MSBS IN BIOINFORMATICS AND PROTEOMICS-GENOMICS

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The Bioinformatics and Proteomics/Genomics (BPG) Programs are designed to provide training in the rapidly-developing interface between computer science and life sciences. Graduates with such training are in high demand, (in part due to the explosion in genome sequence analysis), whether the BPG studies are for an independent degree or for one of the several dual-degree programs. In addition, students in other programs may take BPG courses as electives.

Masters, Certificate and Dual Degree Programs

The program in Bioinformatics and Proteomics/Genomics, along with the Ohio Center of Excellence for Biomarker Research and Individualized Medicine at the University of Toledo, offers a Certificate that can be earned either alone or in association with the degrees of Doctor of Philosophy (PhD) or Doctor of Medicine (MD). The Certificate program is designed to fit smoothly into the doctoral programs with minimal extra time required. BPG also offers a Master of Science in Biomedical Sciences (MSBS) degree. MSBS students follow a well-defined curriculum that includes core courses, journal club, seminars, independent research, and electives in their area of interest. Both Certificate and MSBS students are trained in the theory, methods and applications of bioinformatics, proteomics, genomics, and biomarker research.

Bioinformatics programs generally place more emphasis on either computer science or the biomedical aspects of the field. The University of Toledo's program falls into the latter category. However, there are courses in PERL, Java, and SQL programming (for example), and the Program provides biomedical researchers with a solid introduction to the computational aspects, or computer science experts with a rigorous introduction to the biomedical aspects of bioinformatics.

To be admitted to the Masters in Biomedical Sciences Program with Regular status, applicants must hold an earned baccalaureate (or equivalent) from an accredited college or university. Students with a GPA below 3.0, but at or above 2.5, may apply for provisional acceptance that would change to regular (non-probationary) status if their first term graduate coursework has a GPA of 3.0 or above. Typically, applicants will have an undergraduate major in Biology or a related discipline such as Biochemistry or Biophysics. Students with other majors are encouraged to apply; however, their coursework should include several semesters in biology. The GRE is not required for US students with GPA above 3.0, UT or Findlay students entering the bachelors-masters pipeline program, or students with a recent MCAT score of 25 or higher. The GRE is required for all other applicants. For international applicants, the Test of English as a Foreign Language (TOEFL) is also required. Scores must be 550 or higher for paper-administered version, 213 or higher for computer-administered version, and 80 or higher for internet-administered version. For all applicants, laboratory research or computer programming experience is favored, but not required.

(CPRA = Current Problems & Research Approaches)

(BIPG = Bioinformatics & Proteomics/Genomics)

First Term		**Hours**
BMSP 6340	Curr Prob Res App Genes/Genom (8 weeks) [1]	2
BIPG 5200	Statistical Methods in Bioinformatics (16 weeks)	3
BIPG 5100	Fund Bioinformatics Proteomics (16 weeks)	3
BMSP 6390	Mentored Research (10 weeks; 2 x 5 wk lab rotations) [2]	1
	Hours	**9**
Second Term		
BIPG 6100	Bioinformatic Computation (16 weeks)	3
BIPG 6400	Applications of Bioinformatics (16 weeks)	3
or		
BRIM 6200	Biomarker Disc,Valid & Impleme	
BMSP 6350	Cell Biology & Signaling (16 weeks)	3
	Hours	**9**
Third Term		
BIPG 5400	Biodatabases (4 weeks)	1
INDI 6020	On Being a Scientist	1
BIPG 5500	Mining Omics Data (4 weeks)	1
BIPG 6990	Thesis in Bioinformatics [3]	3
	Hours	**6**
Fourth Term		
Elective 2 (see approved list)		3
BIPG 5300	Current Topics in BPG (16 weeks) [4]	1
BIPG 6990	Thesis in Bioinformatics	5
	Hours	**9**
Fifth Term		
Elective 2 (see approved list)		3
BIPG 6990	Thesis in Bioinformatics	6
	Hours	**9**
Sixth Term		
	Hours	**0**
	Total Hours	**42**

1 CPRA = Current Problems & Research Approaches.

2 Students must register for a specific 10 wk/1 cr section of BMSP 6390 Mentored Research for 2 five-week rotations. As a prerequisite, students must attend an introductory series of short research presentations "Introduction to Biomedical Research". These presentations do not require students to register, but BIPG students are expected to attend for the first 3-4 weeks of the Fall semester.

3 Students must pass Qualifying Exam before registering for BIPG 6990 Thesis research. In this and other terms, with permission of advisory committee, student may take Scholarly Project in BIPG (BIPG5900) in place of Thesis in Bioinformatics.

4 Journal paper review and presentation.

The minimum number of credits required for MSBS is 42, with a minimum of 20 credits of didactic coursework (letter grade), and a minimum of 10 credits of thesis research. The rest of the credits are approved electives and research in the BIPG track.

EDUCATIONAL PROGRAM OBJECTIVES FOR THE BIOINFORMATICS/PROTEOMICS/GENOMICS TRACK

Program Student Learning Outcomes
K1 Knowledge of molecular, biochemical, and cellular mechanisms involved in regulation of cellular processes and development.

K2 Knowledge of fundamental systems biology technologies, such as proteomics, genomics and transcriptomics.

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

K4 Knowledge of at least one modern computer programming language, such as PERL.

K5 Knowledge of database design and management.

K6 Knowledge of the principles and legal responsibilities that govern responsible conduct of research, and the accurate reporting of research results.

S1 The ability to perform procedures necessary for the completion of the student's thesis (M.S.) research project(s).

S2 The ability to design and complete an independent research project.

S3 The ability to assess statistical and biological significance of bioinformatic results and patterns.

S4 The ability to perform research productively as an individual or member of a research team.

S5 The ability to communicate research findings effectively, both orally and in writing.

S6 The ability to use electronic databases via automated scripting.

S7 The ability to retrieve biomedical information for solving problems that are relevant to the appropriate completion of a research project, and accurate reporting of the results.

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.