

Graduate Certificate in Biotechnology Program Policy

Part I. Program history

A) Statement of purpose and expectations for graduate study

The Graduate Certificate in Biotechnology seeks to provide advanced, interdisciplinary didactic coursework in the life sciences.

B) Date of permanent status-

Provisional status, May 2010; Pending review for Permanent Status in 2015

C) Degrees offered Graduate Certificate in Biotechnology

Part II. Admission

A) Admission requirements

Admission to the Certificate in Biotechnology requires a scholastic index (grade point average on a 4.0 point scale) of at least 2.8 overall and 3.0 in the sciences. Those who meet the stated minimum requirements are not guaranteed admission, nor are those who fail to meet all those requirements necessarily precluded from admission if they offer other appropriate strengths.

There is also the possibility of entering the program after the successful completion of two courses of the Biological Sciences core with a grade of B or better (not B-) as a continuing education student or as a student enrolled in other UD graduate programs and the achievement of an overall GPA of 3.0 in graduate classes attempted.

Applicants who are not U.S. citizens or permanent residents must complete the Test of English as a Foreign Language (TOEFL) with a score of 550 or higher on the paper-based test or 79 or higher on the Internet-based test. Previous education, training or residence in the U.S. does not exempt foreign nationals from these requirements. Requests for a waiver of the language test requirements (for example, for students from English-speaking countries outside of the U.S., or for foreign students who have a college degree from a U.S. institution) must be approved by the University of Delaware Office of Graduate Studies. Students who need further training in English prior to attending graduate school may apply for admission through the University of Delaware English Language Institute's Conditional Admission Program http://www.udel.edu/eli/programs_grad_cap.html.

The Graduate Record Examination is not required of applicants to the Certificate in Biotechnology.

B) Prior degree requirements

BA or BS degree, preferably in a science or engineering discipline

C. Application deadlines.

Fall admission: Full consideration deadline: January 15th with rolling admission to continue until May 1st for foreign nationals and July 1st for US citizens/permanent residents.

Spring Admission: Full consideration deadline: October 1st with rolling admission to continue until November 1st for foreign nationals, December 15th for US citizens/permanent residents.

D. Special competencies needed

Applicants are required to have completed at the undergraduate level the following (or the equivalent): two years of biological sciences; one year of mathematics, preferably to include calculus and/or statistics; one year of college physics; one year of general chemistry; and one

course in organic chemistry.

E. Admission categories.

Provisional admission may be offered with the stipulation that any deficiency in undergraduate training be made up (without graduate credit).

Students with TOEFL scores below the minimum required for admission may be considered for conditional admission if they enter the University of Delaware English Language Institute's academic English program.

F. Other documents required

Applications must also include three letters of recommendation from persons able to judge the applicant's ability to pursue graduate study, a resume or CV outlining work and/or academic experience in the field of biotechnology as well as an application essay consisting of the answers to the following questions:

1. What scientific research/employment experience have you had? Please be specific about the field of work and job responsibilities
2. What are your long-term professional objectives?
3. What specific attributes of our Department and the Certificate in Biotechnology make you feel that this degree is appropriate to help you achieve your professional objectives?

G. University statement:

Admission to the Certificate in Biotechnology program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths.

Part III. Academic

A. Degree Requirements

1. List course requirements

The Certificate in Biotechnology requires 15 credits of graduate level course work consisting of:

- 1) 9 credits of graduate level course work in the biological sciences comprised of three classes, spread over at least two of the five following areas: Molecular Biology, Genetics, Cell Biology, Physiology and Microbiology (see list below).
- 2) 6 credits of graduate level courses in fields related to biotechnology including bioinformatics, engineering, chemistry, agriculture, food safety, health sciences and statistics (see approved list below).

Biological Sciences Core (9 credits, three classes; must include classes from at least two of the five following categories)

Cell Biology	Credits
BISC 612- Advanced Cell Biology	3
BISC 625- Cancer Biology	3
BISC 671- Cellular and Molecular Immunology	4
PLSC635- Plant Developmental Biology	3
<u>ANFS 671 Paradigms in Cell Signaling</u>	<u>3</u>
<u>BISC639 Developmental Neurobiology</u>	<u>4</u>
<u>BISC690 Fundamentals of Pharmacology</u>	<u>3</u>
<u>BMEG605 Princ of BME I: Molec and cell systems</u>	<u>3</u>

Genetics	Credits
BISC 654- Biochemical Genetics	3
BISC 656- Evolutionary Genetics	3
BISC 693- Human Genetics	3
PLSC 636- Advanced Plant Genetics <u>Plant Genes and Genomes</u>	3
PLSC 605- Plant breeding	3

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Microbiology	Credits
ANFS 635- Animal Virology	3
ANFS 639- Food Microbiology	3
BISC 641- Microbial ecology	3
BISC 682- Bacterial Pathogens; molecular mechanisms	3
BISC 645- Bacterial Evolution	3
BISC 679- Virology	3
PLSC 619- Soil Microbiology	4
PLSC 629- Introduction to Fungi	4
MAST 618- Marine microbial ecology	3
<u>MAST625 Microbial Physiology and Diversity</u>	<u>3</u>

