Washington University in St. Louis

Biomedical Informatics

The mission of the Institute for Informatics, Data Science and Biostatistics (I^2DB) focuses on the informatics, data science, and biostatistics landscape at Washington University School of Medicine in order to transform research, education, and patient care by emphasizing precision medicine and efforts to improve the quality of health care and public health initiatives locally, nationally, and worldwide.

Our vision at I^2DB is to serve as the academic and professional home for a preeminent interdisciplinary program of research, education, and service in informatics, data science, and biostatistics at Washington University by enabling advances in biomedical research and improvements in the quality of health care.

I^2DB provides an academic and professional home for both research and practice. While sitting at the intersection of all three fields, I^2DB spans the School of Medicine and works collaboratively with the McKelvey School of Engineering, the Institute for Public Health, the Brown School, the Olin School of Business, the Health Systems Innovation Lab and Center for Clinical Excellence at BJC HealthCare, and the Cortex Innovation Community.

I^2DB offers a Master of Science (MS) and a certificate program in Biomedical Informatics. The purpose of the MS and certificate courses is to provide comprehensive and competency-based training in core Biomedical Informatics theories and methods for the following individuals:

- Recent college graduates with backgrounds in the biological and/or computational sciences; and
- In-career learners with a broad range of experiences in biomedicine/biosciences, mathematics, physical or computer information sciences or engineering, and cognitive and/or social sciences.

Academic Calendar

The academic programs begin in early July each year. They start with preparatory workshops, which are followed by intensive summer semester courses. The program follows the Washington University Arts & Sciences academic calendar for fall and spring courses.

Location

The Biomedical Informatics program is located in the I^2DB, which is on the fifth floor of the Bernard Becker Medical Library (660 S. Euclid Ave., St. Louis, MO 63110), rooms 500 through 508.

Additional Information

Shelby Cripe, MA
Program Manager
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Po-Yin Yen, PhD, RN, FACMI, FAMIA, FAAN
Program Director
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Washington University School of Medicine
Biomedical Informatics Education Program
Institute for Informatics, Data Science and Biostatistics (I^2DB)
660 S. Euclid Ave., MSC 8067-0013-05
St. Louis, MO 63110-1093

Website: https://i2db.wustl.edu/

Degrees & Offerings

- PhD in Biomedical Informatics
- Master of Science in Biomedical Informatics
- Certificate Program in Biomedical Informatics

Research

Mentored Research

All students enrolled in the Mentored Research course will complete a master's thesis, which may involve conducting and reporting a comprehensive data analysis or conducting research and reporting on a focused methodological problem; the latter may include a computer simulation approach to solve a problem, an in-depth review of available methods in a certain topical area, or the development of new methods. Each student will work closely with a mentor with expertise in biostatistics or a related quantitative field. The grade for each student will be determined in consultation with the mentor.

Internship

The primary goal of the Internship program is for all students enrolled in the Internship to acquire critical professional experience so that they will be well-prepared to enter the job market upon graduation. This provides an opportunity for students to test-drive the job market, develop contacts, build marketable skills, and figure out likes and dislikes in the chosen field.

Faculty

Philip R.O. Payne, PhD, FACMI, FAMIA, FAIMBE, FIAHSI
Founding Director, Institute for Informatics, Data Science and Biostatistics (I^2DB)
Janet and Bernard Becker Professor
Associate Dean for Health Information and Data Science, School of Medicine
Chief Data Scientist, School of Medicine

Po-Yin Yen, PhD, RN, FACMI, FAMIA, FAAN
Program Director
Associate Professor of Medicine, Division of General Medical Sciences, School of Medicine
Associate Professor, Goldfarb School of Nursing, Barnes-Jewish College

Joanna Abraham, PhD, FACMI, FAMIA
Associate Professor of Anesthesiology
School of Medicine

Chih-Hung Chang, PhD
Professor of Occupational Therapy, Medicine and Orthopedic Surgery

Sabine M. Dietmann, PhD
Assistant Professor of Developmental Biology and Medicine, School of Medicine

William Dunagan, MD,MS
Professor of Medicine in the Division of Infectious Diseases, School of Medicine

