Administrative Unit: Science Department

Course Prefix and Number: BIOL 342

Course Title: Genetics

Number of Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Catalog Description: Basic principles of Mendelian and molecular genetics. Students majoring in Biology must earn a grade of C or better. Offered odd Fall.

Prerequisite(s)/Corequisite(s): BIOL 110.

Text(s): Textbooks designed for a one semester course in Genetics are suitable for this course. Topics should include both classical and molecular genetics. Examples include.

Basic Genetics by Weaver, W.C. Brown Publishing.

Essentials Of Genetics by Klug and Cummings, MacMillan Publishing.

Genetics by Russell, Addison Wesley Longman Publishing.

Course Objectives:

• To examine the fundamental principles that underlie classical and molecular genetics
• To understand the structure of prokaryotic and eukaryotic genes, and relate aspects of gene structure to gene expression and protein synthesis
• To investigate mechanisms of gene expression and regulation
• To understand the basic mechanisms of genetic engineering, and the uses and impacts of this technology
• To examine the impact of genetic variation on evolution of populations and species

Measurable Learning Outcomes:

• Describe the relationship between genotype and phenotype; recognize different patterns of phenotypic variation
• Apply the laws of probability and the Chi-square test to determine outcomes of specific genetic crosses
• Summarize the basis of autosomal inheritance, sex-linked inheritance, and cytoplasmic inheritance; give specific examples of different types of inherited diseases and describe their genetic basis
• Describe overall chromosome structure, how genes are arranged on chromosomes, how chromosomes are partitioned into cells during mitosis and meiosis, and the effects of aneuploidy
• Explain the different stages in the cell cycle, and the behavior of the chromosomes at each stage; describe
the mechanisms that govern genetic recombination and regulation of the cell cycle

- Summarize the history of gene mapping, and the key experiments and techniques involved, relate this to current molecular mechanisms for gene mapping
- Compare and contrast genome arrangement and function in prokaryotic and eukaryotic cells; describe mechanisms of genetic variation and genome mapping in bacterial cells
- Demonstrate understanding of the interactions that occur between the alleles of one gene, between genes and proteins, and illustrate these concepts with specific examples
- Describe the chemical and physical structure of DNA molecules; compare and contrast this with RNA molecules
- Detail the steps and enzymes involved in accurate replication of DNA
- Explain the mechanism of transcription in prokaryotic and eukaryotic cells; describe the role of promoters, terminators, enhancers, silencers, introns, exons, and catalytic RNA
- Describe the steps involved in protein synthesis and post-translational modifications
- Summarize mechanism of regulation of gene transcription, and give specific examples of regulated systems in prokaryotic and eukaryotic cells
- Relate chromosome structure and chromatin remodeling to different levels of gene expression
- Define the basic methods used in gene isolation and generation of recombinant DNA molecules; interpret the results of restriction enzyme analyses and polymerase chain reaction assays; relate these techniques to specific current applications of DNA technology and functional genomics
- Explain the role of mutations in genetic variation, and describe the actions of specific mutagenic agents, the types of mutations generated, and repair systems in cells
- Detail the mechanisms by which large-scale changes in chromosome number can occur, and give examples of the results of these processes in living cells
- Relate genetic variation to differences in natural populations; describe the processes that cause changes in genetic variation at the population level

Topical Outline (major areas of coverage):

- Transmission genetics analysis
- Relationship between DNA and phenotype
- Genome structure and engineering
- Mutation and large-scale chromosomal changes
- Gene function and regulation
- The effect of genetic variation on evolution of populations

Recommended maximum class size for this course: 30
Library Resources:  Online databases are available at http://www.ccis.edu/offices/library/resources.asp. You may access them from off-campus using your eServices login and password when prompted.

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Name  Signature

Date:  September 27, 2005

NOTE:  The intention of the master syllabus is to provide an outline of the contents of this course, as specified by the faculty of Columbia College, regardless of who teaches the course, when it is taught or where it is taught. Faculty members teaching this course for Columbia College are expected to facilitate learning pursuant to the course objectives and cover the subjects listed in the topical outline. However, instructors are also encouraged to cover additional topics of interest so long as those topics are relevant to the course’s subject. The master syllabus is, therefore, prescriptive in nature but also allows for a diversity of individual approaches to course material.

Office of Academic Affairs  
12/04