

## **BIOL 233 Course Topic Schedule:**

**The course is taught in 11 weekly modules, with a week midterm break between Modules 6 & 7.**

**Module 1. How different are we?** Introduction to DNA, genes and chromosome. Genetic similarities and differences, and the relationships between human populations. Ancestral interbreeding with Neanderthals. Tutorial: Human genetic diversity

**Module 2. How DNA molecules change.** The causes and immediate consequences of mutations. Tutorial: How mutations arise and accumulate in DNA sequences

**Module 3. DNA differences and gene functions.** How mutations that change gene activity or function affect the properties of organisms. Tutorial: How DNA sequence changes affect gene functions

**Module 4.** Mutations in regulatory genes. How mutations cause cancer. Sex determination and genes on sex chromosomes. Tutorial: Genetic interactions in sex determination and cancer

**Module 5. Natural genetic variation.** How natural genetic variation is studied, and how it differs from classical alleles. Heritability and genome-wide association studies. Genetic variation for cancer risks. Tutorial: Genome-wide association study of genes affecting cancer risk

**Module 6. Personal genomics.** Kinds of DNA typing and genome analysis, and what can be learned from them about health risks, personal attributes and ancestry. Tutorial: Exploring personal genomics analysis with 23andMe

**Module 7. The mechanics of inheritance.** How genes and chromosomes are transmitted through the generations. The molecular mechanisms of mitosis and meiosis. Detailed analysis of ancestry. Tutorial: Using VNTR alleles to analyze family relationships

**Module 8. Genetic analysis.** Using genetic crosses as a research tool to investigate how genes work and what they do. Sex-linkage, pedigree analysis, and hypothesis testing. Tutorial: Investigating MDM2 and P53 functions by classical genetic analysis

**Module 9. All about breeding and inbreeding.** More about heritability and association studies. Inbreeding in humans, crops and livestock, and in the evolution of species. Hybrids and genetically modified organisms. Tutorial: Designing matings to preserve genetic diversity in a giraffe breeding program

**Module 10. Chromosomal changes.** Causes and consequences of changes in the number of chromosomes and in how genes are arranged on them. Genome evolution. Tutorial: Evolution and function of the opsin gene family

**Module 11. Advanced topics of particular relevance.** The origin of life, mitochondrial genes and mutations, genetic mosaicism, fetal DNA in mothers, epigenetic inheritance, and other topics students may suggest. Tutorial: Genetic analysis reveals human history.