



Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Student Exploration: DNA Analysis

**Vocabulary:** allele, codon, DNA, DNA sequence, gene, genotype, identical twins, nitrogenous base, phenotype, trait

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)



1. The two navy officers shown at left are **identical twins**. Why do you think identical twins look so similar?

\_\_\_\_\_  
\_\_\_\_\_

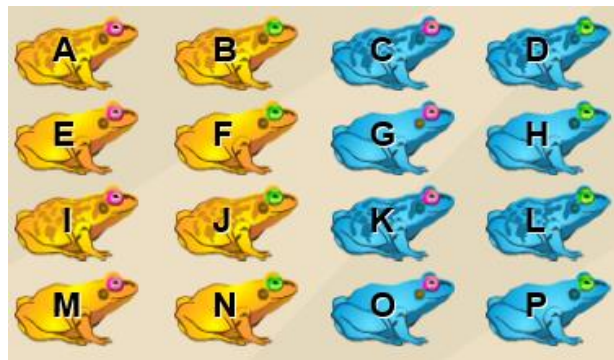
2. Most brothers and sisters don't look exactly the same. What causes most siblings to have different appearances?

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\_\_\_\_\_

### Gizmo Warm-up

Most of an organism's **traits**, or characteristics, are determined by **genes** encoded in **DNA**. Traits are determined by the sequence of the four **nitrogenous bases** in the DNA molecule: adenine, thymine, cytosine, and guanine.

Except for identical twins, the **DNA sequence** of every individual is unique. In the *DNA Analysis* Gizmo, you will analyze partial DNA sequences of frogs.




1. Select the POPULATION tab. What are the three main traits that vary between the frogs?

\_\_\_\_\_

2. Which frog would you expect to have the most similar DNA sequence to frog A? Why?

\_\_\_\_\_



<b>Activity A:</b> <b>Identical twins</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Select the FIND THE TWINS tab.</li> </ul>	
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**Question: How are DNA sequences used to analyze relationships?**

1. Observe: Look at the three frogs on the TWINS tab. How does their appearance compare?

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2. Predict: What do you expect the DNA sequences of the three frogs to look like? \_\_\_\_\_

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3. Identify: Drag frog **A** to the scanning station and click **SCAN**. Drag the resulting DNA sequence to the bin at the upper right of the Gizmo. Each band on the sequence represents a single nitrogenous base of DNA. The band is dark if that base is present and pink if that base is absent.

Scan frogs B and C. Drag their DNA sequences into the bin. If two frogs are identical twins, they will have exactly the same DNA sequence. Compare the three sequences.

Could any of these frogs be identical twins? If so, which frogs? \_\_\_\_\_

4. Analyze: DNA is composed of four different nitrogenous bases. For the type of DNA sequence used by the Gizmo, a complete DNA sequence would have scan readouts for all four nitrogenous bases. Knowing this, why can you not be entirely certain the frogs are identical twins using the simplified sequences on the Gizmo?

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5. Apply: Click **New**. For the new frogs, find the possible pair of identical twins.

A. Which two frogs could be identical twins? \_\_\_\_\_

B. How do you think DNA sequences can be used in the real world to identify relationships between individuals? \_\_\_\_\_


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<b>Activity B:</b> <b>Comparing genes</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Select the POPULATION tab.</li> </ul>	
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**Introduction:** In this frog population, traits such as eye color, skin color, and spots are coded for in the DNA. For each gene, there are two **alleles**, or versions. The sequence of nitrogenous bases in a strand of DNA make up an organism's **genotype**. The physical traits resulting from the genotype makes up the organism's **phenotype**.

**Question: How are DNA sequences used to analyze traits?**

1. Observe: Describe frog A's phenotype. \_\_\_\_\_
2. Compare: Which frogs share frog A's skin color, but not its eye color or spots? \_\_\_\_\_
3. Analyze: A group of three consecutive nitrogenous bases in a strand of DNA is a **codon**. In a real organism, genes are made up of hundreds of codons. In the Gizmo, a single codon codes for a trait. Scan frog A and the two frogs that share only frog A's skin color.

Turn on the **Comparison guides**, and compare the three DNA sequences. Codon 1 is made up of bases 1–3, codon 2 is made up of bases 4–6, etc. The last two bases are part of codon 7, which was cut off when the scan was made.

- A. Which codon or codons are identical in all three frogs? \_\_\_\_\_  
 \_\_\_\_\_
  - B. Scan more frogs with orange skin until you are confident that you have identified the correct codon that represents the allele for orange skin. Describe the results:  
 \_\_\_\_\_  
 \_\_\_\_\_
  - C. Which codon codes for orange skin in this frog population? \_\_\_\_\_
4. Analyze: Pick out two frogs with blue skin and nothing else in common.
    - A. Which codon do they share? \_\_\_\_\_
    - B. Scan two more frogs with blue skin to confirm you have identified the correct codon.  
 Describe the results: \_\_\_\_\_  
 \_\_\_\_\_

**(Activity B continued on next page)**