Rosie Dutt, PhD
Instructional Consultant

Dennis Goldfarb, MD
Assistant Professor of Cell Biology and Physiology, School of Medicine

Richard Head, MS
Director, Center for Translational Bioinformatics
Professor of Pathology and Immunology

Mackenzie Hofford, MD
Associate Chief Research Information Officer, School of Medicine
Assistant Professor of Medicine Division of General Medicine School of Medicine

Thomas Kannampallil, PhD, FAMIA
Associate Professor of Anesthesiology, School of Medicine
Associate Chief Research Information Officer, School of Medicine

Albert M. Lai, PhD, FACMI, FAMIA
Deputy Director, Institute for Informatics, Data Science and Biostatistics (I^2DB)
Chief Research Information Officer, School of Medicine
Professor of Medicine, Division of General Medical Sciences, School of Medicine

Fuhai Li, PhD
Assistant Professor of Pediatrics, School of Medicine

Sunny Lin, PhD, MS
Assistant Professor of Medicine, Division of General Medical Sciences

Andrew P. Michelson, MD
Assistant Professor of Medicine, Division of Pulmonary and Critical Care Medicine

Shamim Mollah, PhD
Assistant Professor of Genetics, School of Medicine

Tara Payne, MA, FAMIA
Lecturer

Beth Prusaczyk, PhD, MSW
Assistant Professor of Medicine, Division of General Medical Sciences

Aristeidis Sotiras, PhD
Assistant Professor of Medicine, School of Medicine

Adam Wilcox, PhD, FACMI
Director, Center for Applied Clinical Informatics
Professor of Medicine, Division of General Medical Sciences

Courses

Visit online course listings to view offerings for M18 BMI.

M18 BMI 5000 Independent Study in Biomedical Informatics
Investigation of a topic in biomedical informatics of mutual interest to the student and mentor. Students and mentor must fill out an agreement and return to the I2DB education office to gain MS credit approval.
Credit variable, maximum 3 units.

M18 BMI 5200 Biomedical Informatics Journal Club
Trainees will attend weekly one-hour seminars and student-led journal club discussions in which current peer-reviewed publications relevant to biomedical informatics will be reviewed and discussed.
Credit 1 unit.

M18 BMI 5201 Biomedical Informatics Rotation
Students will be responsible for arranging two rotations to identify a thesis lab or capstone project site. Each rotation will last approximately one month, with the goal being to expose students to research and practical biomedical informatics opportunities in both academic and industry settings.
Credit 1 unit.

M18 BMI 5204 Mixed Methods in Biomedical Informatics
Building on the fundamentals of biomedical informatics in BMI I & II, this course will introduce students to the various research methods and underlying theories used to conduct biomedical informatics research studies. This course will cover research methods, including the systematic review of published research as well as qualitative, quantitative, and mixed methods. Under each topic, we will focus on the formulation of research questions/hypotheses, the selection of appropriate study design, data collection and analysis methods, and methods to ensure rigor and reproducibility of research. The course will encompass several hands-on components for students to practice and apply their learned skills.
Credit 3 units.

M18 BMI 5205 The Electronic Health Record
The electronic health record (EHR) has become a central technology for the provision of clinical care. This course will use the EHR as a reference point to explore key areas in clinical informatics, including history, applications and policy.
Credit 3 units.

M18 BMI 5302 Introduction to Biomedical Informatics I
This survey and methods course provides an overview of the theories and methods that comprise the field of biomedical informatics. Topics to be covered include the following: (1) information architecture as applied to the biomedical computing domain; (2) data and interoperability standards; (3) biological, clinical, and population health relevant data analytics; (4) healthcare information systems;

(5) human factors and cognitive science; (6) evaluation of biomedical computing applications; and (7) ethical, legal, and social implications of technology solutions as applied to the field of biomedicine.
The course will consist of both didactic lectures and experiential learning opportunities, including hands-on laboratory sessions and journal club-style discussions. The course will culminate with a capstone project requiring the in-depth examination, critique and presentation of a student-selected topic related to the broad field of biomedical informatics. Biomedical Informatics I is designed primarily for individuals with a background in the health and/or life sciences who have completed a course in introductory statistics (e.g., Math 1011). No assumptions are made about computer science or clinical background; however, some experience with computers and a high-level familiarity with health care will be useful. This course does not require any programming knowledge, and it will not teach students how to program.
Credit 3 units.

