

Name \_\_\_\_\_

## Relationships and Biodiversity

### Introduction

*Botana curus* is a valuable plant because it produces Curol, a compound used for treating certain kinds of cancer. Curol cannot be produced in the laboratory. *Botana curus* grows very slowly and is on the endangered species list, so its ability to provide Curol in large quantities is limited.

Species that are more closely related to *Botana curus* are more likely to produce the important substance Curol. Three similar plant species that are plentiful (X, Y and Z) may be related to *Botana curus*. You will work as a researcher to:

- gather structural and molecular evidence to determine which plant species is most closely related to the hypothetical species, *Botana curus*
- use this evidence to decide which plant species is most likely to survive as a source of the important substance Curol

### Pre lab Questions

1. Why is *Botana curus* an important plant?
2. Why do we need to find a different plant that is closely related to the *Botana curus*?
3. What types of experiments could we use to find a species that is closely related to the *Botana curus*?

### Structural Evidence for Relationships

Complete the following three structural tests, recording your results in your data table at the end of the lab:

Test 1: Structural characteristics of plants.

Test 2: Structural Characteristics of Seeds

Test 3: Microscopic Internal Structure of Stems

### Hypothesis

1. Based on your data so far, which species (X, Y, or Z) do you think is most likely to produce Curol? \_\_\_\_\_
2. Explain how the evidence from your data table supports your hypothesis. You will test your hypothesis by completing additional tests in the second part of the lab.

### Molecular Evidence for Relationships

Test 4: Paper chromatography (results go on table 1)

Test 5: Indicator test for Enzyme M (results go on table 1)

Test 6: Simulated Gel Electrophoresis to Compare DNA

Wells → # DNA Bases	<i>Botana curus</i> (green)	Species X (pink)	Species Y (yellow)	Species Z (blue)
25				
24				
23				
22				
21				
20				
19				
18				
17				
16				
15				
14				
13				
12				
11				
10				
9				
8				
7				
6				
5				
4				
3				
2				
1				

### Test 7: Translating the DNA Code to Make a Protein

#### ***Botana curus***

Sequence of bases in mRNA produced

Sequence of amino acids in the protein

CAC	GTG	GAC	TGA	GGA	CTC	CTC

#### **Species X**

Sequence of bases in mRNA produced

Sequence of amino acids in the protein

CAC	GTG	GAC	AGA	GGA	CAC	CTC

#### **Species Y**

Sequence of bases in mRNA produced

Sequence of amino acids in the protein

CAC	GTG	GAC	AGA	GGA	CAC	CTC

#### **Species Z**

Sequence of bases in mRNA produced

Sequence of amino acids in the protein

CAC	GTA	GAC	TGA	GGA	CTT	CTC

3. State how the amino acid sequence you obtained from the gene fragment for *Botana curus* compares with the sequences for the other three *species*.

4. Summarize your observations of the number of differences in Table 1.

### **Analysis of Results**

1. Using the information in Table 1, identify which plant is most closely related to *Botana curus* and therefore most likely to produce Curol. Explain your choice by citing specific evidence from your research.

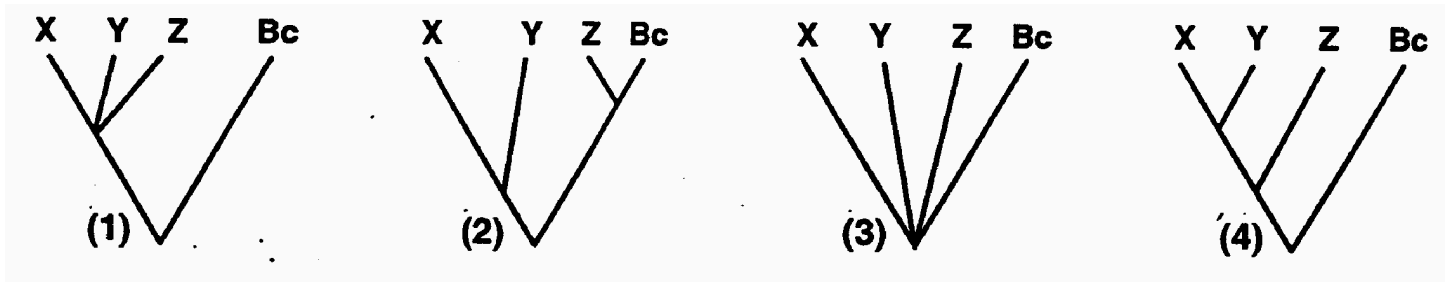
2. Did the addition of molecular evidence support or refute the hypothesis that you made earlier based on structural evidence only? Explain why or why not.

3. Which kind of evidence-structural or molecular-is most helpful in making decisions about relationships between species? Explain why.

4. Based on your observations, list three characteristics (structural or molecular) that all four species have in common.

5. What biological explanation would evolutionists give for the common characteristics that these species share?

6. Scientists frequently use branching tree diagrams to represent graphically the relationships between species. Which branching tree, shown below, best represents the relationships among the four species?



7. Explain how you used the information on the data table to select this tree.

8. State two additional kinds of evidence you might use to further support your hypothesis about the relationship between *Botana curus* and species X, Y, and Z.

**After you read the article, “The Biodiversity Crisis,” answer the following questions.**

Assume that the plant you identified as being closely related to *Botana curus* grows rapidly, survives in many environments, and produces Curol. News reports indicate that *Botana curus* plants may become extinct unless expensive efforts are made to preserve the species. Members of your research team disagree as to whether or not *Botana curus* should be saved.

9. State three examples of human activities that could endanger *Botana curus*.

10. State three reasons why it might be important to preserve *Botana curus*.

11. State two arguments people might make for NOT preserving *Botana curus*.

Species Z	Species Y	Species X	Botana curus	Species	Table 1
				Structural Characteristics of Leaves	Structural Evidence
				Structural Characteristics of Seeds	
				Microscopic Stem Structure	
				Paper Chromatography	Molecular Evidence
				Test for Enzyme M	
				Gel Electrophoresis DNA Banding Pattern	
				Differences in Amino Acid Sequences	