# Minnesota State University Moorhead

## BIOL 341: Genetics

### A. COURSE DESCRIPTION

Credits: 4

Lecture Hours/Week: 3

Lab Hours/Week: 3

OJT Hours/Week: *.*

Prerequisites:
This course requires both of these prerequisites
BIOL 111 - Cell Biology
CHEM 150 - General Chemistry I

Corequisites: BIOL 341L

MnTC Goals: None

A survey of the modern molecular and classical Mendelian principles underlying biological inheritance. With lab.

**B. COURSE EFFECTIVE DATES:** 06/01/1995 - Present

## C. OUTLINE OF MAJOR CONTENT AREAS

1. Cell cycle distinctions between mitosis & meiosis; importance of recombination in sexual reproduction; chromosomal theory of inheritance.
2. Mendelian inheritance: monohybrid and dihybrid crosses; applying basic probability rules to extend predictions for any number of traits; product rule, sum rule, and binomial expansion equation; chi square testing for goodness of fit; dominant & recessive alleles, codominance, incomplete dominance, overdominance, incomplete penetrance; expressivity; temperature-sensitive alleles; lethal alleles; pleiotrophy.
3. Inheritance of sex-linked traits: distinction between sex-linked, sex-limited, and sex-influenced inheritance.
4. Multi-gene expression of traits: epistasis, complementation, gene redundancy.
5. Non-Mendelian inheritance: maternal effect; epigenetic effects; X-inactivation; genomic imprinting; extranuclear inheritance.
6. Linkage and genetic mapping: linkage groups and crossing over; calculating map distance; genetic mapping in plants and animals; mitotic recombination.
7. Chromosomal abnormalities: variation in chromosome structure and number; translocations.
8. Discovery and molecular structure of DNA and RNA: classic experiments leading to discovery of DNA as hereditary material; base-sugar-phosphate structure of nucleotides; distinction between DNA and RNA.
9. Genome organization of viruses, bacteria, and eukaryotes: chromosome compaction; heterochromatin & euchromatin.
10. Replication of genetic material: DNA structure provides mechanism of replication; molecules involved and their roles during replication; features of bacterial and eukaryotic replication.
11. Transcription of DNA to RNA: transcription in bacteria and eukaryotes; role of major molecules involved; role of promoter and regulatory sequences
12. RNA modification: processing; alternative splicing; capping; polyA tailing.
13. Translation of RNA to protein: degeneracy and universality of the genetic code; role of tRNA and ribosomes in gene expression; function of major molecules involved in translation of mRNA to polypeptide.
14. Molecular mechanisms of mutation: types of mutations; natural mutations; influence of chemical and physical mutagens on DNA; DNA repair mechanisms.
15. Population genetics and Hardy-Weinberg equilibrium; allelic and genotypic frequencies; effects of mutation, migration, selection, and genetic drift; different selection models; fitness.
16. Evolutionary genetics and natural selection in genetic terms; speciation models; phylogenetic trees; gene families; molecular clock.
17. Developmental genetics: invertebrate, vertebrate, and plant development; genetic determination of body plans; HOX genes; cell differentiation.
18. Medical genetics: simple and complex genetic diseases; cancer development.
19. This course is the designated writing intensive course for Biology majors.

## D. LEARNING OUTCOMES (General)

1. Demonstrate ability to explain genetics concepts at the molecular, cellular, organism, and population levels.
2. Use critical thinking and problem solving skills to understand, evaluate, or calculate processes of inheritance.
3. Demonstrate ability to apply relevant statistical tests for genetic data analysis.
4. Become familiar and proficient with traditional and modern molecular laboratory techniques.
5. Understand the importance and relevance of model organisms in genetics research and be able to explain the relationships between model organisms and other life, including humans.
6. Demonstrate effective written communication through formal writing including stages of organization, drafting, and revision, as well as editing the work of others.
7. Find, evaluate, and integrate information and ideas from primary literature while providing appropriate citations of material.

## E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

None

## F. LEARNER OUTCOMES ASSESSMENT

As noted on course syllabus

## G. SPECIAL INFORMATION

None noted