

Welcome to BioMedical Genomics, an online **seminar** course (47119 and 70919 for upper level undergraduates and graduate students. A genome is the total genetic content of an organism. Driven by breakthroughs such as the decoding of the first human genome and rapid DNA and RNA -sequencing technologies, biomedical sciences are undergoing a rapid and profound transformation into a highly data-intensive sequence centric enterprise, that requires familiarity with concepts in multiple disciplines, including biology and computer science. Genome information is revolutionizing virtually all aspects of biology, medicine, anthropology and preservation of life on earth. It will lead to major advances in cures and/or prevention of diseases such cancers, malaria and yes, COVID, while promoting a better understanding of population, variation, migration, evolution, ecology and extinction.

A knowledge of basic undergraduate Genetics and Biochemistry is required for this course. Addressing the COVID-19 pandemic has necessitated developing and deploying many novel technological **breakthroughs** in genomics. As a result, it is now possible to learn widely-applicable approaches to genomics, epidemiology and medicine while focusing on COVID-19.

The course will involve making sophisticated presentations and writing a brief proposal addressing the following areas:

- Rapid and accurate DNA and RNA sequencing of viral variants.
- Phylogenetics (Molecular Phylogeny), to track origins and ancestry of strains.
- Genome wide Association Studies (and beyond that, machine learning approaches) to implicate gene contributing human phenotypes.
- CRISPR-Cas technologies for genome editing and, more importantly, for rapid sensitive testing for many viruses including SARS COV 2.
- Molecular modeling of protein structure to identify vulnerable sites.
- Vaccine development.
- Protein-Protein interactions using Mass Spectrometers to identify druggable proteins and pathways.
- Genomic Epidemiology strategies for efficient detection, analysis of distribution and prevention of COVID-19.
- Novel genomic technologies for vaccine development.

Learning Outcomes. By the end of this course students will demonstrate competency in the topics described above as well as expertise in the following areas:

- Bibliographic searching for significant articles in high impact journals.
- Making presentations on the topics described above
- Writing a short proposal and taking two tests.

The course will be conducted online in two essential modes:

1. The Synchronous mode uses Zoom for live, interactive, real-time, teaching, discussion and presentations from 9:00 am to 12:30 pm on the following Saturdays in Fall 2020: 8/29, 9/12, 10/3, 10/17, 11/7, 11/14.
2. The Asynchronous mode involves using VoiceThread and other modern online tools for interactive learning at various times. The tasks include locating, reading, summarizing published articles, collaborating with colleagues, developing VoiceThread slide presentations and contributing to class projects online. Each student will first contribute to a collaborative presentation, and then later develop their own detailed presentation on a topic. The asynchronous component requires at least as much time as the synchronous component, and we recommend using the Same Saturday time slot every free week for this activity. **Therefore, you should set aside most Saturday mornings for this class.**

