

# BIOINFORMATICS, PHD

Code	Title	Hours
BMSP 6340	Curr Prob Res App Genes/Genom	2
BIPG 5200	Statistical Methods in Bioinformatics	3
BIPG 5100	Fund Bioinformatics Proteomics	3
INDI 6020	On Being a Scientist	1
BMSP 6390	Mentored Research	1-15
BIPG 6100	Bioinformatic Computation	3
BMSP 6350	Cell Biology & Signaling (either/or)	3
BIPG 6400	Applications of Bioinformatics	3
BRIM 6200	Biomarker Disc,Valid & Impleme	3
BIPG 5400	Biodatabases	1
BIPG 6890	Independent Study in BPG	4
BIPG 5300	Current Topics in BPG	1
BIPG 9990	Dissertation Research in BIPG	1-9
BIPG 6500	Applied Statistics for Bioinformatics	3
BIPG 6200	Advanced Programming in Bioinformatics	3
BIPG 7300	Transcriptomic Data Science	3
BIPG 7350	Algorithms for Bioinformatics	3
BIPG 6300	Clinical Proteomics	2

## First Year

First Term	Hours	
BMSP 6340	Curr Prob Res App Genes/Genom	2
BIPG 5200	Statistical Methods in Bioinformatics	3
BIPG 5100	Fund Bioinformatics Proteomics	3
INDI 6020	On Being a Scientist	1
BMSP 6390	Mentored Research	1-15
<b>Hours</b>	<b>10-24</b>	

## Second Term

BMSP 6390	Mentored Research	1-15
BIPG 6100	Bioinformatic Computation	3
BMSP 6350	Cell Biology & Signaling	3
BIPG 6400	Applications of Bioinformatics	3
Or		
BRIM 6200	Biomarker Disc,Valid & Impleme	3
<b>Hours</b>	<b>13-27</b>	

## Third Term

BIPG 5400	Biodatabases	1
BIPG 6890	Independent Study in BPG	4
BIPG 7300	Transcriptomic Data Science	3
Students must pass the BIPG 100 Questions preliminary exam before the end of the 1st year.		
<b>Hours</b>	<b>8</b>	

## Second Year

Fourth Term	Hours	
BIPG 5300	Current Topics in BPG	1
BIPG 6890	Independent Study in BPG	4

BIPG 6300	Clinical Proteomics	2
BIPG 6200	Advanced Programming in Bioinformatics	3

PhD Qualifying Examination - successful completion required by end of Fall semester of Year 2

**Hours 10**

## Fifth Term

BIPG 9990	Dissertation Research in BIPG	1-9
BIPG 7350	Algorithms for Bioinformatics	3
BIPG 6200	Advanced Programming in Bioinformatics	3
BIPG 5300	Current Topics in BPG	1

**Hours 8-16**

## Sixth Term

BIPG 9990	Dissertation Research in BIPG	1-9
<b>Hours</b>	<b>1-9</b>	

## Third Year

### Seventh Term

BIPG 9990	Dissertation Research in BIPG	1-9
BIPG 5300	Current Topics in BPG	1

**Hours 2-10**

### Eighth Term

BIPG 9990	Dissertation Research in BIPG	1-9
BIPG 5300	Current Topics in BPG	1

**Hours 2-10**

### Ninth Term

BIPG 9990	Dissertation Research in BIPG	1-9
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The PhD Qualifying Exam is taken in the Fall semester of the second year. Prior to completing the exam, students should carry out their dissertation research under the course BIPG6890 Independent Study in Bioinformatics. After passing the Qualifying Exam, students conduct their research under the course Dissertation Research (CABP9990). The minimum number of credits required for PhD is 90, with a minimum of 25 credits of didactic coursework (letter grade), and a minimum of 30 credits of dissertation research. The remaining credits are approved electives and independent study in the Bioinformatics track.

**Hours 1-9**  
**Total Hours 55-123**

## Learning Outcomes

Bioinformatics Track  
Biomedical Sciences Graduate Program  
College of Medicine & Life Sciences, University of Toledo

## Introduction

Graduate educational programs shall articulate their objectives in order to permit the alignment of course instruction, research training, and evaluation of students with the program's educational objectives (EPO). To meet this requirement, the Bioinformatics (BIPG) faculty has adopted the following objectives for the program leading to the Ph.D. degree in Biomedical Sciences in the BIPG Track.

The EPO competencies reflect scientific knowledge, skills, and professional attitudes. The student's progress will be evaluated and documented with respect to competence in each of these three areas and over the duration of years needed to complete the degree requirements.

I: A BIPG Ph.D. student will be knowledgeable

In the course of their educational program, students are provided the opportunity to gain knowledge through instruction by content experts and by supervised participation in research projects. Knowledge will be assessed by the student's ability to define, describe, and explain facts and concepts, as well as at higher levels of cognition that will be measured by the ability to apply, analyze, and integrate content.

Before graduation, a student will have demonstrated to the satisfaction of the faculty knowledge of the following by being able to:

K1 Describe molecular, biochemical, and cellular mechanisms involved in regulation of cellular processes and development.

K2 Explain fundamental systems biology technologies, such as proteomics, genomics and transcriptomics, and the bioinformatics tools central to their interpretation.

K3 Describe algorithmic and statistical methods for analysis of nucleic acid and protein sequences, such as hidden Markov models and Bayesian statistics.

K4 Explain principles and legal responsibilities that govern responsible conduct of research, and the accurate reporting of research results.

II: A BPG graduate student will be skilled

The BIPG curriculum provides a training environment in which research and teaching skills are learned in concert with the correlated knowledge. Students have the opportunity to gain these skills under the supervision of a faculty mentors with the advice and guidance of the student advisory committee, through direct contact with content and/or technical experts, and through direct participation in research projects.

Before graduation, a student will have demonstrated to the satisfaction of the faculty the ability to:

S1 Execute technical procedures necessary for the completion of the student's doctoral thesis research project(s).

S2 Design and complete an independent research project.

S3 Use least two modern computer programming languages, such as PERL and Python, and the UNIX (Linux) operating system.

S4 Appraise statistical and biological significance of bioinformatic results and patterns.

S5 Demonstrate database design, management, and/or mining.

S6 Experiment productively as an individual or member of a research team.

S7 Critique, organize, and communicate research findings effectively, both orally and in writing.

S8 Interrogate electronic databases via automated scripting.

S9 Identify biomedical information for solving problems that are relevant to the appropriate completion of a research project, and the accurate reporting of the results.

III. A BIPG graduate will be professional

The University of Toledo College of Medicine and the Biomedical Sciences Program recognize the importance of role-modeling and directly training the professional conduct and character of its students. The institution and the BIPG Track devote curricular and extracurricular time to the development of ethical standards humanistic and professional behaviors by its students.

Before graduation, students will have met the following institutional and program standards. Some of these are difficult to demonstrate positively, but the successful student shall have given the faculty no reason to doubt that the student exhibits:

P1 Ethical, responsible, and reliable behavior in all aspects of their professional lives.

P2 Honesty and integrity in all interactions with colleagues, research subjects, and others with whom students may interact in their professional lives.

P3 Professionalism in dress and grooming in compliance with health and safety rules applicable to research laboratories and to other institutional and public sites.

P4 Respect of and adherence to all laws and regulations governing the biomedical research use of animals and patient materials, and for all patient privacy issues.

P5 Respect of and adherence to all laws and regulations governing ethical use of computers and remote computational facilities.