The Master of Biotechnology degree program is offered through a collaboration of the Department of Biochemistry and Molecular Biology and the Huck Institutes of the Life Sciences. It is a multidisciplinary program involving faculty members from different academic departments in Penn State University as well as ad hoc mentors from the academic faculty and from industry.

The Master of Biotechnology curriculum is designed to give students broad knowledge and training in the scientific and practical aspects of biotechnology. It involves innovative, hands-on, and multidisciplinary learning approaches to educate and train students in the science behind biotechnology, its business and legal aspects, and the ethical and social issues that it brings about. In addition, the courses and the activities required of all students in this program develop transferable professional skills such as team-working and communication skills, which are very important in industry in particular.

Graduates of this program are expected to have the knowledge and training for diverse career options: as academic educators, as scientists in both academic and industry settings, as members of decision-making business and management teams in government and biotechnology industries, as bioentrepreneurs, and as members and leaders of governmental, public, and private organizations that deal with social, ethical and legal issues in biotechnology. Because of their broad knowledge in biotechnology, graduates of this program are expected to fill a niche in industry where knowledge and ability to interphase and communicate with various functional groups within the organization are required.

**Admission Requirements**

Applicants apply for admission to the program via the Graduate School application for admission (http://gradschool.psu.edu/prospective-students/how-to-apply). Requirements listed here are in addition to Graduate Council policies listed under GCAC-700 Professional Degree Policies (http://gradschool.psu.edu/graduate-education-policies).

The program is appropriate for students with a baccalaureate degree in biological sciences, chemistry, or engineering or other baccalaureate degrees that include sufficient credits from relevant courses in the life sciences. Applicants must have a minimum junior/senior grade point average of 3.00 (on a 4.00 scale). Graduate Record Examinations (GRE) scores are required for verbal, quantitative, and analytical writing. Typically, students are admitted as part of a cohort to commence studies in the Fall. The best-qualified applicants will be accepted up to the number of spaces available for new students.

**Integrated Undergrad-Grad Programs**

**Integrated B.S. in Biotechnology and M.BIOT. in Biotechnology**

Requirements listed here are in addition to requirements listed in GCAC-210 Integrated Undergraduate-Graduate (IUG) Degree Programs (http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-210-integrated-undergraduate-graduate-degree-programs).

The integrated B.S. in Biotechnology-Master of Biotechnology degree program is designed to enable qualified undergraduate students in the B.S. Biotechnology program to graduate in five years with the Master of Biotechnology degree.

**Admission Requirements**

Students must apply to the program via the Graduate School application for admission (http://www.gradschool.psu.edu/prospective-students/how-to-apply), and must meet all the admission requirements of the Graduate School and the Biotechnology graduate program for the Master of Biotechnology degree, listed on the Admission Requirements tab. Students shall be admitted to an IUG program no earlier that the
beginning of the third semester of undergraduate study at Penn State (regardless of transfer or AP credits accumulated prior to enrollment) and no later than the end of the second week of the semester preceding the semester of expected conferral of the undergraduate degree, as specified in the proposed IUG plan of study.

Students must have a GPA of 3.5 at the time of application to the integrated degree program when they have completed at least 75 credits of their B.S. curriculum. The GRE scores normally required in the Master of Biotechnology in Biotechnology program will be waived for applicants to the integrated B.S.-Master of Biotechnology degree.

In consultation with an adviser, students must prepare a plan of study appropriate to this integrated program, and must present their plan of study in person to the head of the graduate program or the appropriate committee overseeing the integrated program prior to being admitted to the program. The plan should cover the entire time period of the integrated program, and it should be reviewed periodically with an adviser as the student advances through the program.

Degree Requirements
Student must fulfill all degree requirements for each degree in order to be awarded that degree, subject to the double-counting of credits as outlined below. Degree requirements for the Bachelor of Science in Biotechnology are listed in the Undergraduate Bulletin (http://bulletins.psu.edu/undergraduate). Degree requirements for the Master of Biotechnology in Biotechnology degree are listed on the Degree Requirements tab. Students must sequence their courses so all undergraduate degree requirements are fulfilled before taking courses to count solely towards the graduate degree. If students accepted into the IUG program are unable to complete the M.BIOT. degree, they are still eligible to receive their undergraduate degree if all the undergraduate degree requirements have been satisfied.

Up to 12 credits may be double-counted towards the degree requirements for both the graduate and undergraduate degrees; a minimum of 50% of the double-counted courses must be at the 500 or 800 level. Credits associated with the culminating experience for the graduate degree cannot be double-counted.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMB 400</td>
<td>Molecular Biology of the Gene</td>
<td>2-3</td>
</tr>
<tr>
<td>BIOTC 479</td>
<td>Methods in Biofermentations</td>
<td>3</td>
</tr>
<tr>
<td>or BE 468</td>
<td>Microbiological Engineering</td>
<td></td>
</tr>
<tr>
<td>MCIBS 571</td>
<td>Current Issues in Biotechnology</td>
<td>2</td>
</tr>
<tr>
<td>MCIBS 590</td>
<td>Colloquium</td>
<td>1-3</td>
</tr>
<tr>
<td>MCIBS 591</td>
<td>Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences</td>
<td>1</td>
</tr>
<tr>
<td>MCIBS 593</td>
<td>Molecular Biology Laboratory</td>
<td>3</td>
</tr>
</tbody>
</table>

Courses Eligible to Double Count for Both Degrees

Learning Outcomes
1. KNOW. Students will be able to demonstrate conceptual and practical knowledge of the broad aspects of biotechnology: the core areas in science and the technologies that drive progress in biotechnology, the business, intellectual property, regulatory, legal, social and ethical aspects of the biotechnology industry; students will also be able to show practical understanding of the professional skills vital to employment and career success in biotechnology.

