

Unit 3: The Cell Cycle and Genetics

AP Biology

7 Class Meetings

Revised June 2019

Essential Questions

- How is information passed from parent to offspring?
- How do changes in DNA or chromosomes affect genetic diversity?

Enduring Understandings with Unit Goals

EU 1: Somatic cells divide in an orderly process, producing two identical daughter cells.

- Analyze the steps and evaluate the importance mitosis and cell division.

EU 2: Meiosis reduces the number of chromosome sets from diploid to haploid in the production of gametes.

- Analyze the steps and evaluate the importance of meiosis.

EU 3: The laws of probability govern Mendelian inheritance, although inheritance is often more complex than can be predicted by simple Mendelian genetics.

- Predict inheritance based on Mendelian inheritance.

EU 4: Chromosomal basis of inheritance is complex due to linked genes and alterations.

- Describe and evaluate how linkage and alterations affect inheritance.

Standards

Next Generation Science Standards (NGSS):

- **HS-LS1-4.** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
- **HS-LS3-3.** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Common Core State Standards:

- **RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- **WHST.9-12.9** Draw evidence from informational texts to support analysis, reflection, and research.
- **MP.4** Model with mathematics.

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- **HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling.
- **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MSMHS Academic, Civic, and Social Competencies

Competency 1. Read and write effectively for a variety of purposes.

Competency 2. Speak effectively with a variety of audiences in an accountable manner.

Competency 3. Make decisions and solve problems independently and collaboratively.

Competency 4. Apply scientific knowledge and concepts to a variety of investigative tasks.

Competency 5. Contribute to a positive learning environment with respect and responsibility.

Unit Content Overview

- Cellular organization
- Chromosomes
- Phases of the cell cycle
- Mitosis
- Cytokinesis
- Binary fission
- Cytoplasmic signals
- Cancer
- Inheritance of genes
- Sexual v. asexual reproduction
- Fertilization
- Meiosis
- Genetic variation among offspring
- Law of Segregation
- Law of Independent Assortment
- Mendelian inheritance
- Monohybrid crosses
- Multiple alleles
- Pedigree analysis
- Inherited disorders

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- Sex-linked genes
- Genetic recombination and linkage
- Abnormal chromosome number
- Alterations to chromosome structure

Interdisciplinary Connections

- AP Statistics: probability

Daily Learning Objectives with *TWPS Activities*

Students will be able to...

- Identify and describe the phases of the cell cycle and mitosis.
 - *Compare and contrast cytokinesis in plant cells and animal cells.*
- Evaluate the role of meiosis in genetic variation.
 - *Given that the synaptonemal complex has disappeared by the end of prophase, how would the two homologs be associated if crossing over did not occur? What effect might this ultimately have on gamete formation?*
- Compare and contrast mitosis and meiosis in an investigation.
 - *What did you find easy and what did you find difficult in this investigation?*
- Explain the Law of Segregation and the Law of Independent Assortment.
 - *A rooster with gray feathers and a hen of the same phenotype produce 15 gray, 6 black, and 8 white chicks. What is the simplest explanation for the inheritance of these colors in chickens? What phenotypes would you expect in the offspring of a cross between a gray rooster and a black hen?*
- Predict inheritance using Mendelian genetics and analyze fit using a Chi Square test.
 - *Consider what you have learned about dominant and recessive alleles. If a disorder was caused by a dominant X-linked allele, how would the inheritance pattern differ from what we see for recessive X-linked disorders?*
- Explain chromosomal inheritance and compare it to Mendelian inheritance.
 - *Women born with an extra X chromosome (XXX) are generally healthy and indistinguishable in appearance from normal XX women. What is a likely explanation for this finding? How could you test this explanation?*

Instructional Strategies/Differentiated Instruction

- **HLP:** Academically Productive Talk
- **HLP:** Writing to Learn (TWPS)
- **HLP:** Effective Feedback

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- Daily Warm Up Activities
- Power Point Lecture with note-taking
- Flexible grouping
- Foldables
- Exit slips
- Graphic Organizers
- Creating authentic connections for students
- Rephrasing and restatement of information and concepts
- Outlining of text
- Reading and Accountable Talk Discussion of Text
- Laboratory exercises

Assessments

FORMATIVE ASSESSMENTS:

- AP Insight BB Practice Quizzes
- Mitosis and Meiosis Investigation Stations
- Genetics and Chi Square Activity
 - MSMHS Rubric 3: Problem Solving
- Close reading and interpretation of text
- Outlining of textbook
- Warm Up Activities
- Exit slips
- Oral questioning
- Accountable Talk Discussions
- Daily Think-Write-Pair-Share (TWPS)
- Daily check-ins with students
- Practice FRQs
- Practice MCQs
- Homework/Reading checks

SUMMATIVE ASSESSMENTS:

- Quiz on EU 1 and EU 2
- Quiz on EU 3 and EU 4
- Genetics and Chi Square Activity
- Unit Test

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Unit Task

Unit Task Name: Genetics and Chi Square Activity

Description: Students will use information learned about the cell cycle and mitosis (EU 1), meiosis (EU 2), and genetics (EU 3 and EU 4) to complete an activity involving the solving of Punnett Squares and the calculation of Chi Square value to accept or reject a null hypothesis. They will need to use data from the activity to support their accepting or rejection of the hypothesis.

Evaluation: MSMHS Rubric 3: Problem Solving

Unit Resources

- Textbook (Biology in Focus AP Edition. Campbell et al. 2014. Pearson Education, Inc)
- Interactive Science Notebook
- MSMHS School-wide Rubrics
- Lab Supplies
- Graphing calculators
- Internet databases
- Laptops