

## Lesson 2: What Does the Nucleus Do?

1. Before you begin the lesson, we want you to start thinking about how good or bad evidence is.

When evidence is good, you can believe the conclusions.

When evidence is bad, you cannot believe the conclusions.

Here are two examples:

A. Sarah wanted to find out if the students in her class like chocolate chip cookies. She asked each person in her class, and found that 23 said they like chocolate chip cookies, and 1 did not. She concluded that nearly all the students in her class like chocolate chip cookies. IS THIS GOOD EVIDENCE OR BAD EVIDENCE for Sarah's conclusion? WHY?

B. Anne wanted to find out if the students in her class like carrot cake. At night, she had a dream that everyone in her class was eating carrot cake, and they were all smiling and looked happy as they were eating. From this, she concluded that all the students in her class like carrot cake. IS THIS GOOD EVIDENCE OR BAD EVIDENCE for Anne's conclusion? WHY?

2. In this lesson, as you read the 5 pieces of evidence, you will be asked to rate how good that piece of evidence is using the numbers 0, 1, and 2.

Rating of 0: This is very bad evidence. This means: We cannot believe the conclusions at all. We should ignore this evidence and not think about it any more.

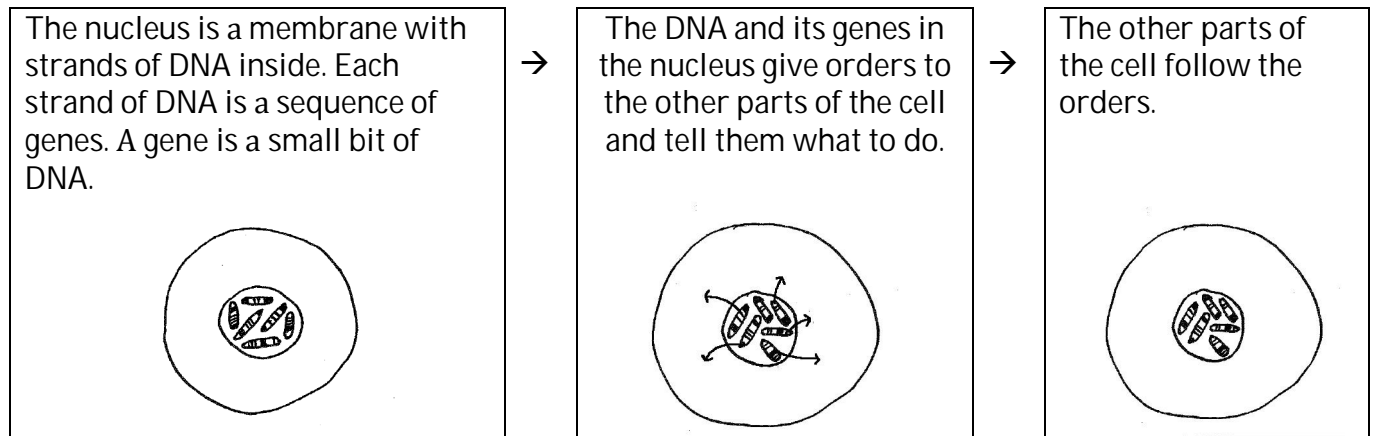
Rating of 1: This is not very good evidence, but it is not totally bad evidence. This means: We can believe the conclusion a little, but we have to be careful.

Rating of 2: This is good or very good evidence. This means: We believe the conclusion. The evidence shows that the conclusion is correct.

3. Here are two models of what a nucleus does. You will use 3 pieces of evidence to determine which model is better. You will then revise the better model to make it even better. Read each of the two models.