2. APPLY/CREATE/THINK. Students will be able to demonstrate critical review of scientific literature, proficiency in the conduct of scientific research independently or in a team setting, as well as in non-bench research-related responsibilities in broad areas of biotechnology as necessary. Students will also demonstrate adequate professional preparation for competitive curricular employment (internships and cooperative education or co-op) and entry-level employment post-degree.

3. COMMUNICATE. Students will demonstrate skills in communicating scientifically through group work, research papers and oral presentations, and professionally through networking, interviews, resumes or curriculum vitae (CVs), and other required career-related activities.

4. PROFESSIONAL PRACTICE. Students will demonstrate knowledge of interpersonal workplace dynamics, the ability to perform in a team environment and adapt to a very dynamic biotechnology workplace, participation in professional networking, and engagement in professional activities and organizations serving the discipline and the industry.

Student Aid
Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (http://gradschool.psu.edu/graduate-funding) section of The Graduate School’s website. Students on graduate assistantships must adhere to the course load limits (http://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants) set by The Graduate School.

Courses
Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Molecular, Cellular, and Integrative Biosciences (MCIBS) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/mcibs)

Learning Outcomes
1. KNOW. Students will be able to demonstrate conceptual and practical knowledge of the broad aspects of biotechnology: the core areas in science and the technologies that drive progress in biotechnology, the business, intellectual property, regulatory, legal, social and ethical aspects of the biotechnology industry; students will also be able to show practical understanding of the professional skills vital to employment and career success in biotechnology.

2. APPLY/CREATE/THINK. Students will be able to demonstrate critical review of scientific literature, proficiency in the conduct of scientific research independently or in a team setting, as well as in non-bench research-related responsibilities in broad areas of biotechnology as necessary. Students will also demonstrate adequate professional preparation for competitive curricular employment (internships and cooperative education or co-op) and entry-level employment post-degree.

3. COMMUNICATE. Students will demonstrate skills in communicating scientifically through group work, research papers and oral presentations, and professionally through networking, interviews, resumes or curriculum vitae (CVs), and other required career-related activities.

4. PROFESSIONAL PRACTICE. Students will demonstrate knowledge of interpersonal workplace dynamics, the ability to perform in a team environment and adapt to a very dynamic biotechnology workplace, participation in professional networking, and engagement in professional activities and organizations serving the discipline and the industry.

Student Aid
Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (http://gradschool.psu.edu/graduate-funding) section of The Graduate School’s website. Students on graduate assistantships must adhere to the course load limits (http://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants) set by The Graduate School.

Courses
Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Molecular, Cellular, and Integrative Biosciences (MCIBS) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/mcibs)

Learning Outcomes
1. KNOW. Students will be able to demonstrate conceptual and practical knowledge of the broad aspects of biotechnology: the core areas in science and the technologies that drive progress in biotechnology, the business, intellectual property, regulatory, legal, social and ethical aspects of the biotechnology industry; students will also be able to show practical understanding of the professional skills vital to employment and career success in biotechnology.

2. APPLY/CREATE/THINK. Students will be able to demonstrate critical review of scientific literature, proficiency in the conduct of scientific research independently or in a team setting, as well as in non-bench research-related responsibilities in broad areas of biotechnology as necessary. Students will also demonstrate adequate professional preparation for competitive curricular employment (internships and cooperative education or co-op) and entry-level employment post-degree.

3. COMMUNICATE. Students will demonstrate skills in communicating scientifically through group work, research papers and oral presentations, and professionally through networking, interviews, resumes or curriculum vitae (CVs), and other required career-related activities.

4. PROFESSIONAL PRACTICE. Students will demonstrate knowledge of interpersonal workplace dynamics, the ability to perform in a team environment and adapt to a very dynamic biotechnology workplace, participation in professional networking, and engagement in professional activities and organizations serving the discipline and the industry.

Student Aid
Graduate assistantships available to students in this program and other forms of student aid are described in the Tuition & Funding (http://gradschool.psu.edu/graduate-funding) section of The Graduate School’s website. Students on graduate assistantships must adhere to the course load limits (http://gradschool.psu.edu/graduate-education-policies/gsad/gsad-900/gsad-901-graduate-assistants) set by The Graduate School.

Courses
Graduate courses carry numbers from 500 to 699 and 800 to 899. Advanced undergraduate courses numbered between 400 and 499 may be used to meet some graduate degree requirements when taken by graduate students. Courses below the 400 level may not. A graduate student may register for or audit these courses in order to make up deficiencies or to fill in gaps in previous education but not to meet requirements for an advanced degree.

Molecular, Cellular, and Integrative Biosciences (MCIBS) Course List (https://bulletins.psu.edu/university-course-descriptions/graduate/mcibs)