

# Mendelian Genetics in an Introductory Biology Class for Majors

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# Learning Objectives

*Students should be able to interpret a pedigree chart and determine if traits are dominant or recessive*

- **(LO 1)** Students should be able to define alleles, heterozygous, homozygous, laws of segregation and independent assortment
- **(LO 2)** Students should be able to describe the relationships between dominant and recessive alleles
- **(LO 3)** Students should be able to predict the outcomes of mating among homozygous and heterozygous organisms
- **(LO 4)** Students should be able to read a pedigree chart

# In Class

## Saturday

Review textbook sections for Mendelian Genetics

Review Heredity worksheet

Knowledge Grid completed during first week on semester

## Sunday

Review textbook sections for Mendelian Genetics

Review Heredity worksheet

## Monday

Lecture

Animations/Videos

One-minute Pair Discussions

## Tuesday

Lecture

Animations/Videos

One-minute Pair Discussions

## Wednesday

Lecture/Review/Student Questions

Worksheet due → Debrief

## Thursday

Prepare for Quizzes

Online practice quiz available

## Friday

Individual quiz → Debrief

Group quiz → Debrief

Knowledge Grid on Mendelian Genetics

# On Their Time

# Formative Assessment 1

## Knowledge Grid

- Assess student confidence about topics before and after discussion of Mendelian Genetics

### Sample Questions

<b>Rate the level of your confidence in accurately describing each topic in a short paragraph to your instructor</b>			
	Very Confident	Somewhat Confident	Not Confident
Punnett Square			
Law of Independent Assortment			
Law of Segregation			
Pedigree Chart			

# Formative Assessment 2

## Online Practice Quiz

- 8-10 multiple choice questions (knowledge & apply)
- Students can take quiz multiple times
- Scores given, correct answers are not given
- Opportunity to determine weak areas

## Sample Questions

What are alleles?

- a. specific physical locations of genes on a chromosome
- b. variations of the same gene (i.e., similar nucleotide sequences on homologous chromosomes)
- c. homozygotes
- d. heterozygotes

Answer: b

LO 1

In pea plants, yellow pods are recessive to green pods. If you see yellow pods then the genotype of that plant must be \_\_\_\_\_ for pod color.

- a. heterozygous
- b. homozygous recessive
- c. homozygous dominant
- d. a and b
- e. a and c

Answer: b

LO 2 & 3

A pedigree analysis for a given disorder's occurrence in a family shows that, although both parents of an affected child are normal, each of the parents has had affected relatives with the same condition. The disorder is then which of the following?

- A) Recessive
- B) Dominant
- C) Incompletely dominant
- D) Maternally inherited
- E) A new mutation

Answer: A

LO 2-4

# Summative Assessment 1

## Heredity Worksheet

- Posted to Blackboard
- Completed on their time
- Apply & evaluate
- Ten minutes in class to discuss with peers
- Review answers after submitted

## Sample Questions

1. In pea plants, the white flower trait is recessive to purple flowers and the dwarf trait is recessive to the tall trait. Assume a pea plant that is tall with white flowers; using T to designate the plant size gene and P to designate flower color, this would require a genotype of:
    - a. PPTt
    - b. ppTT or ppTt
    - c. pptt
    - d. pptt or ppTt
    - e. PpTtAnswer: b
- LO 2 & 3**
2. Classical albinism results from a recessive allele. Which of the following is the expected offspring from a normally pigmented male with an albino father and an albino wife?
    - A) 75% normal; 25% albino
    - B) 75% albino; 25% normal
    - C) 50% normal; 50% albino
    - D) all normal
    - E) all albinoAnswer: C
- LO 1-3**
3. Martians normally have three eyes (*E*), but the rare "humanoid" mutation (*e*) causes monsters with two eyes to be born. Eye color in Martians is inherited similarly to humans, with brown eyes (*B*) being dominant to blue (*b*). Assuming these two genes are carried on separate chromosomes, what must the genotypes of two normal, brown-eyed parents be if they have a blue-eyed, humanoid son?
    - A) EEBB and eebb
    - B) both EeBb
    - C) eeBB and EEbb
    - D) both eebb
    - E) You cannot tell from the information provided.Answer: B
- LO 1-4**

# Summative Assessment 2a

- Individual Quiz
  - 10 questions, reviewed in class
  - Knowledge, apply

## Sample Questions

What was the most significant conclusion that Gregor Mendel drew from his experiments with pea plants?

- A) There is considerable genetic variation in garden peas.
- B) Traits are inherited in discrete units, and are not the results of "blending."
- C) Recessive genes occur more frequently in the F<sub>1</sub> than do dominant ones.
- D) Genes are composed of DNA.

When crossing an organism that is homozygous recessive for a single trait with a heterozygote, what is the chance of producing an offspring with the homozygous recessive phenotype?

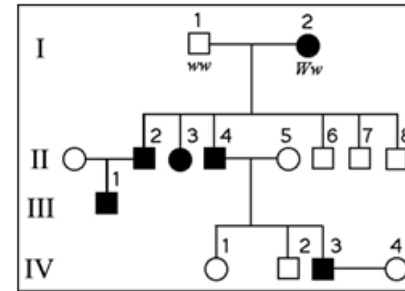
- A) 0%
- B) 25%
- C) 50%
- D) 75%
- E) 100%

# Summative Assessment 2b

- Group Quiz
  - Minimum 5 students
  - One quiz per group
  - Apply, evaluate

## Sample Questions

Refer to the pedigree chart below for a family, some of whose members exhibit the dominant trait, wooly hair. Affected individuals are indicated by a darkened square or circle.



What is the genotype of individual II-5?

- A)  $WW$
  - B)  $Ww$
  - C)  $ww$
  - D)  $WW$  or  $ww$
  - E)  $ww$  or  $Ww$
- Answer: C

What is the likelihood that the progeny of IV-3 and IV-4 will have wooly hair?

- A) 0%
  - B) 25%
  - C) 50%
  - D) 75%
  - E) 100%
- Answer: C



# Summative Assessment 3

## Unit Exam

- Knowledge, apply, evaluate
- Multiple choice
- True/False (correct false)
- Matching
- Short Answer
- Critical Thinking

## Sample Questions

### True/False

If an organism is diploid and a certain gene found in the organism has 18 known alleles, then any given organism of that species must have at most two alleles for that gene.

True          False

LO 1

### Short Answers

Why would lethal disorders caused by dominant alleles be rare in populations?

LO 1-3

### Multiple Choice

When the two gametes that fuse to form a zygote contain different alleles of a given gene, the offspring is... |

- A) haploid.
- B) heterozygous.
- C) abnormal.
- D) homozygous.
- E) a new species.

LO 1-2

A man who is an achondroplastic dwarf with normal vision marries a color-blind woman of normal height. The man's father was six feet tall, and both the woman's parents were of average height. Achondroplastic dwarfism is autosomal dominant, and red-green color blindness is X-linked recessive.

How many of their daughters might be expected to be color-blind dwarfs?

- A) All
- B) None
- C) Half
- D) One out of four
- E) Three out of four

LO 1-4