BROWARD COLLEGE
COURSE OUTLINE

LAST REVIEW: 2009-10 *(i.e. 2003-2004)*
NEXT REVIEW: 2014-15 *(i.e. 2008-2009)*
STATUS: A *(A, I, D)*

COURSE TITLE: Genetics

COMMON COURSE NUMBER: PCB3063

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN *(per 16 week term)*

CLOCK HOURS: *(Voc. Course ONLY)*

Lecture: 48 Lab:

Clinic: Other:

PREREQUISITE(S): BSC 1010, BSC 1010L, BSC1011, BSC 1011L

COREQUISITE(S):

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum)*:

This course is an introductory study of the principles of inheritance and the molecular genetics of both prokaryotes and eukaryotes. The main objective of this course is to provide the pre-professional science educator a broad understanding of molecular, transmission, population and quantitative genetics from both an historical and modern perspective. This course addresses specific Sunshine State Standards, subject matter competencies, and pedagogy pertinent to the discipline required for teacher certification.

UNIT TITLES

1. **The principles and patterns of inheritance**
2. **DNA, genes, and gene expression**
3. **The study of genomes**
4. **Gene regulation in prokaryotes and eukaryotes**
5. **Cell cycle regulation and the genetics of cancers**
6. **Population genetics, quantitative genetics, and molecular evolution**

EVALUATION:

Evaluation will be in the form of homework, quizzes, tests and projects.

****** Complete the following only if course is seeking general education status ******

GENERAL EDUCATION Competencies and Skills *:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1. Read with critical comprehension	
2. Speak and listen effectively	
3. Write clearly and coherently	
4. Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)	
5. **Demonstrate and apply literacy in its various forms:** *(highlight in green ALL that apply)* (1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental)	
6. Apply problem solving techniques to real-world experiences	
7. Apply methods of scientific inquiry	
8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings	
9. Demonstrate an understanding of and appreciation for human diversities and commonalities	
10. Collaborate with others to achieve common goals.	
11. Research, synthesize and produce original work	
12. Practice ethical behavior	
13. Demonstrate self-direction and self motivation	
14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

* *General Education Competencies and Skills endorsed by '05-'06 General Education Task Force*

Common Course Number: PCB 3036

UNITS

Unit 1 The principles and patterns of inheritance

General Outcome:

1.0 The student shall be able to explain the inheritance of genetic traits utilizing classical genetic principles.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

1.1 Explain the process of meiosis and how it impacts genetic variations within a species.

1.2 Recount and explain Mendel's principles of inheritance.

1.3 Predict the results of monohybrid crosses.

1.4 Predict the results of a dihybrid cross and use these results to demonstrate the principle of independent assortment.

1.5 Evaluate the role of chance in producing deviations between observed and expected values using chi-squared tests.

1.6 Explain the different mechanisms that determine sex including: chromosomes and the environment.

1.7 Identify the specific patterns of inheritance that are characteristic of autosomal traits.

1.8 Identify the specific patterns of inheritance that are characteristic of sex-linked traits.

1.9 Explain how these basic principles are altered due to multiple alleles, many genes impacting one phenotype, and the environment.

1.9 Use pedigree analysis to study the inheritance of human characteristics.

1.10 Explain the chromosomal basis for genetic linkage and demonstrate how the chromosomal locations of linked genes can be mapped.

Common Course Number: PCB 3036

Unit 2 **DNA, genes, and gene expression**

General Outcome:

1.0 The student shall understand the chemical and physical structure of DNA; understand the chemical and physical structure of chromosomes; explain the essential features of the central dogma of molecular biology.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

2.1 Describe the studies that lead to the conclusion that DNA possesses heritable information.

2.2 Describe the structure of a nucleotide, focusing on the role of the 5' phosphate and 3' hydroxyl groups and the nitrogenous bases.

2.3 Describe the structure of DNA, including the anti-parallel nature of the molecule.

2.4 Outline the steps in DNA replication and explain the roles of the different enzymes involved in the process.

2.5 Describe different models of genetic recombination.

2.6 Describe chromosomal structure, including the role of telomeres and histones in this structure.

2.7 Describe the mechanism of transposition and discuss the possible roles of this process in evolution.

2.8 Describe the structure of RNA, comparing and contrasting the structure to DNA.

2.9 Discuss the role of RNA in the cell, including the role of small nuclear RNA (snRNA) in regulation of gene expression.

