

STATE UNIVERSITY OF NEW YORK  
COLLEGE OF TECHNOLOGY  
CANTON, NEW YORK



## MASTER SYLLABUS

BIOL 310 – The Human Genome

**CIP Code:** 26.0801

*For assistance determining CIP Code, please refer to this webpage*

*<https://nces.ed.gov/ipeds/cipcode/browse.aspx?v=55>*

*or reach out to Sarah Todd at [todds@canton.edu](mailto:todds@canton.edu)*

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**Updated by: William Rivers**

**School of Science, Health, and Criminal Justice**  
**Science Department**  
**Spring 2024**

- A. TITLE: The Human Genome
- B. COURSE NUMBER: BIOL 310
- C. CREDIT HOURS (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity):

**# Credit Hours: 3**  
**# Lecture Hours 3 per Week**  
**# Lab Hours \_\_\_ Week**  
**Other \_\_\_ per Week**

**Course Length (# of Weeks): 15**

- D. WRITING INTENSIVE COURSE:
- E. GER CATEGORY: GER 5 Natural Science
- F. SEMESTER(S) OFFERED: Fall, Spring

G. COURSE DESCRIPTION: This course covers the fundamental concepts of molecular genetics and heredity, as well as mutations, the genetics of sex and gender, the human genome, complex traits, genetic testing, gene therapy, and the near future of human genetics. Besides providing a basis for understanding the current state of human genetic knowledge, future discoveries, and novel applications, a major focus of the course is developing the sophistication necessary to sort out myths and misconceptions about human heredity.

H. PRE-REQUISITES: BIOL 150 College Biology I OR BIOL 217 Human Anatomy & Physiology I

CO-REQUISITES:

I. STUDENT LEARNING OUTCOMES:

<u>Course Student Learning Outcome</u> <u>[SLO]</u>	<u>PSLO</u>	<u>GER</u>	<u>ISLO</u>
1. Describe what a gene is and apply the concepts of transmission genetics to human inheritance. Describe the molecular structure of DNA, DNA replication, transcription, translation, mRNA splicing, and the control of gene expression. Describe in detail the processes of mitosis and meiosis and how genes “move” between generations.	1.		5. Industry, Professional, Discipline-Specific Knowledge and Skills
2. Describe the categories of mutations, how mutations are detected, and explain how they bring about their effects on human traits. Explain the role of genes and chromosomes in determining sex, and differentiate between sex, gender, and orientation. Explain the			5. Industry, Professional, Discipline-Specific Knowledge and Skills

epigenetic nature of imprinting and conditional traits, and how to determine whether a trait is genetic.			
3. Explain how the human genome sequence was determined, how the chromosomal location of genes is determined, and the molecular basis of cloning. Discuss the relationship between genotype and phenotype and analyze the impact of genotype/phenotype interactions on gene expression.			5. Industry, Professional, Discipline-Specific Knowledge and Skills
4. Explain the genetic basis of heterogeneous traits, quantitative traits, and cancer (multiple-hit hypothesis). Explain the various techniques of genetic testing, the current state of gene therapy, and the future potential of gene therapy.			5. Industry, Professional, Discipline-Specific Knowledge and Skills
5. Critically evaluate ethical issues arising from our expanded understanding of, and increasing ability to manipulate, the human genome.			2. Critical Thinking [CA] 5. Industry, Professional, Discipline-Specific Knowledge and Skills
6. Demonstrate an understanding of the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of data analysis or mathematical modeling; and application of scientific data, concepts, and models in one of the natural sciences.		GER 5	5. Industry, Professional, Discipline-Specific Knowledge and Skills

<b>KEY</b>	<b><u>Institutional Student Learning Outcomes</u></b> <b>[ISLO 1 – 5]</b>
<b>ISLO #</b>	<b>ISLO &amp; Subsets</b>
<b>1</b>	<b>Communication Skills</b> Oral [O], Written [W]
<b>2</b>	<b>Critical Thinking</b> <i>Critical Analysis [CA], Inquiry &amp; Analysis [IA], Problem Solving [PS]</i>
<b>3</b>	<b>Foundational Skills</b> <i>Information Management [IM], Quantitative Lit./Reasoning [QTR]</i>

