

THE WAGNER FREE INSTITUTE OF SCIENCE

Spring 2019
BIOLOGICAL SCIENCES SERIES
Genetic Engineering and its Impact on Society
Professor Mary Beth Davis

The course meets at the **Independence Branch of the Free Library**, located at 18 S. 7th Street (between Chestnut and Market Streets), Philadelphia.

Dates: 6 Wednesdays, April 3 to May 8, 2019

Time: Classes meet from 6:15 to 7:30 PM

No pre-registration required. Please register by filling out a registration form at the class.

Course Description

Launched in 1990 and completed in 2003, the goals of the Human Genome Project (HGP) were to determine the DNA sequence and identify all of the genes in the human genome. In addition, the HGP dedicated funding to explore the Ethical, Legal, and Social Implications of this emerging technology. Discoveries from genome research, especially rapid, low-cost DNA sequencing, is making accessing one's personal genetic information a reality. This course will explore some "hot topics" in genetic engineering, including gene-editing technologies.

Course Schedule

1. Wednesday, April 3, 2019 – Genes and genomes: Perspectives 16 years after the completion of the Human Genome Project

From Gregor Mendel's 1866 paper on the particulate theory of inheritance through the Human Genome Project to 21st century research, the concept of a "gene" has evolved from abstract descriptions to operational definitions involving complex biochemical and molecular processes. This lecture will cover introductory background topics from genetics and genomic science to set a foundation for the course.

2. Wednesday, April 10, 2019 – Genotype, phenotype, and epigenetics

Phenotype refers to the observable characteristics of an organism, such as physical, biochemical, and behavioral traits, and it is derived from the interplay of genetic and environmental factors. The field of epigenetics explores how heritable changes in gene expression that are not caused by alterations in DNA sequence itself can affect the phenotype of an organism. Environmental factors may also have an influence on the "epigenome." Identical twins have the same initial genome because they develop from a single fertilized egg, thus studying the epigenome from identical twins can provide insight into environmental effects on gene expression. Examples from studies of DNA from identical twins and also from research on cancer epigenetics will be presented.

3. Wednesday, April 17, 2019 – Searching for identity and connections through personalized DNA testing services

Many commercial companies offer the opportunity for individuals to purchase direct-to-consumer genetic tests and genome profiling. Depending on the tests, data from DNA sequencing can reveal information about potential health issues, familial relationships or clues about ethnicity or geographical history of ancestors. We will discuss examples of results from such DNA testing as well as personal and ethical dilemmas associated pursuing these types of commercial tests.

4. Wednesday, April 24, 2019 – Genome editing I: What is the CRISPR technology?

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is part of a naturally occurring microbial genome editing system that provides microbes with a defense against viruses. Significant scientific breakthroughs developed the CRISPR system into a gene-editing tool that could be used in cells from humans, animals, and plants. The first class of a two-class sequence will focus on an overview of genome editing and CRISPR technology.

5. Wednesday, May 1, 2019 – Genome editing II: Applications of CRISPR technology

Almost daily, there are news articles of remarkable accomplishments with CRISPR-associated technology. We will discuss how CRISPR technology has revolutionized biological research, with applications to medicine, agriculture, and basic research. However, the November 2018 report of a scientist using CRISPR to edit human embryos that allegedly resulted in the birth of “gene-edited” babies was met immediate controversy and condemnation. The status of this case by the time of the class will be reviewed.

6. Wednesday, May 8, 2019 – Paleogenetics and paleoproteomics: What can ancient molecules reveal about evolutionary history?

Analysis of DNA from fossilized remains helps to clarify relationships between extant organisms and may provide insight on adaptations with respect to climate change. The emerging field of paleoproteomics focuses on the extraction and identification of “ancient proteins” from fossils. Collectively these technologies can also give clues about ancient diets, microbial populations, and environments thereby shedding light on evolutionary history of humans, animals, and plants.

Wednesday, May 15, 2019 – Make-up class (if needed)

Recommended Readings

There is no text that covers the material from this class, but there are many excellent online resources.

Genetics Home Reference from the U.S. National Library of Medicine - <https://ghr.nlm.nih.gov/> - has excellent information on genetics and molecular biology for the general public.

Many of the topics covered in this class are often covered in the science sections of many major magazines and news organization, which often give perspective on impacts in society.

About the Professor

Dr. Mary Beth Davis is a Pre-Health Advisor at Drexel University. She previously served as Assistant Dean and Undergraduate Health Professions Advisor at Bryn Mawr College. She received a PhD in Genetics from Cornell University and has conducted research at the University of Virginia, the University of Pennsylvania Medical School, and at Fox Chase Medical Center. She also taught biology at Bryn Mawr College and at Swarthmore. She has been a member of the faculty of the Wagner Free Institute of Science since 2000.

The course is presented by the Wagner Free Institute of Science. Founded in 1855, the Wagner is dedicated to providing free science education. All classes are free and open to the public. To attend, please complete a registration form at the class. For more information about the Wagner Free Institute of Science and its programs, please visit www.wagnerfreeinstitute.org or call 215-763-6529.
