

# GENE 220: Evolutionary Genetics and Genomics: From Charles Darwin to Integrated-Omics

This course teaches key concepts of evolutionary genetics, using a historical framework. Class discussions will use historical examples from the literature, primary and review literature, modern and historical, with each class session focusing on progressively modern material. The course will start with Charles Darwin's theory of evolution: selection, variation, and the historical background of selective breeding and heredity. Subsequent classes will cover population genetics and the modern evolutionary synthesis, chromosomal theory and the central dogma of molecular biology as well as phylogenetics, diversity, and common descent. Molecular genetics will be introduced in the context of bacterial gene regulation and gene regulatory networks. The course will end with a discussion on genomics, post-genomics, and epi-genomics. Student assignments will include an essay about a specific topic on breeding and heredity, a presentation about traits or diseases associated with cytogenetic abnormalities or the research of a modern synthesis contributor, and a descriptive report about a disease-causing gene and its genomic setting. At the end of the course, students will understand how the paradigms of evolution and genetics have advanced since Darwin and will be able to discuss our modern-omics- oriented understanding of heritable disease and evolution in its historical context.

## Learning Objectives

- Explain key paradigms, advancements, and scientists contributing to evolutionary genetics and evolutionary theory, starting with early nineteenth-century scientific thought
- Analyze experimental strategies and key studies of evolutionary genetics, focusing on specific examples of advancements in understanding hereditary disorders and genetic conditions
- Discuss early paradigms of selective breeding and hereditary, the "Modern Synthesis," discoveries of chromosomal inheritance as well as the central dogma of molecular biology
- Discuss basic gene regulation paradigms, developmental genetics and evolutionary-developmental biology, and conceptualization of genetics in the '-omics era'
- Review and report on a specific historical example of evolutionary genetics of own interest or relevance

**Credits:** 2

**Class Type:** Graduate Course

**Prerequisites:**

undergraduate-level genetics.

**Program:** Biology, Genetics, and Medicine