

**The University of Findlay
College of Science
Fall Semester, 2XXX**

***The Mission of the University is to equip our students
for meaningful lives and productive careers.***

Course Number/Title **BIOL 310 – Human Genetics
Room: Davis 102**

Credit Hours: **4 with Lab**

Class Time/Place:

Prerequisites: Prerequisite: Intro to Cell Biology BIOL152

Instructor:

Course Description This course covers the nature of genetic materials, the fundamental processes of gene replication, and the role of the gene in directing the formation of materials in the cell. Bacterial genetic processes will also be reviewed. Applications of genetic inheritance patterns and population genetics will be studied.

Relationship to the Conceptual Framework This course supports the technical, integrative and problem solving aspects of the Biology curriculum by providing problem sets, and experience in techniques employed by modern experimental molecular biology. This course will require the student to integrate and synthesize information and concepts from different disciplines (biology, chemistry, mathematics) and the subdisciplines within biology that involve form, function, and change. Genetics is both a computational intensive and an integrative course.

The Genetics curriculum supports the Biology Program Objectives by:

Assessing knowledge and application in the subdiscipline of molecular genetics, Mendelian genetics and population genetics

Assessing laboratory skills and technical proficiency in the molecular biology field

Assessing communication skills in the presentation of data

Assessing integrative skills using mathematics and statistics within the context of data collection and analysis

Course Objectives

Modern experimental genetics and molecular biological assays rely upon the manipulation of genetic material and analysis of data. Data can be generated at the visual phenotypic level, molecular phenotypic and genetic level and by population study. This course seeks to study genetics and analyze data at the cellular, organism and population level. Principles in genetics are taught with a problem-solving approach. The study of genetics require intensive application of arithmetic, algebra, statistics, and abstract reasoning to draw inferences and logical deductions from observations and data. The course is divided into 2 major sections: Molecular Genetics, and Heritability/Population Genetics.

Upon completion of this course students will be able to:

Demonstrate an understanding and knowledge base in **molecular genetics** by:

1. Describing the structure and function of nucleic acids
2. Describing the organization of and structure of the viral genome, bacterial and eukaryotic chromosomes
3. Describing how genetic information is repeated and its impact on evolution
4. Explain how nucleic acid sequences can be used to construct phylogenetic trees, or be used in forensic analysis
5. Discussing how the interruption of genetic structure may lead to disease
6. Explaining the process of DNA replication
7. Explaining the manner in which DNA is mutated, damaged, and repaired
8. Explaining the molecular details of transcription
9. Describing the molecular details of the processing of hnRNA into mature mRNA
10. Describing the regulation of genetic information at the transcriptional and post-transcriptional level, including:
 - a. Micro RNA

- b. siRNA
- c. Promoters, enhancers, repressors, activators
- d. Chromatin remodeling
- e. DNA Methylation

- 11. Manipulating DNA and RNA in the laboratory setting (lab)
- 12. Explaining the genetic manipulation of organisms as models to study genetics including:
 - a. Yeast genetics
 - b. Bacteria
 - c. Transgenic and knock-out mice
 - d. Use of plasmids, cosmids and phage
- 13. Explaining the flow of genetic information to protein products

Demonstrate an understanding and knowledge base in the **genetic principles of inheritance** by:

- 14. Describing the relationship between genotype and phenotype
- 15. Describing Mendel's laws of equal segregation and independent assortment
- 16. Explaining the role meiosis in inheritance
- 17. Explaining inheritance results seen genotypic and phenotypic ratios in the progeny of crosses.
- 18. Describing chromosomes as the units on which genes are carried and that it is their behavior that dictates segregation and assortment.
- 19. Explaining and quantifying the linkage of genes (map linkage)
- 20. Defining Quantitative Trait Loci and their role in understanding heritability of disease
- 21. Describing the influence of life cycles on the expression of genetic characteristics (ploidy)
- 22. Defining the term dominance and recessive in describing the relationships of traits.
- 23. Explaining the multigenic nature of many traits (epistasis, imprinting, incomplete penetrance)
- 24. Using statistical analysis and probability to determine and predict the likelihood that traits are linked.
- 25. Describing the transfer of genetic information in prokaryotes
- 26. Describing how changes in chromosome number and structure affect development, phenotype and are associated with medical conditions.
- 27. Describing non-mendelian inheritance including:
 - a. X-inactivation
 - b. Genomic Imprinting
 - c. Extranuclear inheritance
- 28. Discussing the application of population genetics to quantify and predict heritability, such as in selective breeding

- 29. Applying the Hardy-weinberg equilibrium to calculate gen frequencies
- 30. Using the tools of bio-informatics to explore evolutionary genetics and construct phylogenetic trees
- 31. Using bio-informatics to direct inquiries and form hypotheses

Required Textbooks
and other materials
Knowledge Base

Genetics Analysis and Principles by Robert Brooker:
Third Edition, McGraw Hill
Hands-on application of analytical equipment