M18 BMI 5303 Introduction to Biomedical Informatics II
This course builds upon the principles taught in Biomedical Informatics I by focusing on theories and informatics methods used in the study of populations. Topics include study design, statistical inference, bias, confounding factors, causality, and multi-level populations scale data. This course is intended to enable individuals to critically select relevant methods and evaluate their results as part of both the design of new projects as well as the review of results available in the public domain (e.g., literature, public data sets). Core concepts to be reviewed during this course include computational skills, data modeling and intergration, fomal knowledge representation, in silico hypothesis generation, quantitative data analysis principles, and critical thinking skills surrounding the ability to ask and answer questions about complex and heterogeneous biomedical data. Prerequisite: M18 5302 or instructor permission.
Credit 3 units.

M18 BMI 5304 Introduction to Biomedical Data Science I
Biomedical Data Science I will provide students with an introduction to tools, theories and methods related to data modeling, management and query, data manipulation and analysis, and visualization that serve as the foundations for advanced topics in Biomedical Informatics and Data Science. The course consists of didactic lectures and experiential learning opportunities including hands-on laboratory sessions and a culminating project. No assumptions are made about computer science or clinical background; however, prior experience with health and life sciences data, and data structures and algorithms are strongly encouraged. Lectures will be held asynchronous. Labs are in person.
Credit 3 units.

M18 BMI 5305 Introduction to Biomedical Data Science II
Building upon the fundamental principles of informatics tools and data analysis taught in Biomedical Data Science I (M18-5304), this course provides students with more advanced methods in the areas of biomedical computing, including data analysis, machine learning, deep learning models, natural language processing, deployment of data analysis models on supercomputers, and development of web apps. Both theory and coding applications and practices will be introduced for usage in the space of genomics, imaging, and medical records data analysis to help students apply learned computational tools and models. Prerequisite: M18-5304 or instructor permission.
Credit 3 units.

M18 BMI 5401 Biomedical Informatics Capstone
Students will demonstrate how to synthesize and apply the full spectrum of biomedical informatics theories and methods used in the program curriculum. The capstone project focuses on an applied informatics problem with relevance to health care research or delivery at the individual or population level, resulting in a report that outlines the student's problem selection and the design, conduct, and results of the student's research. Each trainee will also be expected to present their project and its outcomes or findings in a public seminar, where questions will be posed by both the audience and a committee of faculty members. The specific selection of the capstone or thesis project track as part of a trainee's degree program is to be discussed with and approved by the individual's faculty and academic adviser. Students who do not enroll in the captone course will enroll in the thesis course. Prerequisites: Introduction to Biomedical Informatics I and II (M18 5302 and M18 5303), Introduction ot Biomedical Data Science I and II (M18 5304 and M18 5305), and a minimum of one Advanced Topics course. Permission of the faculty and adviser is also required.
Credit variable, maximum 3 units.

M18 BMI 5402 Biomedical Informatics Thesis
Students will demonstrate how to synthesize and apply the full specturm of biomedical informatics theories and methods included in the program curriculum. The thesis project requires students to formulate research questions that focus on the development or extension of a theoretical framework or a novel method with relevance to the field of informatics, resulting in a report that outlines the student's topic selection and the design, conduct, and results of the student's research. Each trainee will also be expected to present their project and its outcomes or findings in a public seminar, where questions will be posed by both the audience and a committee of faculty members. The specific selection of the capstone or thesis project track as part of a trainee's degree program is to be discussed with and approved by the individual's faculty and academic adviser. Students who do not enroll in the thesis course will enroll in the capstone course. Prerequisites: Introduction to Biomedical Informatics I and II (M18 5302 and M18 5303), Introduction to Biomedical Data Science I and II (M18 5304 and M18 5305), and a mimimum of one Advanced Topics course. Permission of the faculty and academic adviser is also required.
Credit variable, maximum 3 units.