BioInformatics (P.S.M.)

About The Program:

Bioinformatics is the science that happens when computers are joined with the latest discoveries in genomics, biochemistry, and biophysics. It is a rapidly growing field that brings together elements of biology, chemistry, computer science, physics, and statistics. The Bioinformatics degree at Temple University, a leader in the field, is a two-year Professional Science Master's (P.S.M.) degree that features:

- An interdisciplinary approach involving scientists from across Temple University;
- Classes taught by esteemed tenure and tenure-track faculty as well as by our industry and government partners;
- Hands-on training in professional and management skills;
- Partnerships with industry and government leaders, including a diverse and active External Advisory Board;
- Access to real-world independent research projects; and
- An applied focus on responsibility and ethics in research and policy.

Career Options: Official job placement is not offered, but Bioinformatics is an area of rapid job growth and has become an essential part of healthcare research and the biotechnology and pharmaceutical industries. Graduates of P.S.M. programs are in high demand, which underscores the P.S.M. as an attractive career path for those who do not wish to become academic researchers or pursue a doctorate.

Prerequisites for Admission: Prior coursework in Computer Sciences, Physics, Chemistry or Biology with a GPA of 3.0 or above

Requirements of Programs:

- **Total Credit Hours**: 30
- **Culminating Events**
  Capstone Project:
  Capstone Project constitutes a culminating event of the Bioinformatics P.S.M. and requires the submission of a written project and oral presentation of the results.

Year 1

Fall

Genomics – Genomics is the study of the mechanisms of gene inheritance and gene expression as they are manifested across the entire genome. Students will learn about genome-related technologies, including genome sequencing and mapping. They will also learn about genome structure and how genomes vary across species, as well as the forces driving these evolutionary changes. Students will also learn how to carry out genome-level data analyses.

Structural Bioinformatics I – This course will cover the basic concepts of protein structure analysis, with focus on database searching and molecular modeling techniques. A broad qualitative overview of

macromolecular structure and protein folding will be provided before addressing the issues of sequence alignment, secondary structure calculation, and tertiary structure prediction. The course will also cover few selected advanced topics such as prediction of quaternary structure, Hidden Markov Models, and other approaches for building probabilistic models of sequence ensembles. Computer-based activities will allow students to develop a strong familiarity with molecular visualization software and web-based tools.

Scripting for Sciences and Business – Focus on three scripting languages and multiple operating environments for scientific computing and for business, practical scientific computing projects, and integration of numerical computation with experimental results.

Spring

Computational Genomics – This is a course on the application of genome-related concepts to genome sequence data. Students will gain familiarity with both existing software and with basic programming (scripting) skills for problems in genomics. Further, students will come to understand the connections between standard computational and statistical approaches and their underpinnings in those fields increasingly dominated by genomic approaches. These include the fields of molecular evolution, population genetics, molecular genetics, molecular biology, and biochemistry. The course will be a hands-on computational lab course, with students working on problems and assignments in class using their laptop computers.

Structural Bioinformatics II – This course provides an introduction to structural bioinformatics, with focus on understanding three dimensional structures of biological macromolecules. Topics covered include: an overview of macromolecular structure determination, introduction to molecular modeling theory and the application of computational modelling in structure based drug design. The course also offers practical training on the application of molecular modelling methods for understanding structural biology and in rational drug discovery.

Elective (3 Credits Worth)

Year 2

Fall

Biostatistics – Biostatistics is an important part of the research activities related to biological and medical issues. Statistics is used to analyze phenomena with random properties and is often essential to draw the right conclusions based on a data set. The course will be designed to cover different statistical methods for data analysis mainly applied to medical and biological problems. Advanced undergraduate and graduate students with interests in medicine and biomedical research will benefit most from the course. However statistical methods that can be applied to behavioral science and ecology will also be covered.

