

Name: _____ Date: _____

Student Exploration: Microevolution

In this activity, you will explore how allele frequencies change over time in a population of parrots. You can change which parrots have a survival advantage.

What is another word for allele frequencies changing over time? _____

1. The feather color of the parrots in the Gizmo is controlled by two alleles, D and d . What is the feather color of each parrot genotype?

DD _____ Dd _____ dd _____

Remember back to our unit on genetics. This trait shows a blending of the two alleles. This is called _____.

2. Notice that you can control the **fitness** of each parrot genotype. What does fitness mean?

3. Move the sliders for the fitness of one of the genotypes. What changes does this cause?

Why would this cause an increase/decrease in fitness for that genotype of parrot?

4. Set the **Fitness of DD** slider to 100% and the other fitness sliders to 60%. Click **Begin**. When you click **Predator**, hawks will attack some parrots. Which parrots do you predict will be attacked? _____

5. Click **Predator**. Which parrots were killed by **predators**? _____

Why? _____

6. Run a few rounds of this. What trend do you observe for the proportion of each phenotype in the population? _____

Activity A:
Deleterious dominant alleles

Get the Gizmo ready:

- Click **Reset**.
- Set the ***DD*** and ***dd*** sliders to 34%.



Introduction: A **deleterious** allele is one that significantly lowers the fitness of an individual. If the deleterious allele is a **dominant allele** (*D*), then both **homozygous *DD*** and **heterozygous *Dd*** individuals will be at a disadvantage.

Question: How will allele frequencies change if a dominant allele is deleterious?

1. **Observe:** To model the effects of a deleterious dominant allele, set the **Fitness of *DD*** and **Fitness of *Dd*** sliders to 60%. Set the **Fitness of *dd*** to 100%.

Based on the color of the trees, which parrots will be easiest for predators to spot and kill?

2. **Predict:** How do you expect the proportions of *D* and *d* alleles to change in five generations?

3. **Gather data:** Click **Breed**, and then click **Hatch**. Click **Continue**, and then click **Predator**. Repeat this sequence to play the simulation for five generations. Select the **TABLE** tab and record the genotype populations over time in the spaces below.


Generation	<i>DD</i>	<i>Dd</i>	<i>dd</i>
0			
1			
2			
3			
4			
5			

4. **Analyze:** What patterns do you see in your data? _____

5. Interpret: Select the ALLELE GRAPH tab. What does this graph show? _____

6. Interpret: Select the GENOTYPE GRAPH tab. What does this graph show? _____

7. Think and discuss: Why do you think deleterious dominant alleles are not very common?

Activity B: Deleterious recessive alleles	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Click Reset. • If necessary, set DD and dd to 34%. 	
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Introduction: **Cystic fibrosis** is a genetic disease caused by a **recessive allele**. **Individuals with one copy of this allele are healthy**, but having two copies of the allele causes the production of abnormally thick mucus in the lungs and pancreas. This leads to breathing difficulty, frequent infections, and usually a shortened life span.

Question: How will allele frequencies change if a recessive allele is deleterious?

1. Observe: To model the effects of a deleterious recessive allele, set the **Fitness of DD** and **Fitness of Dd** to 100%. Set the **Fitness of dd** to 60%.

Based on the colors of the trees, which parrots will be easiest for predators to spot and kill?

2. Predict: How do you expect the proportions of *D* and *d* alleles to change in five generations?

3. Gather data: Click **Begin**. Play through the simulation for five generations. Select the **TABLE** tab and record the genotype populations over time in the spaces below.

Generation	<i>DD</i>	<i>Dd</i>	<i>dd</i>
0			
1			
2			
3			
4			
5			

4. Analyze: What patterns do you see in your data? _____

5. Interpret: Select the ALLELE GRAPH tab. What does this graph show? _____

6. Interpret: Select the GENOTYPE GRAPH tab. What does this graph show? _____

7. Compare: Compare the rate at which the deleterious *d* allele disappears in this activity to the rate at which the deleterious *D* allele disappeared in activity A.

A. Which disappears more rapidly from a population, a deleterious dominant allele or a deleterious recessive allele? _____

B. Why do you think this is so? _____

8. Think and discuss: Why are most genetic diseases caused by recessive alleles?
