

SOLUTIONS MANUAL

LAB MANUAL AND WORKBOOK FOR
**PHYSICAL
ANTHROPOLOGY**



SEVENTH EDITION

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Chapter 2 Population Genetics

LEARNING OBJECTIVES

By the end of this chapter, students should be able to:

1. Discuss Gregor Mendel's Laws of segregation and assortment principles of inheritance and describe how to predict genotypes and phenotypes using a punnett square.
2. Know the difference between dominant, recessive, and co-dominant traits
3. Define pedigree analysis for mendelian traits and sex linked traits.
4. Define blood types and terminology
5. Analyze evolution of a population using the Hardy-Weinberg Equilibrium formula.
6. Identify principals of evolutionary change such as genetic drift, gene flow, and founder effect

KEY TERMS

agglutination (p.51)
antigens (p. 51)
assertive mating (p. 65)
blood typing (51)
co-dominant (p. 35)
dominant (p.35)
founder effect (p. 55)
genetic drift (p. 55)
gene flow (p. 55)
genotype (p. 38)

Hardy-Weinberg formula (p. 55)
natural selection (p. 69)
pedigree (p. 45)
phenotype (p.42)
Principle of Independent Assortment (p. 35)
Principle of Segregation (p. 35)
punnett square (p. 37)
recessive (p.35)
sex linkage (p.46)

CHAPTER SUMMARY

Chapter two discusses the principles of inheritance and the genetic dynamics of populations. Covered in the chapter are Mendel's work, his Law of Segregation, the Law of Independent Assortment as well as the concepts of genotype, phenotype, dominant and recessive inheritance, expression and how to predict outcome of various gamete crosses using a punnett square.

This chapter also discusses blood typing and pedigree analysis for mendelian traits as well as sex linked traits and expression of those traits and types in a population. The chapter shows how to track the level of evolution in a population using the Hardy-Weinberg mathematical formula and how mutation, gene flow, genetic drift, founder effect, and natural selection all affect the evolutionary process of a group of organisms.

INTERNET RESOURCES

1. www.scienceclarified.com/Ma-Mu/Mendelian-Laws-of-Inheritance.html
This site explains Mendel's laws, giving examples using roses and explaining how to predict phenotypes and genotypes.
2. <http://www.mnsu.edu/emuseum/biology/evolution/>
This site shows mendelian genetics as it applies to blood typing in comparison to on/off traits such as tongue rolling. The site also has information on other genetic processes as they relate to evolution.
3. www.videosurf.com/videos/mendel
This site has a wealth of video lectures and PowerPoint presentations on Mendel's laws, pedigree analysis and sex linked traits. Please note that this site also collects videos unrelated to anthropology.

CHAPTER EXERCISES

Exercise 2.1 Review Questions – Gamete Formation

1. Briefly explain the difference between genotype and phenotype.
2. What can we predict by looking at possible gamete combinations?

Exercise 2.2 Review Questions – Phenotype Summary

1. What would be the reason that some dominant traits are fewer in your sample than some recessive traits?
2. What be the cause of this phenomenon?

Exercise 2.3 Review Questions – Genotype Formations

1. Do any of the traits in the summary of genetic data for sample exercise seem to have any relationship to each other?
2. How can this be explained using Mendel's law of Independent Assortment?

Exercise 2.4 Review Questions – Pedigree Exercises

1. Using gamete formation information from the previous lessons, what information can we obtain from tracking a given family's pedigree?
2. Why do sex-linked traits only express in males?

Exercise 2.5 Review Questions – Blood Type Genetics

1. If the blood genotype of O is recessive and can only express in the OO configuration, why are more people phenotypically O, than any other blood type, everywhere in the world? What forces of evolution might explain this?

Exercise 2.6 Review Questions – Hardy-Weinberg and Evolution

1. How does the Hardy Weinberg Formula prove that evolution is happening right now?
2. What other applications does the Hardy Weinberg equilibrium have outside of anthropology?

Exercise 2.7 Review Question – Evolving Populations

1. What is the purpose of using these rules to predict allele frequencies in a population?

Exercise 2.8 Review Question – Gene Flow

1. Why do anthropologists study migration and gene flow? What can we find out from that?

Exercise 2.9 Review Question – Population Genetics

1. How do all these principles help us understand the processes of evolution and how it works?

Additional In Class Exercise – Punnett Practice

A. Exercise Introduction

This exercise will give students the opportunity to get hands on experience learning Mendel's Law of Independent Assortment, the Law of Segregation, dominant/ recessive relationships, and genotype/phenotype outcomes and expression.

Using shapes or buttons of different sizes, and a piece of poster board with simple punnett squares (4 spaces) and more complicated punnett squares (16 spaces) on them will allow your students to practice as a group. After reviewing chapter two, have them show you the gamete formation from hybrids, heterozygotes, and so forth using props to represent traits. Ask them to show you the results of these various crosses using the shapes and the poster board punnett squares.

B. Recommended Supplies

1. Each group of four students should receive 1 poster board with three punnett squares along one side and a larger (16 space) punnett square on the other.
2. Each group receives a set of four different shapes in two sizes. These can be foam shapes, small wood shapes, or even buttons in four colors or types in two sizes, all of which are available at any craft store for cheap, usually in bags of 50 or 100. Each group will need 72 pieces to work with.

C. Troubleshooting

1. Confusion about the rules of gamete formation: I use the shapes to show them how Independent Assortment works as they watch. This usually helps.
2. Confusion about colors and shapes: It's good to assign traits to shapes and colors (like a color key) so students can visualize real life applications.

D. Exercise Review

1. Practice with Mendel's Laws
2. Practice with dominant/recessive relationships
3. Practice and discussion of genotype/phenotype relationships

E. Critical Thinking Questions

1. What do dominant and recessive mean in genetic context?
2. What must the genotypes of the parents be for an offspring to express a recessive trait phenotypically?
3. How do Mendel's Laws of inheritance help us understand evolutionary outcomes?

Additional In Class Assignment – Mendelian Traits

Relate the above exercise to blood groups or other mendelian traits such as those in the chapter and ask them to solve problems such as: “If you can roll your tongue and your father can roll his but your mom cannot -- what must each of the genotypes be for the three of you?” or “Molly has just given birth to a baby whose blood type is AB. Molly’s is A. What are the possible genotypes for the parents of this child?”