Overview

This class will focus on how state-of-the-art -omics approaches are being leveraged to understand the biological basis of common human diseases and to develop new treatments for these diseases. -omic approaches for DNA, the epigenome, RNA, protein, and metabolites will be discussed. Common human diseases have a multifactorial basis with environment and genetic susceptibility contributing to risk. Evidence for the multi-factorial basis of common diseases will be covered as well as -omic approaches to identify common and rare DNA variants that contribute to disease. How these genetic variants interact with the environment to increase risk will be discussed. The mapping of these risk variants to noncoding protein sequence and their relevance to gene regulation will be covered as well as how these genetic variants interact with pharmaceuticals to influence treatment. Proteomic, epigenomic and metabolomic approaches for disease profiling will be covered next. The class will end on how these approaches are being leveraged to develop personalized medicine approaches for cancer and autism.

Pedagogy

The course will employ: PPT presentations by the faculty, assigned readings and PPT presentations by the students. Each student will be required to participate in class when papers are discussed and to present one paper as a PPT presentation.

Learning goals

After taking the course students should be able to:

- Understand how common human diseases are due to both genetic and non-genetic factors
- How genetic variants interact with non-genetic environmental factors and drugs to affect phenotypes and treatment outcomes
- Understand how these genetic variants may affect gene function and regulation
- How -omics approaches can be leveraged to understand the biological basis of these diseases and to develop new treatments

Required Readings

Two papers from the primary literature will be required for each class. PPT presentations by the faculty will introduce the concepts for each class.
Assignments
Primary literature readings, class participation and student PPT presentations

Basis of grade assignments
Class participation and student PPT presentations
Grades will be
A, B+, B, C+, C and F

Course schedule
9/4 intro
9/11 Week 1: The multi-factorial basis of common diseases
9/18 Week 2: Common variants and disease
9/25 Week 3: Rare variants and disease
10/2 Week 4: Genetic x environmental interactions in disease
10/9 Week 5: ENCODE
10/16 Week 6: Pharmacogenomics
10/23 Week 7: free week
10/30 Week 8: Proteomics and disease
11/6 Week 9: Epigenomics
11/13 Week 10: Metabolomics
11/20 Week 11: Cancer
12/4 Week 12: Stem cells and disease