Genetics

Course Overview

Campus Location: Summer Springboard Boston (class at MIT)
Instructors: Summer Morrill & John Replogle

Overview: Students will be introduced to the fundamentals of genetics through a hands-on, integrated approach. From its origins to its modern-day applications, genetics is a way to solve some of biology's most complicated problems. Students will work together through a series of problem-based learning exercises to understand what genes are and how genetic information is translated into observed characteristics and traits in every life form, from bacteria to humans. Throughout the two week session, students will also work on a laboratory-based project to investigate genes of unknown function in budding yeast (Bowling et. al. 2016). Laboratory modules will include in silico (computer simulation) and in vivo (in the organism) experimental techniques, providing students with a genuine research experience.

Topics to cover

- Gene structure and organization: What is a gene? What do genomes look like?
- Inheritance: How is genetic material copied and transmitted? How do we make new cells?
- Genetics as probability: What are the patterns of inheritance? What predictions can we make about genetic outcomes?
- The genetics of human disease: What is a mutation, and how does it lead to the development of a disease? How can we use information about genetics to improve treatment and prognosis?
- Genome editing: How do we manipulate the genomes of biological organisms?
- Bioethics: What are the ethical and social implications of genetic testing?

Learning Objectives

Students will be able to...

- Describe the historical experiments fundamental to the discovery of DNA as the genetic material
- Explain the Central Dogma of molecular biology, highlighting how genetic information becomes visible as a physical and measurable trait
- Predict inheritance patterns of diseases caused by Mendelian traits
- Connect key cellular processes, such as DNA replication, to modern experimental techniques, like PCR and DNA sequencing
- Discuss the ethical implications of how DNA sequencing and gene editing are used in society
- Design and test original hypotheses to predict gene function of yeast "orphan" genes

Guest Speakers & Excursions

Students will visit a pharmaceutical or biotechnology company where career scientists share what they do and reflect upon their successes, failures and learnings. Accomplished industry professionals will speak about their career path and about the wide range of career opportunities in biomedical research and biotechnology.

Instructors:
Summer Morrill is an accomplished researcher with diverse laboratory experience. Her research at MIT includes studying the effect of gene dosage on genome maintenance as well as uncovering the origin and maintenance of haploinsufficiency in eukaryotic organisms. Summer graduated from Tufts University summa cum laude with highest thesis honors.

John Replogle is also a talented researcher and has written multiple publications. At MIT, he has researched aneuploidy in primary cells versus cancer cells. His findings were published in Cancer Cell, a scientific journal. John holds a Bachelor in Molecular Biology as well as a minor in Mathematics from Pomona College.

Course Structure: Students live and eat on the campus of Simmons University, and travel to class on the campus of MIT. There are 9 class sessions over the two-week course. During the first week, students have class from 9am-12pm, Monday through Friday. During the second week, students have class from 9am-12pm Monday through Thursday. Friday morning there is no class, students check out from the program and depart on that day.

Tuition

- **Residential Students**: $4,998
  - Includes: all meals, lodging, excursions, academic program, weekend excursions
  - Excludes: optional airport pickup and drop off service (available for an additional fee)

- **Commuter Students**: $2,798
  - Includes: lunch, academic program, excursions, programming from 9am to 5pm, Monday-Friday
  - Excludes: lodging, breakfast, dinner, weekend excursions

- **Extended Commuter Students**: $3,398
  - Includes: lunch, dinner, excursions, academic program, programming from 9am to 8pm, weekend excursions
  - Excludes: lodging, breakfast