Molecular Biology	Credits
ANFS 670- Principles of Molecular Genetics	3
BISC 602- Molecular Biology of Animal Cells	3
BISC 665- Advanced Molecular Biology and Genetics	3
CHEM642- Biochemistry II	3

Physiology	Credits
BISC 605- Advanced Mammalian Physiology	3 <u>4</u>
BISC 615- Vertebrate Developmental Biology	3
BISC 675- Cardiovascular Physiology	3
<u>HESC-KAAP 651-Neurophysiological Basis of Human Movement</u>	<u>3</u>
HESC 654- Survey of Medical Physiology	3
<u>BISC 606 Advanced Mammalian Physiology II</u>	<u>4</u>
<u>BISC627 Advanced Neurophysiology</u>	<u>3</u>
<u>BMEG606 Princ of BME II: Tissue and organ systems</u>	<u>3</u>

Biotechnology-related science courses (two courses from the following list adding up to at least 6 credits)

Agriculture/food science:	Credits
ANFS 628- Food Chemistry	4
ANFS 629- Food Analysis	4
ANFS 633- Poultry pathology	3
ANFS 636- Immunology of domestic animals	3
ANFS 637- Avian immunology	3
ANFS 643- Food engineering technology	3
ANFS 649- Food biotechnology	4
ANFS 654- Advanced ruminant nutrition	3
BREG 603/PLSC 603- Soil physics	3
ENWC 611- Insect pest management	3
ENWC 610- Medical, Veterinary, and forensic entomology	3
ENWC 619- Biological control	3
ENWC 805- Insect-plant chemical ecology	3

Bioinformatics:	Credits
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ANFS-BINF 644- Bioinformatics	3
CISC 636- Introduction to bioinformatics	3
CISC 637- Database Systems	3
CISC 681- Artificial Intelligence	3
CISC 683- Introduction to data mining	3
CISC 841- Bioinformatics	3
MAST 697- Bioinformatics programming for Biologists	3
MAST 698- Environmental and systems bioinformatics	3

BINF650 Protein Modifications 3

BINF694 Systems Biology I 3

BINF695 Computational System Biology 3

BINF816 Systems Biology of Cells in Engineered Environments 3

Chemistry/Biochemistry Credits

CHEM 641- Biochemistry	3
CHEM 645- Proteins, Structure and Function	3
CHEM 646- DNA-Protein Interactions	3
CHEM 649686- Biophysical Chemistry Molecular Biophysics	3
CHEM 653- Bioinorganic Chemistry	3
CHEM 681- Green Chemistry	3

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CHEM643 Intermediary Metabolism 3

CHEM684 Biochemistry of Nucleic Acids 3

MAST683 Environmental Chemistry 3

PLSC608/CHEM608 Environmental Soil Chemistry 3

Engineering:

CHEG 617- Colloid science and engineering	3
CHEG 620- Biochemical Engineering	3
CHEG 621- Metabolic engineering	3
CHEG 625- Green Engineering	3
CHEG 649- Molecular Biophysics	3
CHEG 650- Biomedical Engineering	3
CHEG 805- Multidisciplinary biotechnology	3
CPEG 630- Neurons and networks	3
ELEG 643- Biomedical Nanotechnology	3
ELEG 670- Biophysics of excitable membranes	3
ELEG 671- Introduction to biomedical engineering	3
ELEG 675- Image processing with biomedical applications	3
ELEG 678- Introduction to nano and biophotonics	3
ELEG 679- Introduction to medical imaging systems	3
MEEG 612- Biomechanics of human movement	3
MEEG 682- Clinical biomechanics	3
MEEG 683- Orthopedic Biomechanics	3
MEEG 684- Biomaterials and tissue engineering	3
MEEG 685- Control of human movement	3

MEEG 686- Cell and tissue transport 3

~~BMEG679 Introduction to Medical Imaging Systems 3~~

~~CHEG624 Bio-Based Materials 3~~

~~ELEG801 Advanced Topics in Biomedical Engineering 3~~

Health Sciences

BISC600- Biotechnology and molecular medicine 3

~~HESC 601 Research Methods 3~~

HESC NURS 687- Nursing Sciences Research 3

NURS 621- Advanced pathophysiology 3

NURS 622- Advanced pharmacology 3

~~NURS 638 Health sciences evaluation 3~~

~~PHYT 809 Psychosocial Aspects of Health and Disease 3~~

~~PHYT 606 Research 3~~

PHYT 623- Clinical Neuroscience 3

Advanced Laboratory Techniques

BISC 601- Immunochemistry 4

BISC 604- Nucleic Acids Laboratory 4

~~BISC 619 Gene Expression Laboratory 4~~

~~CHEM679 Biomolecular NMR Spectroscopy 3~~

Statistics/data analysis:

BISC 643- Biological Data Analysis 3

~~CHEG 604 Probability and statistics for engineering 3~~

STAT 608- Statistical Research Methods 3

STAT 609- Regression and Experimental Design 3

STAT 611- Regression Analysis 3

STAT 615- Design and Analysis of Experiments` 3

STAT 616- Advanced Design of Experiments 3

~~STAT 617 Multivariate Analysis 3~~

~~STAT 619 Time Series Analysis 3~~

~~STAT 620 Nonparametric Statistics 3~~

STAT 621- Survival Analysis 3

STAT 656- Biostatistics 3

STAT 674- Applied Data Base Management 3

STAT 675- Logistic Regression 3

2. Advisement All students will develop a plan of study in consultation with their advisor upon matriculation into the program.