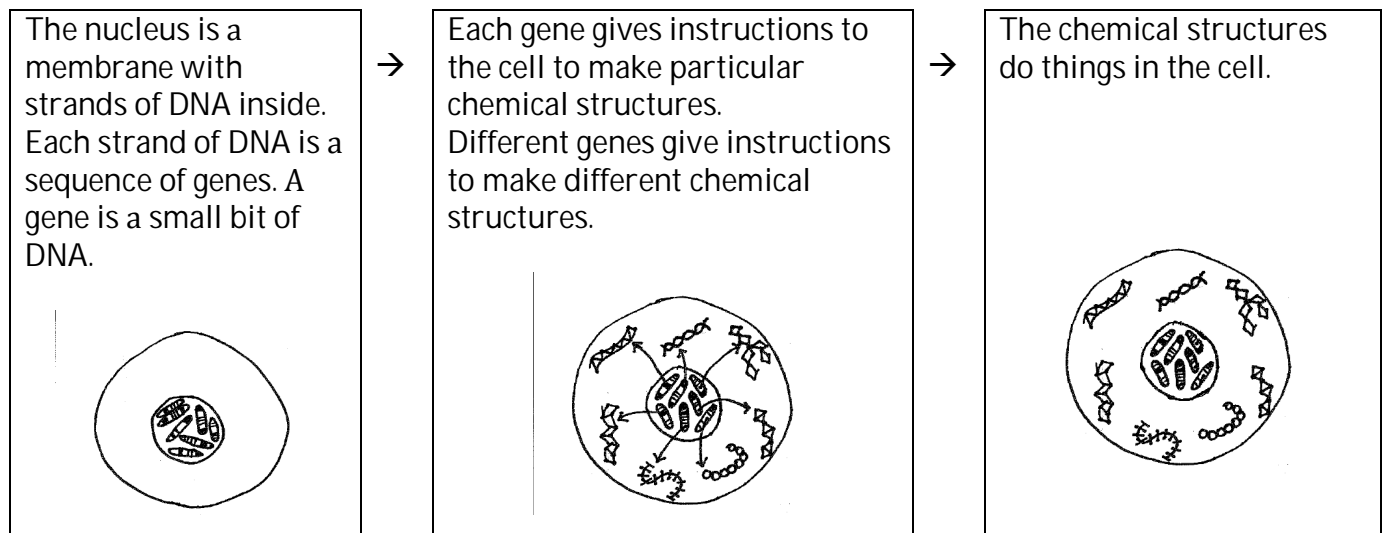
### CONTROL CENTER MODEL

The nucleus is the control center of the cell. It is like a brain. It works like this:



### INSTRUCTIONS MODEL

The nucleus gives instructions to make cell structures. It works like this:



### Evidence #1 - Dolly

4. In pairs, complete Evidence 1. Evidence 1 is a computer simulation. Follow the directions that you see on the computer.

5. Individually, answer this question: How good or bad is Evidence #1? Write your reasons for your answer. Write to someone who might disagree with you.

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6. A. Individually, rate how good this piece of evidence is (0, 1, or 2) in the small box under Evidence #1 on Page 5.

B. In pairs, discuss your evidence goodness ratings. Use a red pen if you want to change your evidence ratings after discussing them.

7. A. Individually, draw appropriate arrows to connect the evidence with each model on the right hand side.

B. In pairs, discuss your arrows. Give lots of reasons, and discuss anything you disagree about. If you change your mind about an arrow, draw a new arrow in red ink.

C. Individually, write your answer: Which model (or models) does this evidence support, and why? (Don't take more than 3 minutes to write your answer.)

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## Evidence #2 – Glowing Cats

8. Read the Scientific American Blog in your groups on the computer. Follow the directions that you see in the blog.

Glowing Cats Evidence Check: Discuss all these questions in pairs. Then circle the best answer to Questions I-V. Use the evidence summary pages to help you.

I. According to the scientists, what makes the jellyfish glow?

- A. Their GFP genes glow.
- B. Their GFP protein glows.
- C. Their GFP mitochondria glow.

II. Which of these did the scientists do?

- A. They injected a glow-in-the-dark chemical into adult jellyfish.
- B. They injected a glow-in-the-dark chemical into adult cats.
- C. They put a cat gene into a jellyfish egg.
- D. They put a jellyfish egg into a cat egg.

