Syllabus

Indiana Wesleyan University

BIOL 504: Genetics
Winter/Spring II
Session Dates: 3/1/22-4/25/22 (Online)
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BIOL-504 Course Description

This course integrates basic principles of genetics in eukaryotes and prokaryotes at the level of molecules, cells, and multi-cellular organisms including humans. Also covered are Mendelian genetics, the molecular basis of gene function and mutation, transmission systems, population, and evolutionary genetics. Subtopics also include the structure and function of chromosomes and genomes, and biological variation resulting from recombination, mutation, and selection. Prerequisite: a bachelor's degree with a Biology major or must be state certified (in any state) to teach Biology at a secondary school level. Undergraduate coursework must include a "C" level or higher in Introductory Biology, Introductory Biology Lab, General Chemistry, and General Chemistry Lab. Note: This course is designed for those seeking the credentials required by many regional accrediting bodies in order to be able to teach advanced placement, concurrent early college, and undergraduate college Biology courses.

Credit Hours: 3
Prerequisite Courses: Chemistry & Biology
Prerequisite Skills and Knowledge: None

Module One Introduction

This module introduces the basic concepts of genetics. Genetics is the study of heredity, or in other words how the biological process of passing genes from parent to offspring works. Gregor Mendel was the first to understand and present information about this process, hence the field of Mendelian Genetics we still study today. Mendel's laws govern inheritance, or the process of passing along genes from one generation to the next.

Module One Outcomes

Upon successful completion of this Module you should be able to:

1. Describe the basic history of the field of genetics.
2. Explain how cell structure and DNA is involved in genetics.
3. Identify Mendel's specific role in our understanding of heredity and inheritance.
4. Analyze patterns of inheritance according to Mendelian Genetics.

Module One Resources

- **Ch 1: Intro to Genetics**
- **Ch 3: Mendelian Genetics**

Module One Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
1.0 Devotional	Discussion	Due by the end of the module.	—	0
1.1 Introduction to Genetics	Discussion	Initial post due by day 4 of the module. Two responses due by the end of the module.	**2 hours**	40
1.2 Post-Reading Questions	Dropbox	Due by the end of the module.	**9 hours**	50
1.3 Case Study	Dropbox.	Due by the end of the module.	**4 hours**	90
Totals			**15 hours***	**180**

*These times are only estimates. Actual assignment completion times will vary.

Module Two Introduction

This module introduces the chromosomes and how they determine sex. Chromosomes are the nucleic acids and proteins that make up the DNA found in living structures. DNA contains the specific blueprint

that is passed from one generation to the next and contains the genetic material of the cell. Chromosome mutations are unpredictable variations in the organization of chromosomes, which result in abnormal gene expression.

Module Two Outcomes

Upon successful completion of this Module you should be able to:

1. Describe the structure of chromosomes.
2. Explain how x and y chromosomes determine sex.
3. Identify chromosome mutations including variations in number and arrangement.
4. Analyze chromosome deletions, duplications and translocations.

Module Two Resources

- **Ch 5: Sex Determination and Sex Chromosomes**
- **Ch 6: Chromosome Mutations: Variations in Number and Arrangement**

Module Two Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
2.0 Devotional	Discussion	Due by the end of the module.	—	0
2.1 Chromosomal Mutations	Discussion	Initial post due by day 4 of the module. Two responses due by the end of the module.	**2 hours**	40
2.2 Post Reading Questions	Dropbox	Due by the end of the module.	**9 hours**	50
2.3 Case Study	Dropbox	Due by the end of the module.	**4 hours**	70
Totals			**15 hours***	**160**

*These times are only estimates. Actual assignment completion times will vary.

Module Three Introduction

This module introduces genetic material. DNA and RNA make up the genetic material upon which all life is built. Have you ever wondered why you are tall or short or your hair is blonde or brown? Your genetic material is the answers. DNA is made up of molecules called nucleotides. This module digs into the structure of DNA as well as the replication process and critical components of DNA.

Module Three Outcomes

Upon successful completion of this Module you should be able to:

1. Describe the characteristics of genetic material.
2. Explain DNA structure.
3. Identify key parts of the DNA replication process.
4. Analyze critical components in the replication of genetic material.

Module Three Resources

- **Ch 9: DNA Structure and Analysis**
- **Ch 10: DNA Replication**

Module Three Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
3.0 Devotional	Discussion	Due by the end of the module.	—	0
3.1 Genes	Discussion	Initial post due by day 4 of the module. Two responses due by the end of the module.	**2 hours**	40
3.2 Post-Reading Questions	Dropbox	Due by the end of the module.	**9 hours**	50

3.3 Case Study	Dropbox	Due by the end of the module.	**4 hours**	70
Totals			**15 hours***	**160**

*These times are only estimates. Actual assignment completion times will vary.

Module Four Introduction

This module introduces the basics of gene mutation and expression. Gene expression refers to the way all of the genetic material coded for in our DNA is translated into instructions for the cell's behavior and appearance. Gene expression can be thought of as the interpretation of the programmed genetic code. At times, mutations cause permanent changes in the expression of that genetic code. The effects of genetic mutations can range from harmless to extremely harmful.

