

# BIOINFORMATICS AND GENOMICS

## Joint Degrees

### Joint M.D. / Ph.D. with the College of Medicine

Requirements listed here are in addition to requirements listed in GCAC-211 Joint Degree Programs (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-200/gcac-211-joint-degree-programs/>).

#### Admission Requirements

Students interested in simultaneously pursuing an M.D. and Ph.D. degree must apply to the College of Medicine M.D. program using the national American Medical College Application Service (AMCAS) application system and indicate their intent to pursue the joint degree program. The College of Medicine M.D./Ph.D. Admissions Committee reviews applications and evaluates candidates for acceptance into both the M.D. and Ph.D. program. Students not accepted into the joint degree program can be referred to either the M.D. or Ph.D. program, depending on their qualifications.

The general admission requirements for the Ph.D. degree are listed on the Admission Requirements tab. Additional requirements for the joint degree are listed below. Admissions requirements and applications for admission for Penn State College of Medicine are available at the M.D. Program (<http://med.psu.edu/md/>) section of the Penn State College of Medicine website. After the review committee has accepted an applicant to the joint degree program, s/he must apply to the Graduate School (<http://www.gradschool.psu.edu/prospective-students/how-to-apply/>) for admission to the graduate program.

In addition to the basic college level premedical school requirements for the Penn State College of Medicine (one year each of biology, chemistry, physics, math, and organic chemistry), the M.D./Ph.D. program has the following requirements:

- **Academic Achievement.** Applicants to our program generally have very strong grades and MCAT scores. In recent years, successful applicants have an average GPA of 3.75 and MCAT scores of 33-34. Applicants are not required to take the GREs.
- **Research Experience.** We are especially interested in students with a strong and sustained background in research. Students who have spent 1-2 years after graduation conducting research are strongly encouraged to apply. Alternatively in-depth research experience as an undergraduate can suffice.
- **Recommendations.** We are especially interested in receiving letters of recommendation from faculty with whom you conducted research and who can comment on your passion and potential for research.
- **Goals.** Applicants must be able to clearly articulate the reasons for pursuing the joint degree.
- **International Students.** All qualified students are eligible to apply regardless of citizenship.

#### Degree Requirements

Students must fulfill all 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 M.D. program are listed on the Penn State College of Medicine (<http://med.psu.edu/md/>) website. Degree requirements for the Ph.D. degree are listed in the Ph.D. Degree Requirements section.

During the first two years of medical school, the student conducts at least three research rotations. After successful completion of the first two years of medical school the candidate enters the BGEN Graduate Program.

During the summer after the second year of medical school, M.D./Ph.D. students take Step 1 of the United States Medical Licensing Examination (USMLE), which serves in lieu of the knowledge-based part of the qualifying examination for the BG program. Successful completion of BMS 506A and BMS 506B, which are taken in the second year of medical school, with a grade of B or higher meets the critical thinking and paper analysis requirement of the qualifying exam.

The Ph.D. committee of an M.D./Ph.D. student in the BG program is formed upon entry into the dissertation laboratory, and must comply with all Graduate Council requirements (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). The committee must include at least two members of the BG program Graduate Faculty and one M.D./Ph.D. steering committee member.

Code	Title	Credits
<b>Required Courses</b>		
MCIBS 589		3
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	1
MCIBS 551	Genomics	3
MCIBS 554	Foundations in Data Driven Life Sciences	3
BGEN 541	Critical Analysis of Bioinformatics and Genomics Research Topics	1
STAT 555	Statistical Analysis of Genomics Data	3
<b>Electives</b>		
In addition, based on the background and needs of the student the following elective courses will also be taken:		
BIOL 405	Molecular Evolution	3
STAT 500	Applied Statistics	3
BMMB 852	Applied Bioinformatics	2
<b>Total Credits</b>		<b>22</b>

The BG program will accept SPM 711 in lieu of 6 credits of elective courses and 2 credits of MCIBS 596. If students accepted into the joint degree program are unable to complete the M.D. degree, they are still eligible to receive the Ph.D. degree if all Ph.D. degree requirements have been satisfied.

The M.D./Ph.D. student prepares a written comprehensive examination in the format of a grant application and gives an oral presentation of this proposal to their Ph.D. committee.

M.D./Ph.D. candidates are required to have at least one paper submitted for publication in a major peer-reviewed scientific journal prior to the final doctoral examination, and this must be accepted before they return to the third year of medical school. A dissertation must be prepared and defended by each M.D./Ph.D. candidate.