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Major: Biotechnology

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I. Major Options - What options are offered within the major? How do they differ?

There are several different options within the major:

The General Biotechnology Option is the overall, nonspecific path. It requires 1 course from General Biotechnology Option

Electives - Group 1, 1 course from General Biotechnology Option Electives - Group 2, and 9 credits from 126 General Option Electives or Biotechnology Research Courses.

The Animal Biotechnology Option is a focus on biotechnology in regards to animals. It requires Integrative Physiology or Molecular and Cellular Physiology, Animal Micro-techniques and Tissue Culture, and 9 credits from Animal Biotechnology Option Electives.

The Plant Biotechnology Option is a focus on biotechnology in regards to plants. It requires Plant Science, Plant Molecular Biology, Plant Tissue Culture and Engineering, and 2 courses from Plant Biotechnology Option Electives or Biotechnology Research Courses.

The Bioinformatics Option is a focus on using statistics and computers to analyze biological data. It requires Introduction to Computer Science, Data Structures, Bioinformatics, Basic Probability and Statistics or Basic Statistics for Research, Tools for Bioinformatic Analysis or Functional Genomics for Research, and 3 credits from 126 General Option Electives or Biotechnology Research Courses.

The Microbial Biotechnology Option is a focus on the microbiome. It requires Applied Microbiology, either Microbial Genetics and Genomics, Microbial Physiology, or Microbial Ecology and Diversity, and 8.5 credits of Microbial Biotechnology Option Electives.

The Bioscience Policy and Management Option is a focus on the business side of biotechnology. It requires Principles and Applications of Microeconomics, Introduction to Marketing, Introduction to Management, Innovation and Entrepreneurship, and Bioscience Policy, as well as two electives for a concentration

in either Business Management or Bioscience Policy.

II. Total number of students within the major

There are about 170 total with 35 graduating. Usually each year is around 60-65 students, but it varies.

III. Goals with in the major - What are expectations of students post-graduation?

Students should be able to find an occupation or position, whether with a Medical School, a PhD program, the bio-pharmaceutical industry, or even with a business position.

IV. Major Courses- What is the goal of each course? What should students be learning?

There are several essential courses for all biotech majors:

General Biology and Lab- Students should be learning broad principles of cell biology, genetics, and evolution; the diversity of life and its physiology, ecology, and population dynamics, as well as a laboratory designed to introduce and explore principles of research in the biological sciences by engaging in semester-long research projects requiring students to analyze data, synthesize new experiments, and evaluate findings

General Chemistry and Lab- Students should be learning an introduction to chemical principles and their application, with topics such as stoichiometry, states of matter, atomic and molecular structure, solutions, thermodynamics, equilibrium,

oxidation-reduction, kinetics, nonmetals, metals and coordination compounds, and nuclear chemistry, and a laboratory illustrating basic chemical methods.

Experience Based Education Courses- Students should learn the required skills and perform their own hands-on research in a realistic setting.

Quantitative Methods- Students should learn mathematics that serve as a basic foundation required for future courses.

Computer Competence- Students should be able to learn perform computer analysis of nucleotide sequences: assembly; restriction analysis; gene location and identification; protein sequence analysis and structure prediction; database searching; sequence alignments; and phylogenetic analysis.

Professional Ethics- Students should survey the methods and applications of biotechnology and to examine the consequences of developments in this area and perform informed debate in many topics related to animals, microbes, human health, agriculture and the environment OR survey the methods and applications of biotechnology and the ethical consequences of developments in this area.

Physics- Students should learn physics that serve as a basic foundation required for future courses.

V. Concerns/Student issues with classes? How to resolve, suggestions?

No student issues currently.

VI. Things going on within the major (Research, Visitors, Talks, Seminars within the major)

The department wishes to improve on how updated it is with current science, especially on education in regards to the new CRISPR technology. It is looking for opportunities to cover more areas of biotechnology, such as synthetic biology (organic chemicals in for bugs) and biofuels, but it needs more faculty. Finally, it is continuously trying to improve recruiting, as there always could be more students.

In regards to seminars, the plant science department, under which the biotech program is a part of, hosts several seminars, some of which are relevant to the program.

VII. Research Opportunities

The department offers several programs to help with the required research, such as SPIN, GH COOK Honors Program, and the Aresty Research Programs.

VIII. Job Outlook, suggestions for students in this major (ex: organizations to join, news to pay attention to)

Potential jobs can be found with BioNJ is a network of almost all biotech companies in NJ and the New Jersey Bioscience Center. The job markets that are in high demand are Bioinformatics (although it has lessened recently), and pharmacy. Fierce Biotech is a resource for biotechnology-related news.

IX. Changes within the major in the upcoming year?

There were several recent changes in major, so there are no planned new changes in the near future.

X. Other Suggestions

Dr. Paul Meers: Be flexible; learn as much as you can.