2.10 Explain the process of transcription, describing the three steps involved in the process.

2.11 Compare and contrast bacterial transcription to eukaryotic transcription.

2.12 Describe RNA processing in eukaryotes, including RNA splicing and RNA editing.

2.13 Describe the molecules involved in and detail the three steps in protein synthesis: initiation, elongation, and termination.

2.14 Describe the degeneracy of the genetic code and discuss the evolutionary implications for a universal genetic code.

Common Course Number: PCB 3036

Unit 3 Recombinant DNA technology and the study of genomes

General Outcome:

1.0 The student shall understand how genomics attempts to understand the content, organization, function, and evolution of genetic information contains in whole genomes.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

3.1 Understand the difference between genetic and physical maps and explain their roles in structural genomics.

3.2 Understand how comparative genomics allows for the comparison of gene content, function, and organization among genomes of different organisms.

3.3 Describe the importance of proteomics in understanding how the phenotype of an organism is shaped.

Common Course Number: PCB 3036

Unit 4 **Gene regulation in prokaryotes and eukaryotes**

General Outcome:

1.0 The student shall understand the importance of gene regulation in controlling life processes in all organisms and how this regulation allows for organisms to be successful despite ever changing environments.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

4.1 Compare and contrast gene regulation in bacteria and eukaryotes.

4.2 Outline the different points of control in, including: alteration of gene structure, transcription regulation, RNA stability, and protein modification.

4.3 Explain the structure of DNA-binding proteins and their roles in gene regulation.

4.4 Define an operon and discuss both negative and positive controls of operons in prokaryotes using the *lac* operon of *E. coli* as an example.

4.5 Explain how mutations within the *lac* operon increased our understanding of how the *lac* operon functions.

4.6 Describe how alterations in chromatin structure affect the expression of genes in eukaryotes.

4.7 Explain the role of transcription factors and transcriptional activator/repressor proteins in initiating transcription in eukaryotes.

4.8 Describe the use of posttranscriptional gene regulation in eukaryotes, including regulation of RNA stability and RNA splicing.

4.9 Describe the roles of small interfering RNAs and MicroRNAs in gene regulation in eukaryotes.

Common Course Number: PCB 3036

Unit 5 Cell cycle regulation and the genetics of cancers

General Outcome:

1.0 The student shall understand the genetic nature of cancer and explain the roles of different genes that contribute to cancer.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

5.1 Describe the nature of a cancerous cell.

5.2 Outline how alterations of different genes contribute to cancer, focusing specifically on how mutations in oncogenes and tumor suppressor genes lead to uncontrolled cell division.

5.3 Describe how the cell cycle is controlled and outline how mutations in the genes controlling the cell cycle lead to cell proliferation.

5.4 Utilize the example of colorectal cancers as a way to highlight how the accumulation of multiple genetic defects leads to cancer.

Common Course Number: PCB 3036

Unit 6 Population genetics, quantitative genetics, and molecular evolution

General Outcome:

1.0 The student shall understand how some characteristics are quantitative and vary continuously along a scale of measurement with overlapping phenotypes; understand how genetic compositions amongst groups of people change over time; explain the role of genetics in evolution.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

6.1 Describe the difference between a qualitative characteristic and a quantitative characteristic.

6.2 Discuss the impact of alleles at multiple loci on continuous variation on various traits.

6.3 Utilize statistical analyses like distributions, means, variance and standard deviation to analyze the inheritance of quantitative characteristics.

6.4 Describe the use of correlation in the inheritance of more than one characteristic.

6.5 Calculate genotypic and allelic frequencies to describe the gene pool of a population.

6.6 Use the Hardy-Weinberg law to describe the effects of reproduction on genotypic and allelic frequencies.

6.7 Describe the use of molecular data to observe evolutionary changes in protein and nucleic acid sequences within a species.

6.8 Define the processes of exon shuffling, gene duplication, genome duplication, and horizontal gene transfer and describe how genomes evolve through these processes.