<b>4</b>	<b>Social Responsibility</b> <i>Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]</i>
<b>5</b>	<b>Industry, Professional, Discipline Specific Knowledge and Skills</b>

J. APPLIED LEARNING COMPONENT:      **Yes** \_\_\_\_\_      **No** **X** \_\_\_\_\_

If Yes, select one or more of the following categories:

Classroom/Lab \_\_\_\_\_

Civic Engagement \_\_\_\_\_

Internship \_\_\_\_\_

Creative Works/Senior Project \_\_\_\_\_

Clinical Practicum \_\_\_\_\_

Research \_\_\_\_\_

Practicum \_\_\_\_\_

Entrepreneurship \_\_\_\_\_

Service Learning \_\_\_\_\_

(program, class, project)

Community Service \_\_\_\_\_

K. TEXTS:

Concepts of Genetics, 12th edition; Published by Pearson (May 9th 2019) , William S Klug, Michael Cummings, Charlotte A. Spencer.

Ridley, Matt. Genome: The Autobiography of a Species in 23 Chapters. Harper Perennial. 2000.

L. REFERENCES:

Strachan, T., and A. Read. Human Molecular Genetics, 3rd edition. Garland Science/Taylor & Francis Group. 2003.

Korf, B. Human Genetics: A Problem-Based Approach, 2nd edition. Blackwell Publishers. 2000.

Ridley, M. Genome. Harper Perennial. 2000.

Lewin, B. Genes VIII, 1st edition. Prentice Hall. 2003.

Cummings, S. Current Perspectives in Genetics: Insights and Applications in Molecular, Classical, and Human Genetics, 2000 edition. Wadsworth Publishing.

Alberts, B., A. Johnson, J. Lewis, M. Raff, K. Roberts, and P. Walter. Molecular Biology of the Cell, 4th edition. Garland Publishing. 2002.

Hamer, D. Living With Our Genes: Why They Matter More Than You Think. Anchor. 1999.

Various internet sites (changeable) - HumGen, Genetics Education Center, GenomicsHome (CDC), e.g.

M. EQUIPMENT: Students will need computer and internet access.

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Participation (discussion groups)

Written exams

Final exam

P. DETAILED COURSE OUTLINE:

DETAILED OUTLINE

BIOL 310 The Human Genome

TOPICS

I. Fundamentals of heredity

a. Genes as “blueprints”

b. Review of Mendelian transmission genetics

c. Human Mendelian genetics

d. Traits vs. diseases

II. Fundamentals of molecular biology

a. DNA structure and replication

b. Transcription and translation

- c. mRNA processing and the modular gene concept
- d. Regulation of gene expression

### III. Chromosomes and cell division

- a. Chromosome structure
- b. Mitosis and the cell cycle
- c. Meiosis and genetic recombination
- d. The chromosomal basis of heredity

### IV. Mutations

- a. Absent essentials and monkey wrenches
- b. Biotechnological techniques for detecting mutations
- c. Point mutations
- d. What is normal?
- e. Mutations in mammoth genes
- f. Expanded repeated traits

### V. The genetic basis of sex and gender

- a. X and Y chromosomes
- b. Genetics of sex and gender
- c. Aneuploidy

### VI. Epigenetic changes and the interaction between genotype and the environment

- a. Imprinting
- b. Pleiotropy and epistasis

### VII. The human genome

- a. The Human Genome Project
- b. Cloning
- c. The human genome sequence
- d. Finding genes in the human genome

### VIII. Complex and heterogeneous traits

- a. Genotype/phenotype correlations
- b. Multifactorial traits
- c. Quantitative traits
- d. The monoamine oxidase A gene (MAOA)
- e. The genetics of cancer

### IX. Genetic testing and gene therapy

- a. Genetic testing and screening
- b. Gene therapy

### X. The near future of genetics

- a. Fears, Faith, and Fantasies  
Ethics - the possible and the actual

## Q. LABORATORY OUTLINE: