason Boock, Carlos A. Castañeda, Arindam Chakraborty, Heather D. Coleman, Jen Cook, Melanie J. Decker, Steve Dorus, Robert P. Doyle, Scott E. Erdman, Christopher W. Fernandez, Austin M. Garner, Sarah E. Hall, Julie M. Hasenwinkel, Heidi Hehnly, James H. Henderson, James A. Hewett, James Hougland, L. Jamie Lamit, Li-En Jao, Eun-Deok Kim, Katharine Lewis, Chih Hung Lo, Sarah Lucas, Yan-Yeung Luk, Jessica MacDonald, Lauren Mavica, Mathew M. Maye, Vera McIlvain, Alexander McKelvie, Liviu Movileanu, Davoud Mozhdehi, Allison Oakes, Angela Oliverio, Susan Parks, Melissa E. Pepling, Scott Pitnick, Ramesh Raina, Surabhi Raina, Michael B. Sponsler, Nancy I. Totah, Roy D. Welch, Michele Wheatly, Jason R. Wiles, and Weiwei Zheng

Program Description

Biotechnology is an interdisciplinary program that offers students an opportunity to take courses in biology, environmental sciences, chemistry, engineering, management, public policy and law that will be important for addressing biotechnology-related issues. This program will help students prepare for jobs in areas such as the biotechnology industry, health professions, pharmaceutical and agricultural industry, environmental conservation and research in academia. The program requires many of the same basic courses as the B.S. degree in Biology, with additional courses in engineering, management and public policy. A variety of elective courses in biology, engineering, law, management and public policy can be used to fulfill the major requirements as well. A senior year capstone class (Biotechnology Seminar) and valuable industry internships and research opportunities are also part of this major.

Student Learning Outcomes

1. Be able to recognize and distinguish theories, concepts and principles from the major sub-fields of biology relevant to biotechnology
2. Recognize and practice methods and techniques of molecular biology that are often applied to problems in biotechnology
3. Identify and apply concepts and methods in selected areas of Bioengineering and Materials Science that can be relevant to biotechnology applications
4. Identify and apply concepts and methods of Public Policy and Management that can be relevant to biotechnology applications
5. Employ experimental design and practice, including presentation of data and findings in written and oral formats
6. Apply quantitative methods to solve problems in the biological sciences

B.S. Degree Requirements (65-71 credits)

To Declare the B.S. in Biotechnology

A student may declare the B.S. major in Biotechnology during the admission process or anytime thereafter by contacting the Academic Coordinator of the Biology Department.

Code	Title	Credits
Introductory Biology		
Students must take the following three Introductory Biology courses:		
BIO 121	General Biology I	3
BIO 122	General Biology I Laboratory	1
BIO 224	Integrative Biology Laboratory	2
BIO 224 cannot be omitted nor substituted. No transfer credit petitions will be accepted for BIO 224.		
(Students with AP credits of Biology with laboratory may omit BIO 121 and BIO 122)		
Core Courses		
All core courses should be completed by the end of a student's sophomore year.		
BIO 322	Cell and Molecular Biology	4
BIO 326	Genetics	3
Upper-Division Courses (32-26 credits)		
Biotechnology		
BIO 449	Biotechnology Lab	3
BIO 463	Molecular Biotechnology	3
BIO 464	Applied Biotechnology	3
Bioengineering/Biomaterial Sciences		
BEN 568	Biomaterials & Medical Devices	3
Public Policy/Management		
ECN 101	Introductory Microeconomics	3
ECN 102	Introductory Macroeconomics	3
EEE 370	Introduction to Entrepreneurship and Emerging Enterprises	3
Electives		
Choose three of the following courses, one of those should be a 3-credit lab:		
ACC 201	Essentials of Accounting	
BEN 541	Principles of Tissue Engineering	
BIO 316	Anatomy and Physiology I for Biology Majors	
BIO 317	Anatomy and Physiology II for Biology Majors	
BIO 355	General Physiology	
BIO 407	Advanced Neuroscience	
BIO 409 & BIO 410	General Microbiology and General Microbiology Laboratory	
BIO 422	Bioinformatics for Life Scientists	

BIO 430	Genetics Laboratory	
BIO 436	Pharmacology of Substance Abuse	
BIO 440	Applied Genomics	
BIO 443	Seminar in Epigenetics	
BIO 444	Seminar in Neurotoxicology	
BIO 446	Epigenetics of Health & Disease	
BIO 447	Basic Immunology	
BIO 448	Evolutionary Medicine	
BIO 456	Seminar in Human Disease Genomics	
BIO 457	Principles of Human Toxicology	
BIO 462	Molecular Genetics	
BIO 467	Advances in Biotechnology Research & Ideas	
BIO 468	Microbiomes in Biotechnology and Medicine	
BIO 471	Cell and Developmental Biology Laboratory	
BIO 472	Advanced Light Microscopy	
BIO 474	Experimental Design & Interpretation	
BIO 477	Personalized Medicine	
BIO 478	Biochemistry Laboratory	
BIO 501	Biology of Cancer	
BIO 503	Developmental Biology	
BIO 565	Cellular Physiology	
BCM 475	Biochemistry I	
BCM 476	Biochemistry II	
BCM 477	Proteins and Nucleic Acids Lab	
BCM 478	Biochemistry Laboratory	
BPE 420 - Bioseparations		
BPE 421 - Bioprocess Kinetics and Systems Engineering		
BPE 440 - Bioprocess and Systems Laboratory		
BPE 481 - Bioprocess Engineering Design		
BTC 401 - Molecular Biology Techniques		
CHE 412	Metals in Medicine	
CHE 477	Proteins and Nucleic Acids Lab	
CEE 472	Applied Env Microbiology	
ECN 301	Intermediate Microeconomics	
GEO 415	Food: A Critical Geography	
LPP 255	Introduction to the Legal System	
MAR 301	Essentials of Marketing (for Non-Management Students)	
MGT 355	Strategic Human Resource Management	
PHI 393	Contemporary Ethics	
PSC 318	Technology, Politics, and Environment	
PST 410	Practicum in Public Policy	
PST 451	Environmental Policy	
PST 315	Methods of Public Policy Analysis and Presentation	
Elective Courses by Petitioning to the Biology Department		

In addition, other courses related to biotechnology (including from other departments, for example, Chemistry, Bioengineering, Physics, Psychology, Biomaterial Institute, Maxwell School, Law School, Whitman School, ESF and Upstate Medical University) can be used as elective courses by petitioning to the Biology Department.

Senior Capstone Seminar Course		
BIO 421	Capstone Seminar in Biotechnology	3
Internship/Independent Research		
This requirement can be fulfilled by a) completing an approved internship during spring and/or fall semester of junior or senior year or b) completing an approved internship over the summer after a student's junior year, or c) completing approved independent research in any biotech-related field, including biology, chemistry, engineering, public policy, law or management. For example, if a student chooses to do independent research in biology, they can register for 1-4 credits of BIO 460. If a student chooses an internship instead, they can register for 0 credits of BIO 461.		0-4
BIO 460	Research in Biology	
BIO 461	Experience in Biology	
Math and Chemistry Requirements		
CHE 106 & CHE 107	General Chemistry Lecture I and General Chemistry Laboratory I	4
CHE 116 & CHE 117	General Chemistry Lecture II and General Chemistry Laboratory II	4
CHE 275 & CHE 276	Organic Chemistry I and Organic Chemistry I Laboratory	5
MAT 285	Life Sciences Calculus I	3
or MAT 295	Calculus I	
MAT 221	Elementary Probability and Statistics I	4
OR		
APM 391 - Intro to Probability & Stats (7 to 8 credit hours total)		

Distinction in Biotechnology

Students may earn a B.S. in Biotechnology degree with Distinction by meeting the following requirements:

- The student must have an overall cumulative GPA of 3.4, and a minimum cumulative GPA of 3.4 in upper-division courses needed to satisfy the BS Biotechnology major requirements.
- The student must take a minimum of 6 credits of BIO 460 Research in Biology and BIO 495 Distinction Thesis in Biology combined (exceptions granted on a case by case basis: contact directors for details).
- The student must complete four semesters of BIO 419 Junior and Senior Thesis Seminar (three semesters for students studying abroad.)
- The student must give a presentation (either poster or oral) based on their thesis research before completion of their final semester.
- The student must write a Senior Thesis or Honors Capstone Thesis judged to be of high quality.

College of Arts and Sciences Requirements

For all Arts and Sciences|Maxwell students, successful completion of a bachelor's degree in this major requires a minimum of 120 credits, 96 of which must be Arts and Sciences|Maxwell credits, completion of the Liberal Arts Core (https://coursecatalog.syracuse.edu/undergraduate/arts-sciences/#text) requirements, and the requirements for this major (30 credits) that are listed above.

Dual Enrollments:

Students dually enrolled in **Newhouse*** and Arts and Sciences|Maxwell will complete a minimum of 122 credits, with at least 90 credits in Arts and Sciences|Maxwell coursework and an Arts and Sciences|Maxwell major.

*Students dually enrolled in the College of Arts and Sciences|Maxwell as first year students must complete the Liberal Arts Core (https://

coursecatalog.syracuse.edu/undergraduate/arts-sciences/#text). Students who transfer to the dual program after their first year as singly enrolled students in the Newhouse School will satisfy general requirements for the dual degree program by completing the Newhouse Core Requirements.

Undergraduate University Requirements
The following requirements and experiences apply to all Syracuse University Undergraduate matriculated degree programs.

- IDEA Course Requirement (https://coursecatalog.syracuse.edu/undergraduate/idea-course-requirement/)
- First Year Seminar (https://coursecatalog.syracuse.edu/undergraduate/courses/fys/)