Module Four Outcomes

Upon successful completion of this Module you should be able to:

1. Describe gene mutations and how they may occur.
2. Explain DNA repair and modulation.
3. Identify the important components of transposition.
4. Analyze the expression of genes under various circumstances.

Module Four Resources

- Ch 14: Gene Mutation, DNA Repair and Transposition
- Ch 15: Regulation of Gene Expression

Module Four Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points

4.0 Devotional	Discussion	Due by the end of the module.	—	0
4.1 Environmental Mutagens	Discussion Part 1	Initial post due by the end of the module, discussion continues into Module 5	**3 hours**	20
4.2 Post-Reading Questions	Post reading questions	Due by the end of the module.	**10 hours**	50
Totals			**13 hours***	70

*These times are only estimates. Actual assignment completion times will vary.

Module Five Introduction

This module deepens the exploration of gene mutation and expression. Gene expression refers to the way all of the genetic material coded for in our DNA is translated into instructions for the cell's behavior and appearance. Gene expression can be thought of as the interpretation of the programmed genetic code. At times, mutations cause permanent changes in the expression of that genetic code. The effects of genetic mutations can range from harmless to extremely harmful.

Module Five Outcomes

Upon successful completion of this Module you should be able to:

1. Describe gene mutations and how they may occur.
2. Explain DNA repair and modulation.
3. Identify the important components of transposition.
4. Analyze the expression of genes under various circumstances.

Module Five Resources

- Ch 14: Gene Mutation, DNA Repair and Transposition
- Ch 15: Regulation of Gene Expression

Module Five Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
4.1 Environmental Mutagens (continued)	Discussion Part 2	Two classmate responses due by the end of the module.	**3 hours**	20
5.1 Case Study	Case study	Due by the end of the module.	**10 hours**	70
Totals			**13 hours***	90

*These times are only estimates. Actual assignment completion times will vary.

Module Six Introduction

This module introduces the process of growth and development of organisms as regulated by genes. Growth involves the development of a single-celled organism into a multicellular organism with added complexity along the way. All of this development is controlled by genes

Module Six Outcomes

Upon successful completion of this Module you should be able to:

1. Describe the basic field of developmental genetics.
2. Explain how differentiated states develop from coordinate programs of gene expression.
3. Identify evolutionary conservation of developmental mechanisms.
4. Analyze the intersection of genetics, technology and society.

Module Six Resources

- Ch 20: Developmental Genetics

Module Five Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
6.0 Devotional	Discussion	Due by the end of the module.	**--**	0
6.1 Stem Cells	Discussion	Initial post due by day 4 of the module. Two responses due by the end of the module.	**2 hours**	40
6.2 Post-Reading Questions	Dropbox	Due by the end of the module.	**9 hours**	50
6.3 Case Study	Dropbox	Due by the end of the module.	**4 hours**	70
Totals			**15 hours***	**160**

*These times are only estimates. Actual assignment completion times will vary.

Module Seven Introduction

This module introduces the fields of population genetics and evolutionary genetics. Population genetics is the study of genetic changes and variations within populations, and the frequencies of specific genes and alleles expressed within populations. Evolutionary genetics is the study of changes in groups of genes over time as a result of environmental or other outside factors. It involves studying patterns of adaptations to habitats and conditions.

Module Seven Outcomes

Upon successful completion of this Module you should be able to:

1. Describe genetic patterns of populations.
2. Explain the Hardy-Weinberg law as it relates to population genetics.
3. Identify the main ideas of natural selection and genetic drift.
4. Analyze trends in migration and gene flow.

Module Seven Resources

- Ch 22: Population and Evolutionary Genetics

Module Seven Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
7.0a Devotional	Discussion	By the end of the module	**--**	0
7.0b Devotional	Discussion	By the end of the module	**--**	0
7.1 Study of Genetics	Discussion Part 2	Initial post due by the end of the module.	**3 hours**	20
7.2 Post-Reading Questions	Dropbox	Due by the end of the module.	**10 hours**	50
Totals			**13 hours***	70

*These times are only estimates. Actual assignment completion times will vary.

Module Eight Introduction

This module deepens the study of the fields of population genetics and evolutionary genetics. Population genetics is the study of genetic changes and variations within populations, and the frequencies of specific genes and alleles expressed within populations. Evolutionary genetics is the study of changes in groups of genes over time as a result of environmental or other outside factors. It involves studying patterns of adaptations to habitats and conditions.

Module Eight Outcomes

Upon successful completion of this Module you should be able to:

1. Describe genetic patterns of populations.
2. Explain the Hardy-Weinberg law as it relates to population genetics.
3. Identify the main ideas of natural selection and genetic drift.
4. Analyze trends in migration and gene flow.

Module Eight Resources

- Ch 22: Population and Evolutionary Genetics

Module Eight Outline

Assignments	Type	Due- (See syllabus pacing guide for details)	Estimated Time*	Points
8.0 Devotional	Discussion	By the end of the module	--	0
7.1 Study of Genetics (continued)	Discussion	Two responses due by the end of the module.	**3 hours**	20
8.2 Case Study	Dropbox	Due by the end of the module.	**10 hours**	70
End of Course Survey	Quiz/Survey	Due by the end of the module.	**30 minutes**	10 extra credit
Totals			**13:30***	90

*These times are only estimates. Actual assignment completion times will vary.