Professional Development Seminar for PSM in Biotechnology – The PSM program prepares graduates for careers in biotechnology-related fields with a strong emphasis on skill areas that include management, policy and regulation in addition to scientific discovery. This course will provide students with career exposure through interviews with professionals in government and industry and will assist students in developing a career plan. Students will develop a white paper on the current state of Biotechnology based on new advances and challenges in the past year. Members of the advisory board will participate in facilitating the course.

Ethics in Bioinformatics – This course will examine the social, legal, and privacy issues of applying computational approaches to large datasets including those from personal genome projects. The class will expose students to variation-based approaches in genomics, policies and strategies to share genomic data, database management and security, open-access and

open-source philosophies, the ethics of collecting, storing, and disseminating human data, and HIPAA, FDA, and IRB regulatory policies for health care professionals and bioinformaticians. Students will be given the opportunity to discuss contemporary case studies, in addition to NIH-sanctioned online training modules (Responsible Conduct in Research).

Capstone Project – Capstone project for master's students including students in PSM, MA or MS. This class will provide full-time status. Students in PSM programs need to register for at least one credit of this course to fulfill program requirements. Additional credits may be required for specific programs. Students in the MA program may satisfy this course requirement by completing a library thesis. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Spring

Capstone Project – Capstone project for master's students including students in PSM, MA or MS. This class will provide full-time status. Students in PSM programs need to register for at least one credit of this course to fulfill program requirements. Additional credits may be required for specific programs. Students in the MA program may satisfy this course requirement by completing a library thesis. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Electives (3 Credits Worth)

Courses:

Click HERE for more information on the courses below.

- Evolution
- Genomics in Medicine
- Fundamentals of Genomic Evolutionary Medicine
- Evolutionary Ecology
- Genomics and Infectious Disease Dynamics
- Evolutionary Genetics Genomics
- Innovative Biomodels and Concept
- Biomarkers and Biotargets: Research and Commercialization
- Epigenetics, Genetics: Applications in Drug Design and Drug Response
- Systems Biology: Principles and Applications
- Behavioral Genetics
- Effective Dissemination of Bio-discoveries through Traditional and New Media
- Bioinnovation Seminar
- Milestones in Clinical Translation of Biodiscoveries
- Bioadvanced Screening in Health Disparity
- Virtual Reality in Bioindustry and Medicine
- Dissemination of Biodiscoveries and Virtual Reality in Medicine
- Genomics and Evolutionary Biology of Parasites and Other Dependent Species
- Animal Behavior
- Ecology of Invasive Species
- Cell Biology
- Conservation Biology
- Herpetology
- Biostatistics
- Plant Community Ecology
- Biology of Plants
- Research Techniques in Molecular Biology
- Polar Biology - Life at the Extremes
- Comparative Biomechanics
- Epigenetics
- Cellular/Molecular Neuroscience
- Stem Cell Biology
- Genomics
- Structural Bioinformatics I
- Tropical Marine Biology: Belize

- Immunology
- Virology
- Developmental Genetics
- Freshwater Ecology
- Advanced Techniques in Microscopy
- Systems Neuroscience
- Neurological Basis of Animal Behavior
- Organization and Development of the Nervous System
- Biochemistry of Embryogenesis
- Mammalian Development
- Contemporary Biology
- Endocrinology
- Molecular Biology
- Cell Proliferation
- Physical Biochemistry
- General Biochemistry I
- General Biochemistry II
- Biotechnology
- Analytical Biotechnology
- Microbial Biotechnology
- Biotechnology Laboratory I
- Biotechnology Laboratory II
- Ethics Regulation and Policy in Biotechnology
- Professional Development Seminar for PSM in Biotechnology
- Computational Genomics
- Ethics in Bioinformatics
- Nucleic Acid Technologies
- Introduction to Scientific and Regulatory Writing
- Introduction to Grant Writing
- Communicating Science to a Broader Audience / Non-Scientists
- Graduate Independent Study
- Teaching of Biology
- Introduction to Graduate Research
- Seminar in Neuroscience
- Research Techniques
- Teaching in Higher Education: Life Sciences
- Directed Readings
- Master's Research Projects
- Preliminary Examination Preparation
- Capstone Project
- Master's Thesis Research