3. Give procedure for petitions for variance in degree requirements (e.g., course substitution policies, completion deadlines, etc.)

All petitions for course substitutions and variances in the completion deadlines must be made to the Graduate Affairs Committee, Department of Biological Sciences.

4. Define any grade minimums in courses that are different from University policy.

Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements for the Certificate in Biotechnology. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not

approved, the Graduate Affairs Committee will recommend to the Office of Graduate Studies that the student be dismissed from the program.

5. Identify any courses, which may not be used towards the degree

Only courses listed in the curriculum may count towards the degree unless a variance is granted by the Graduate Affairs Committee, Department of Biological Sciences.

6. Identify expectations of facility of expression in English (oral and written) as part of the degree requirement.

Aside from the TOFEL admission requirement for foreign applicants, there are no specific requirements. However, successful completion of the degree will require fluency in both written and spoken English.

B. Committees for exams, thesis, or dissertations

This degree has no thesis or dissertation requirements.

C. Timetable and definition of satisfactory progress towards the degree

1. Academic load

It is expected that the Certificate in Biotechnology will be primarily a part-time program or pursued along with another graduate degree. As such, the only enrollment requirement is that matriculated students must enroll in at least one certificate class per academic year and the certificate must be completed within five years.

Normal progress towards degree is reviewed for all students in the program at the end of every academic year and is assessed based on grades and participation in program activities.

2. Grade requirements (general and specific).

Only graduate courses completed with a grade of B or higher fulfill the biological sciences core and the biotechnology-related course requirements for the Certificate in Biotechnology. Students receiving a B- or lower in a required core course are subject to dismissal from the program. However, they may file an appeal to the Department of Biological Sciences Graduate Affairs Committee for approval to retake the course and remain in the program. If the appeal is not approved, the Graduate Affairs Committee will recommend to the Office of Graduate Studies that the student be dismissed from the program.

3. Thesis/dissertation progress timetable guidelines.

N/A

4. Thesis/dissertation defense guidelines.

N/A

5. Forms required.

Upon completion of the Certificate requirements, the Director of the program will submit the approved plan of study form to the Office of Graduate and Professional Education for audit. The University will state on the student's transcript that the Certificate in Biotechnology was awarded. A diploma for the certificate program is not awarded to the student.

6. Identify consequence for failure to make satisfactory progress.

Students failing to make satisfactory progress towards degree will be identified by the graduate affairs committee in consultation with the student's academic advisor/program director.

Recommendations for dismissal are made by the Department chair of Biological Sciences to the University of Delaware Office of Graduate studies.

Students who feel that they have been graded inappropriately or receive what they perceive as an

unfair evaluation by a faculty member may file [grievances](#) in accordance with University of Delaware policies. Students are encouraged to contact the Department's Graduate Program Director prior to filing a formal grievance in an effort to resolve the situation informally.

Part IV. Assessment Plan

Consistent with the Mission Statement presented earlier in this document, two student learning goals are defined. Students will:

1. Have advanced knowledge of the discipline of biotechnology
2. Achieve competence in scientific communication

The specific goals stated above are mapped to various courses in the program Assessment Plan which guides program evaluation and is filed with the Center for Educational Effectiveness.

These goals will be assessed through multiple indicators including:

- Faculty evaluation of student progress in course work
- Surveys of students and program alumni

Both short term and long term impacts are assessed.

Part V. Financial aid-

Students enrolled in this program are responsible for their own tuition and living expenses. Both the Department of Biological Sciences and University of Delaware Office of Financial Aid will provide assistance in identifying suitable fellowships, grants and loans to help finance their education.

Part VI. Departmental Operations

A. General student responsibilities

Access to Student Records

Students wishing to review their Departmental file must submit a written request to the Graduate Program Director at least 24 hours in advance. Students must review the file in the presence of departmental staff or faculty and are not permitted to remove a file from Wolf Hall but may photocopy documents from their folder. All access to student records is in accordance with the Family Educational Rights and Privacy Act.

Standards of Student Conduct

A) Academic honesty

All graduate students are subject to University of Delaware regulations specified in the University Code of Conduct.

B) Laboratory Safety and Research Regulations

Graduate students performing laboratory research are subject to all University regulations regarding safety, use of human subjects and animals, and hazardous/radioactive material use and disposal. These guidelines may be found in the University of Delaware Policies and Procedures Manual.

C) Contact information

It is the responsibility of all students to ensure that their contact information on file with the university is current (mailing address, phone number, email address). It is also the student's responsibility to regularly monitor their email, phone and mail for important notices regarding

their enrollment.

D). Departmental facilities

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.