



# MATHEMATICAL BIOSCIENCES INSTITUTE

[mbi.osu.edu](http://mbi.osu.edu)

The Ohio State University Mathematical Biosciences Institute (MBI) was established in 2002, with a National Science Foundation (NSF) grant, to maximize opportunities for the mathematical sciences to accelerate progress in the biosciences. MBI is one of only eight mathematical institutes around the country and the only one dedicated to the study of the intersection of math and biology.



MBI is host to hundreds of research talks each year

## MBI UNDERGRADUATE SUMMER RESEARCH PROGRAM

This program introduces students to exciting new areas of mathematical biology, involves them in collaborative research with their peers and faculty mentors, and increases their interest in mathematical biology. The program consists of three parts – a one week program at MBI, an eight week research experience at one of seven partner institutions and a one-week conference at MBI.

*Where the biosciences and mathematical sciences  
come together*

## UNIQUENESS

We foster innovation in the application of mathematical, statistical, and computational methods in the resolution of significant problems in the biosciences.

We foster the development of new areas in the mathematical sciences motivated by important questions in the biosciences.

We engage mathematical and biological scientists in these pursuits.

We expand the community of scholars in mathematical biosciences through education, training, and support of students and researchers.

“Our MBI scholars tackle problems and make discoveries that push the envelope for what can be done to make real progress in the biological and biomedical sciences.”

(Marty Golubitsky, Director, MBI)

[asc.osu.edu](http://asc.osu.edu)

COLLEGE OF ARTS AND SCIENCES

## FACULTY, FELLOWS AND STUDENTS

MBI funding supports the work of 15-20 postdoctoral fellows annually, including:

- **FARRAH SADRE-MARANDI**

Farrah's research is in modeling human disease. Her research has been focused on the structures of viral capsids and understanding nucleic acid-protein interactions in HIV-1. She is also interested in treatment efficacy. She is also interested in analyzing treatment efficacy, studying techniques which could aid in the prevention and reversal of disease, as well as symptom management. She incorporates methods from applied dynamical systems, numerical analysis, biostatistics, and epidemiology which cover issues in the fields of biochemistry, nutritional science and human physiology.

- **REGINALD MCGEE**

Reginald has an interest in many biological systems and primarily uses dynamical system theory and bioinformatics methods to analyze mathematical models and biological data. Previously, he has focused on the development and analysis of deterministic models for signal transduction pathways in normal and mutant lymphocytes. Currently, he is interested in determining characteristic biomarkers for subgroups of acute myeloid leukemia and developing mathematics to better understand signaling pathway dynamics in leukemic cells.

- **PUNIT GHANDI**

Punit is interested in the emergence of spatial patterns in biological and ecological systems. His work makes use of tools from dynamical systems and bifurcation theory to develop and analyze mathematical models of the pattern forming process. One recent focus has been on vegetation patterns in semi-arid regions that are thought to arise through self-organization at a community level in response to limited resources.

In addition to the many Ohio State faculty members who participate in MBI, 10 to 15 faculty visitors are in residence at MBI at any one time. Each year, approximately 800 visitors attend special MBI workshops.

## EMPHASIS PROGRAMS

MBI offers emphasis programs (either annual or semester in length), current topic workshops, educational programs, and sponsored research projects in all areas of bioscience where participation of the mathematical sciences is expected to lead to important progress.

### **2018 SPRING SEMESTER: INFECTIOUS DISEASES: DATA, MODELING, DECISIONS**

The effectiveness of improved sanitation, antibiotics and vaccination programs created a confidence in the 1960s that infectious diseases would soon be eliminated. As a result, chronic diseases such as cardiovascular disease and cancer started to receive more attention in the United States and industrialized countries. But infectious diseases have persisted and continue to be a major cause of suffering and mortality both in developing and industrialized countries. As infectious disease agents adapt and evolve, new infectious diseases have emerged and some existing diseases have recently reemerged. Antibiotic-resistant strains of tuberculosis, pneumonia and gonorrhea are becoming a major concern in many parts of the world. Malaria, dengue and yellow fever have reemerged and are spreading into new regions as climate changes occur. Diseases such as plague, cholera and hemorrhagic fevers (Ebola, Lassa, Marburg, etc.) continue to erupt and occasionally reach dangerous thresholds of global pandemics, with the 2014 Ebola outbreak originating in West Africa providing a recent example.

### **2018 FALL SEMESTER: ANALYZING MACRO AND MICRO POPULATION MODELS**

This emphasis program will look at problems in modeling micro- and macro- populations in biological studies. From DNA molecules and viruses to humans, the collective behavior of individual components gives rise to the overall dynamics of the biological system. The program will explore mathematical, statistical and biological perspectives on analyzing data from such systems and on construction of predictive models of behavior.