First Year Curriculum

At a Glance

At the end of the first year, the Biomedical Informatics (BMI) student will have gained an appreciation for the broadly based, interdisciplinary nature of biomedical sciences and informatics, making them well-prepared to begin their research journey to analyze biomedical data for discovering the insights responsible for the development of human disease:

- Laboratory rotations begin during the first semester. Students will rotate in two or more laboratories of their choosing.
- Biomedical Sciences Concepts: Covers topics relevant to the mechanisms of human disease and emphasizes a systems-integrated perspective on human disease and biomedical research.
- Professional and Ethical Issues in Biomedical Sciences: Offers formal training in the responsible and ethical conduct of research.
- Research Techniques and Resources: Provides laboratory safety training, introduces techniques, promotes presentation skills and informs students of core resources available.
- Statistical Methods in Biomedical Informatics: teaches basic and typical statistical concepts and methods that are used to analyze biomedical data.
- Programming for Biomedical Informatics: teaches basic programming skills and computing concepts that are necessary for biomedical data analysis.
- Introduction to Biomedical Informatics: A survey of BMI theories and methods employed in the design, implementation and management of information systems supporting basic science, clinical and translational research, clinical care, and public health.
- Introduction course to a specialization allowing flexibility based on the student's interest
    - Introduction to Bioinformatics: Covers typical and fundamental concepts and problems of bioinformatics.
    - Introduction to Research Informatics: Provides students with an in-depth study of medical data including electronic health record data, patient generated data, and hospital operational data.
- Select dissertation advisor by spring of first year.

Summer Term

Students will begin in the summer term and will register for a Laboratory Rotation (BSGP 7930). The students will be given a list of faculty members willing to take on rotating students and they may also research faculty members on their own.

In addition, all BMI students are required to take two courses in Statistical Methods in Biomedical Informatics (BMI 5750) and Programming for Biomedical Informatics. The Statistical Methods in Biomedical Informatics course was designed to prepare the students for basic statistical basic and typical statistical concepts and methods that are used to analyze biomedical data:

- Practical biomedical informatics
- Study design
- Statistical analysis
- Computational techniques related to biomedical research.

The Programming for Biomedical Informatics course was designed to prepare the students for basic programming skills and computing concepts that are necessary for biomedical data analysis:

- Fundamental data structures, algorithms and programming skills,

- Useful data analysis tools/libraries that are essentials to get students started with programming for biomedical informatics problems and applications.

Autumn Semester

The autumn semester curriculum includes two required courses and a laboratory rotation. All BMI students are required to take Biomedical Sciences Concepts course (BSGP 7000) and Introduction to Biomedical Informatics course (BMI 5710). The core curriculum concepts course BSGP 7000 is outlined below.

Block 1: Fundamental molecular biology

- Nucleic Acids
- Transcription & Translation
- Proteins
- Genes & Genomes

Block 2: Cell Biology

- Molecular & Cellular Physiology
- Cytoskeleton & Extracellular Matrix
- Development
- Molecular Pharmacology
- Neurobiology

Block 3: Systems

- Immunology
- Microbial Pathogenesis
- Computational Biology
- Experimental Therapeutics

The Introduction to Biomedical Informatics (BMI 5710) course provides a survey of BMI theories and methods employed in the design, implementation and management of information systems supporting basic science, clinical and translational research, clinical care, and public health.

Spring Semester

During the spring semester of the first year students will take two required courses and complete one or two lab rotations that are seven weeks in length. The two required courses are: 1) Professional and Ethical Issues in Biomedical Science (BIOPHRM 7510) and 2) either Introduction to Bioinformatics (BMI 5730) or Introduction to Research Informatics (BMI 5740) based on the student's interest.

The ethics course is designed to provide students with insight into the potential ethical dilemmas associated with biomedical research, and provide a basis for making decisions when faced with an ethical problem.

The Introduction to Bioinformatics course is to introduce students to basic topics of bioinformatics including sequence analyses, proteomics, microarrays, regulatory networks, sequence and protein databases.

The Introduction to Research Informatics course is to introduce trainees to the basic theories and methods employed during the design, implementation, and management of systems used to collect, exchange, store, query, and analyze large-scale, heterogeneous biomedical data sets. Examples of information systems to be discussed include clinical trials management systems, tissue repository management systems, collaborative "team-science" tools/platforms, and integrative data discovery and analysis tools/platforms.

Prior to choosing a dissertation advisor at the end of the first year, students will be required to complete at least two laboratory rotations (BSGP 7930), but not to exceed four rotations by the end of spring semester. Students should spend a minimum of three to four hours in the laboratory for each credit hour of BSGP 7930. By the end of the spring semester, students are expected to have a dissertation advisor and subsequently register for laboratory research in BSGP 8999.

Choice of Advisor and Research Problem

Soon after an applicant is admitted, the Biomedical Sciences Graduate Program office will appoint a First Year Advisor. The first year advisor will meet with their assigned student(s) on orientation day or another designated time close to beginning the program to discuss progress, plans, and challenges. Important items for discussion will be the choice of a laboratory rotation, potential dissertation advisors, elective courses to take, and area-of-research emphasis transcript designations.

Throughout these discussions, the first year advisor will emphasize the integrative and cross-disciplinary aspects of the student's training. Should any urgent issue arise during this time, the student will contact the first year advisor and arrange for additional meetings. The first year advisor will meet with the student for the second time at the end of autumn semester. The student will present to the first year advisor a report of their academic progress, a specific academic plan for the second year, and a general plan for subsequent years. Taking into account the suggestions of the first year advisor, the student will revise this report and submit it to the Biomedical Sciences Graduate Program office.

During mid-spring semester of the first year, the student and first year advisor discuss seriously their academic and research plans, as well as their choices for dissertation advisor. By the end of the first year, and no later than the beginning of second year, each student has chosen a mentor for their dissertation research from the 2-3 rotations they experienced in the first year. As soon as the dissertation advisor is chosen, they will formally meet with the student one-on-one at least once per week, preferably more. The dissertation advisory committee will meet formally with the student twice during the second year and at least annually, thereafter.