

# Evaluating Arguments

## *Luciferase*

### Background

A scientific argument should have a clear claim, supporting evidence, and reasoning that connects the evidence to the claim. It should be based on facts, not feelings.

### Instructions

Read the information on page 2. For both argument A and argument B:

1. Draw a box around the **claim**. A claim is a statement or conclusion that answers the original question.
2. Underline the **evidence**. Evidence is observations or data that support the claim.
3. Squiggly-underline the **reasoning**. Reasoning is the justification for why the evidence supports the claim. It contains logic and relevant science ideas.
4. Use the Argumentation Checklist to evaluate the parts of each argument.

### Questions

1. Which argument do you agree with more, A or B? Why do you agree more with this argument?
  
  
  
  
  
  
  
  
  
  
2. What are the problems with the other argument?

## Firefly Luciferase

Fireflies make their own light, which they use to attract mates and warn predators. Cells in the firefly's tail make luciferase protein. When luciferase reacts with the chemical luciferin, a tiny amount of light is given off. When many of these chemical reactions happen all at once, the light can be quite bright.

Researchers wonder if they can get cells from mammals to make luciferase protein, and then use the luciferase reaction to understand how the mammalian cells behave.



### Observations

1. The gene that codes for luciferase in fireflies is like genes from mammalian cells: they are made up of the building blocks A, T, G, and C.
2. An adult mouse is about 120-200 mm long, including the tail. The average adult firefly is 10-14 mm long.
3. The amino acid sequences of RNA Polymerase proteins from fireflies and mice are 85% identical.
4. Adult fireflies live for 5 to 30 days, and mice typically live for about a year.
5. Researchers can collect firefly cells and break them open to release all of their proteins (including the luciferase). When they add the chemical luciferin, the broken-up cells make light.

### Question

Researchers put the luciferase gene from fireflies into mouse cells. If they collect the cells, break them open, and add luciferin, will the broken-up mouse cells make light?



### Argument A

No, the broken-open mouse cells that have a firefly luciferase gene will not make light. Mice are much larger than fireflies, and they live for a much longer time. Cells from a firefly and cells from a mouse have lots of differences in their genes, their proteins, and their environments. Therefore it is unlikely that the mouse transcription and translation machinery will be able to interact with a gene sequence from a firefly, or with the chemical compound luciferin, which also comes from fireflies.

### Argumentation Checklist

Yes	No	CLAIM	NOTES
<input type="checkbox"/>	<input type="checkbox"/>	Is there a clearly stated claim?	
<input type="checkbox"/>	<input type="checkbox"/>	Is it consistent with all of the available evidence?	
<input type="checkbox"/>	<input type="checkbox"/>	Is it the simplest conclusion based on all of the available evidence?	
EVIDENCE			
<input type="checkbox"/>	<input type="checkbox"/>	Is there enough evidence to support the claim?	
<input type="checkbox"/>	<input type="checkbox"/>	Is all of the evidence relevant to the claim (there are no extra facts)?	
<input type="checkbox"/>	<input type="checkbox"/>	Do the data collection, analysis, and interpretation seem reasonable?	
REASONING			
<input type="checkbox"/>	<input type="checkbox"/>	Is there enough reasoning to justify why the evidence supports the claim?	
<input type="checkbox"/>	<input type="checkbox"/>	Is the reasoning related to the claim?	
<input type="checkbox"/>	<input type="checkbox"/>	Is it related to the evidence?	
<input type="checkbox"/>	<input type="checkbox"/>	Is it consistent with accepted science ideas?	
<input type="checkbox"/>	<input type="checkbox"/>	Does it use facts, not feelings (system 2 thinking, not system 1)?	

## Argument B

Yes, the broken-open mouse cells that have a firefly luciferase gene will make light. All organisms share the genes that code for cellular transcription and translation machinery. The cellular machinery from a mouse is similar to the cellular machinery found in fireflies, and the genes are made of the same building blocks, A, T, G, and C. Therefore, the mouse cells should be able to read the firefly luciferase gene to make luciferase protein, and this luciferase protein should be able to react with luciferin and give off light.

## Argumentation Checklist

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