OLLI Workshop Planning – Spring 2023

Title: What's in my blood? Genomics Testing and You

Instructing team (all from University of Illinois at Urbana-Champaign):

- Brian T. Cunningham* (Dept. of Electrical and Computer Engineering)
- Andrew Smith (Dept. of Bioengineering)
- Xing Wang (Dept. of Bioengineering)
- Yang Zhao (Dept. of Electrical and Computer Engineering)
- Hong Jin (School of Molecular and Cellular Biology)

***Contact instructor:**
Prof. Brian T. Cunningham, bcunning@illinois.edu, phone: 217-265-6291

Other information:

- 8-week course
- Each session is 90 minutes

Brief course description:
Genomics-based tests are increasingly becoming integral parts of our daily lives. From detecting and identifying viral pathogens in our saliva, identifying early signs of cancer, and discovering our ancestry, the information stored in the DNA of ourselves and the world around us can help us stay healthy, assist police in solving crimes, and understand how we are unique individuals that share a great deal in common with all humans. This course will describe how the information in genomes is decoded and applied by technologies that can accurately determine our genetic sequence and look for the presence of specific genes in body fluids, foods, and crime scenes.

Reading list for students:

1. Building blocks of the genetic code: https://www.ashg.org/discover-genetics/building-blocks/
2. Wikipedia: Ancient DNA: https://en.wikipedia.org/wiki/Ancient_DNA
3. Circulating tumor DNA (can provide a downloaded pdf file to the class): https://ascopubs.org/doi/10.1200/JCO.2017.76.8671
4. Next generation sequencing: YouTube Video (10 min): https://www.youtube.com/watch?v=CZeN-IgjYCo
5. PCR: National Human Genome Institute: https://www.genome.gov/genetics-glossary/Polymerase-Chain-Reaction (includes short video) and class notes provided by Instructor.
6. DNA sequencing from Khan Academy: https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation/biotechnology/v/dna-sequencing

Course outline and lecture assignments:
Wednesdays, 3:30-5:00PM at OLLI

	What's in my blood? Genomics Testing and You
1	**2/1/23: The ABC's of life:** *DNA, genes, and their sequences. (Hong)* Explanation of what DNA is made of, the four-letter alphabet of the genetic code, and how regions of the genome are organized to control the function of every cell, virus, and bacteria.
2	**2/8/23: We can all be sequenced!** *The new tools for sequencing, genetic maps, and gene matching (Xing)* Since the cost of sequencing an entire human genome has dropped below $1000 and as a result it is likely that all of us will be sequenced at some point during routine medical treatment. This lecture will describe how "next generation" DNA sequencing technology works.
3	**2/15/23: Gene tests for sale:** *Discovering ancestry and inherited health risks through your genes (Brian)* Commercially available genetic analysis services such as 23andMe and Ancestry have been available for several years. This lecture will describe the technology behind these companies and show how they estimate our genetic origins and potentially identify whether we have increased likelihood for developing specific health conditions.
4	**2/22/23: Genomics for judges:** *Catching criminals and clearing the innocent through genes (Brian)* How does information collected at a crime scene identify the presence of a specific person, and how do the police make a match? In this lecture we will discuss what genomic "fingerprints" are, and how they have been used in some well-known cases.
5	**3/1/23: Liquid Biopsy:** *Diagnosing cancer with molecules in blood that escape from tumors (Yang)* Now, DNA in a blood sample and DNA from a tumor biopsy can be sequenced to understand the specific genetic changes that cause cancer in an individual. How is "liquid biopsy" used to help determine the best course of treatment, measure whether chemotherapy is effective, and monitor for remission after successful treatment?
6	**3/8/23: Name that Pathogen!** *Detecting viruses and bacteria with genes (Xing)* Having lived through the COVID-19 pandemic, we are now all very familiar with Polymerase Chain Reaction (PCR) tests that identify the presence of a specific viral pathogen in our noses or saliva. This lecture will describe how PCR works, and describe other applications for it identifying other viruses and bacteria in applications like food safety, antibiotic resistant bacteria, and other diseases such as HIV.
7	**3/15/23: RNA Vaccines** *Inoculating against COVID-19 and a route toward curing cancer. (Andrew).* During the race to urgently develop effective vaccines against COVID-19, a novel approach that uses RNA instead of deactivated virus to stimulate our immune system was the approach that emerged from Moderna and Pfizer. Before they were used as vaccines against viral pathogens, RNA vaccines were being considered as an approach toward stimulating the immune system to attack cancer cells. This lecture will discuss how RNA vaccines are developed to immunize us against virus infections and how they might be used in the fight against cancer.
8	**3/22/23: Gene Lab:** *Try your hand at some simple gene tests* We will bring some gear from the lab to show what some of the technologies look like. We plan to include gel electrophoresis, a portable PCR device for virus testing, and a cartridge used for next-generation genome sequencing. For instruments that are too large and expensive to travel, we will bring the lab to the workshop with virtual tours from lab directors at the University's Carver Biotechnology Center, Bionanotechnology Laboratory, and the Tissue Engineering Phenotyping facility.