

MS Degree Program in Biotechnology

I. Description

We are proposing a new Master of Science degree in Biotechnology. It is specifically designed for students who complete the BS degree in Biological Sciences with a concentration in Biotechnology. These students will be able to obtain an MS degree in as little as one year from the date of matriculation.

II. Rationale and Demand

Many students in the BS degree in Biological Sciences with a concentration in Biotechnology are engaged in independent research during their undergraduate years and have obtained substantial results. The rationale is that about another year of course work and research after graduation would add significantly to their productivity and development as scientist and potentially qualify them for a Master's degree. The combination of the Master's degree, the extensive research experience and the hands-on experience obtained in the laboratory courses of the BS program would provide these students with excellent credentials to obtain a job in the biotech industry and/or to pursue a PhD.

III. Enrollment, admissions and financial aid

Part A. Program History

The Department of Biological Sciences has, for the last 20 years, offered the BS in Biotechnology to prepare students for careers in biotechnology. Although the program is relatively small (about 10 students/year), at least half of the students have historically been interested in pursuing an advanced degree. The program proposed here will permit students who are in this BS degree program to continue their studies at UD and obtain an MS in as little as one year after graduation.

Part B. Admission

Students applying into the MS degree program in Biotechnology must meet the following criteria:

1. They must be in good standing as students in the BS degree program in Biological Sciences with a concentration in Biotechnology at the University of Delaware. Applications from other students will not be considered.
2. They will have completed at least a year of undergraduate research with a faculty member in Biological Sciences by the time they receive their BS degree.
3. They must have taken or be enrolled in BISC602 and BISC654 for those interested in affiliating with the Molecular Biology and Genetics track or

BISC605 and BISC612 for those interested in the Cell and Organ Systems Physiology track (see Curriculum below).

4. They must take the general GRE examinations. We have no minimum GRE score for admission although most admitted students have GREs over 1100 combined.
5. They must apply by January 15 of the year they plan to matriculate into the MS program. Earlier applications are encouraged. Admission decisions are usually made for this program by March 1.
6. One of the letters of recommendation must be from their undergraduate thesis mentor. For more information about the application process and other matters relating to graduate education in the Biological Sciences, see <http://www.udel.edu/bio/ed/grad/policy>.

Entrance into the MS degree program is dependent on the following additional requirements:

1. Students must satisfactorily complete all requirements for the BS degree in Biological Sciences with a concentration in Biotechnology.
2. Date of matriculation is June 1. A preliminary examination testing competence in Molecular Biology and Genetics or Cell and Organ Physiology will be given in June.
3. They must continue to work in the same laboratory where they performed their research as undergraduates.
4. The research mentor will support the student at least during the first summer. Students are expected to perform their research full time during the summer.

Expectations and requirements for obtaining a Master's degree:

1. Students must form their thesis committee and meet with them to formulate their thesis direction before September 1 following admission into the program.
2. They must pass the graduate preliminary examination of the track they are affiliated with. The possible grades are pass, conditional pass, retake and fail. All conditional passes must be fulfilled satisfactorily within six months into the program. Students receiving a retake grade must retake the exam (only one allowed) during the Fall semester of the same year and no later than December 15. The only possible outcomes of the retake are pass, conditional pass and fail. All conditions must be met within six months of the exam and no later than the defense of the MS thesis. Failure to pass the preliminary examination either the first or second time is likely to lead to a recommendation from the Department to the Graduate School that the student be terminated from the MS program.
3. Students must take at least 30 credit hours of course work, research and thesis as specified by the Molecular Biology and Genetics track or Cell and Organ Physiology track (see below under Curriculum).
4. To obtain the Master's degree, they must write and successfully defend a thesis based on their research.
5. Students can obtain their Master's degree as early as May 31 of the year after matriculation but must complete their Master's degree within three years of

matriculation.

Applications to the MS program in Biotechnology and letters of recommendation are to be submitted to:

Office of Graduate Studies

<http://www.udel.edu/gradoffice/applicants/> or via mail at

234 Hullahen Hall
University of Delaware.
Newark, Delaware 19716.

IV. Curriculum specifics

The MS in Biotechnology requires certain courses as described below, the successful completion of the graduate preliminary examination and a public defense of a research based thesis.