Instructional Strategies

Case Analysis	X	Library and Internet Research	X
Debate		Practice/drill	
Discovery/Independent Research	X	Problem solving	X
Discussion/Questioning/Interviewing		Reading assignments	X
Experiential Learning		Role playing/simulation games	
Field Experience	X	Service Learning	
Group Presentation		Video/Audio Review and Critique	
Laboratory Experiences	X	Other	
Lecture	X		

Methods of Assessment

Abstracts		Participation	X
Attendance		Peer Evaluation	
Capstone Project		Portfolio	
Case Study		Portfolio Lab Performance	
Exams	X	Presentations	
Group Projects		Professional Evaluation	
Homework Assignments	X	Quizzes	
Internet Research		Research project	
Journaling		Other	
Lab Performance	X		
Oral/written review of literature			

Grading Exams 80% (800 pts)
Assignments 20% (200 pts)

Grading Scale/Distribution

A: 94 - 100 %
 A- : 90 – 93.9 %
 B+: 87 -89.9 %
 B : 83 – 86.9 %
 B- : 79 – 82.9 %
 C+: 75-78.9 %
 C: 71-74.9 %
 C-: 68-70.9 %
 D+: 65-67.9 %
 D: 60-64.9
 D-: 57-59.9
 F: <59.9

Honor Code *I will not knowingly engage in any dishonorable behavior, cheat, steal, lie or commit any act of plagiarism during my academic work, course, or endeavor. If I observe an act which I believe violates the University's Honor Code, I may, in my discretion, report it to the appropriate personnel.*

Course Policies and Practices Assignments must be submitted at the beginning of class on the designated due date

Special Services If you are a student with a disability, it is your responsibility to register with the Office of Disability Service and notify your instructor one week prior to any needed service so that reasonable accommodations can be made for you.

**Course and
Instructor
Evaluation**

Taken at end of course

**Additional
Information**

Course Expectations:

- #1. Students should come prepared to discuss all assigned reading in class. The best learning occurs from thoroughly preparing in advance of discussion.

- #3. Participants may only submit original work products
 - A. All tests, quizzes, case studies reports, research papers, become the property of the instructor. However, you should expect that all materials except final exams will be returned.

 - B. Any student caught cheating, and/or plagiarizing on a quiz, paper will be dealt with in the most severe fashion possible. This may include dismissal or failure from the course. Cheating includes taking or using stolen information from another student or source.

 - C. Plagiarism is presenting information without giving credit to the author of the information. Work taken from another source must be cited.

Tentative Course Outline - subject to change during semester

Lecture Title	Reading
Introduction to Course and Pre-test	
Introduction	Chapter 1
Molecular Structure of DNA	Chapter 9
Molecular Structure of DNA	
Molecular Structure of DNA	Chapter 10
Molecular Structure of DNA/Chromosome	
Structure of Chromosomes	
Manipulation of DNA	Chapter 18 & 19
Review	
Exam I	
Gene Layout and the Genetic Code	Chapter 12
Gene Transcription	Chapter 12
Gene Transcription	
Exam 1 Retakes	Chapter 12
Translation/ Regulation of Genes	Chapter 13, 14,15
Review mRNA processing	
Post-Transcriptional Regulation	
Review	
Exam II	
DNA Replication	Chapter 11
Fall Break	
DNA Replication	Chapter 16
Cell Cycle, Mitosis & Meiosis	Chapter 3
Mutations and Disease	
Mutations and Disease	
Variations in Chromosomes Structure	Chapter 8
Review	
Exam III	
Monohybrid and Dihybrid Crosses	Chapter 2
Chromosomal Theory of Inheritance	Chapter 3
Inheritance Patterns in Single Genes	Chapter 4
Gene Interactions	
Linkage and Crossing Over	Chapter 5
Genetic Mapping in Plants and Animals	
Non Mendelian Inheritance - Epigenetics	Chapter 7
Extra Nuclear Inheritance	
Exam Review	
Exam IV	
Bioinformatics	Chapter 21
Quantitative Genetics	Chapter 24
Thanksgiving Break	
Quantitative Genetics	
Population Genetics	Chapter 25
Evolutionary Genetics	Chapter 26
Section 1 Final Exam @ 12:00-1:50 PM	Davis 102
Section 2 Final Exam @ 10:00 -11:50 AM	Davis 102

Course/College Specific Information:

All exams will be proctored. Any missed exams can be retaken with a 20% penalty.

You must complete the Exam for the Section you are in.

Do not bring cell phones on exam days. Any one using a cell phone during exams will be asked to leave and take a 0 on that exam.

Your grade will depend largely on exam scores. In class, assignments or quizzes may be unannounced, so you need to be working on the material and understanding terminology as the class progresses. Do not try to cram for exams 2 or 3 days in advance. This is not enough time to truly comprehend the material. This strategy will not work. The best strategy for success in this class is to learn the exact definition of the terms used in lecture and apply those terms to a conceptual framework of learning.