Recommended Curriculum for students interested in Molecular Biology and Genetics

Fall semester of Senior year of the BS degree

- BISC 602 Molecular Biology of Animal Cells
- BISC 604 Nucleic Acids Laboratory
- Other requirements and electives as needed

Spring semester of Senior year

- BISC 654 Biochemical Genetics
- BISC 619 Gene Expression Laboratory
- Other requirements and electives as needed

First Summer of Master's program

- BISC 868 Research (6 credits)

Fall Semester of Master's program

- BISC 868 Research (8 credits)
- BISC 665 Advanced Molecular Biology and Genetics (3 credits)
- BISC 827 Graduate Student Seminar (1 credit)

Total: 12 credits

Spring Semester of Master's program

- BISC 869 Masters thesis (6 credits)
- BISC 868 Research (2 credits)
- BISC 6XX elective - must be one of the following (all these courses are also approved by the Molecular Biology and Genetics track)

BISC 605 Advanced Mammalian Physiology

BISC 612 Advanced Cell Biology

BISC 615 Vertebrate Developmental Biology

BISC 656 Evolutionary Genetics

BISC 671 Cellular and Molecular Immunology (4 credits)

BISC 679 Virology

BISC 693 Human Genetics

CHEM 645 Proteins: Structure and Function

CHEM 646 DNA-Protein Interactions

CHEM 648 Membrane Biochemistry

- BISC 827 Graduate Student Seminar (1 credit)

Total 12-13 credits

Total required M.S. credits: 30

Recommended curriculum for students interested in Cell and Organ Systems Physiology

Fall semester of Senior year

- BISC 605 Advanced Mammalian Physiology
- BISC 604 Nucleic Acids Laboratory
- Other requirements and electives as needed

Spring semester of Senior year

- BISC 612 Advanced Cell Biology
- BISC 619 Gene Expression Laboratory
- Other requirements and electives as needed

First Summer of Master's program

- BISC 868 Research (6 credits)

Fall semester of Master's program

- BISC 868 Research 8 credits
- BISC 6XX Elective – must be one of the following courses (3 credits). All of these courses are also approved by the Cell and Organ Physiology Track.

BISC 602 Molecular Biology of Animal Cells

BISC 615 Vertebrate Developmental Biology

BISC 656 Evolutionary Genetics

BISC 665 Eukaryotic Molecular Biology and Genetics

BISC 671 Cellular and Molecular Immunology

BISC 679 Virology

- BISC 827 Graduate Student Seminar (1 credit)

Total: 12 credits

Spring semester of Master's program

- BISC 869 Masters thesis (6 credits)
- BISC 868 Research (2 credits)
- BISC 806 Advances in Cell and Organ Systems (3 credits)
- BISC 827 (1 credit)

Total: 12 credits

Total required MS credits: 30

Thesis Requirement

Students are encouraged to write and defend a thesis within one year but must do so within three years after matriculation into the M.S. degree program.

Students must maintain continuous enrollment in every regular semester (Fall and Spring) throughout their program except by approved leave of absence. This can be accomplished by registering for classes and thesis credit during the time the thesis project is underway, or by registering for sustaining status. See the catalog for the university policy on sustaining status at <http://www.udel.edu/gradoffice/current/policysustaining.html>, and regarding leave of absence at <http://udcatalog.udel.edu/general/grad/gradregs.html#leave>.

V. Resources available

It is expected that faculty sponsor have sufficient grant support funds to provide the necessary training environment and stipend for completion of their students' MS degree. Students in the MS program in Biotechnology may compete for the same sources of financial assistance as is available to MS students in Biological Sciences. See <http://www.udel.edu/bio/ed/grad/policy/> for specifics. The same criteria for financial assistance apply.

Other Financial Aid Opportunities

Other Fellowships and Internship opportunities are occasionally available through the University. Interested students should check the Office of Graduate Studies website at <http://www.udel.edu/gradoffice/applicants> for the most current opportunities.

Residence Hall Directorships

In addition, the University hires Residence Hall Directors from among the ranks of its graduate students. Candidates are chosen for their superior leadership and communication skills, as well as the capability to provide guidance to undergraduates. Hall Directors are eligible for room and board, and full tuition waivers. Contact the Office of Housing and Residence Life at (302) 831-8423 for additional information as soon as possible. Applicants are usually interviewed around mid-April.

Departmental Operations

Occasionally student's graduate assistantship or other assignments may require the use of departmental laboratories or other facilities. Keys to laboratories, etc., are maintained in the Department office and will be issued based on faculty and Department Chair approval.

Any assignments that require the expenditure of departmental funds (e.g. data collection activities) require departmental approval in advance and are processed through the department in which the work is to be done.

VI. Resources required

No additional resources required.

VII. Implementation and Evaluation

We will evaluate this MS program every two years to determine if it has met the original goal of providing qualified students with an MS degree. Changes will be proposed as required.