III. According to the scientists, why did the cats glow?

- A. The GFP gene glows in cats.
- B. The GFP gene gives instructions to make the GFP protein, and the GFP protein glows in cats.
- C. The GFP gene does not do anything at all in cats, and this is why the cats glow.

IV. What is the best conclusion for this study?

- A. The GFP gene gives instructions to make the GFP protein.
- B. The GFP gene gives instructions to make the GFP protein, and the GFP protein makes animals glow.
- C. The GFP gene does not make any proteins. No one knows why the cats and jellyfish glow.

V. Which model does this evidence support, and why? (Don't take more than 3 minutes to write your answer.)

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9. A. Individually, rate how good this piece of evidence is (0, 1, or 2) in the small box under Evidence #2 on Page 5.

B. In pairs, discuss your evidence goodness ratings. Use a red pen if you want to change your evidence ratings after discussing them.

10. A. Individually, draw appropriate arrows to connect the evidence with each model on the right hand side.

B. In pairs, discuss your arrows. Give lots of reasons, and discuss anything you disagree about. If you change your mind about an arrow, draw a new arrow in red ink.

Model-Evidence DIAGRAM –Evidence 1 and 2

	The evidence <b>supports the model.</b>
	The evidence <b>STRONGLY supports</b> the model.
	The evidence <b>contradicts (goes against)</b> the model.
	The evidence <b>STRONGLY contradicts (goes against)</b> the model.
	The evidence <b>is irrelevant to</b> the model.

Evidence #1 - Dolly

Control Center  
Model

Evidence #2 – Glowing Cats

Instructions  
Model

### Evidence #3 - Tadpoles

11. Read the research report on Tadpoles in groups.
12. In groups, discuss this question: What do you conclude from this study?
13. Copy your evidence rankings and arrows for Evidence #1 and #2 from page 5 to the arrow matrix on page 8.
14. Individually, add evidence ratings and arrows for Evidence #3 on Page 8. Then in pairs discuss your ratings and arrows.

### Evidence #4 - Website

15. Read the information from the website [www.ineedhelp.com](http://www.ineedhelp.com) in your groups on the computer.
16. Individually, add evidence ratings and arrows for Evidence #4 on Page 8. Then in pairs discuss your ratings and arrows.

### Evidence #5 - Diabetes

17. Read the Diabetes study in groups on the computer. Follow the directions you see on the computer.

Diabetes Evidence Check: Discuss all these questions in pairs. Then circle the best answer to Questions I to V.

I. People get Type 1 diabetes because

- A. their bodies produce too much insulin
- B. their bodies do not produce insulin.

II. According to the scientists' hypothesis, healthy people

- A. have a normal DRB gene which gives instructions to make the DRB protein
- B. have a normal DRB gene but no DRB protein
- C. have a mutated DRB gene and no DRB protein
- D. have a mutated DRB gene which gives instructions to make a lot of DRB protein

III. According to the scientists' hypothesis, people with Type 1 diabetes

- A. have a normal DRB gene which gives instructions to make the DRB protein
- B. have a normal DRB gene but no DRB protein
- C. have a mutated DRB gene and no DRB protein
- D. have a mutated DRB gene which gives instructions to make a lot of DRB protein

IV. What is the best conclusion from this study about healthy people?

- A. Most of them have normal DRB genes and DRB protein in their cells.
- B. Most of them have mutated DRB genes and no DRB protein in their cells.

V. What is the best conclusion from this study about people with Type 1 diabetes?

- A. Most of them have normal DRB genes and DRB protein in their cells.
- B. Most of them have mutated DRB genes and no DRB protein in their cells.

18. In groups, discuss this question and write your best answer: What do you conclude from this study?

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19. Individually, add evidence ratings and arrows for Evidence #5 on Page 8. Then in pairs, discuss your ratings and arrows.

### Arrows Diagram

Evidence Goodness	Control Center Model	Instructions Model
#1. Dolly <div></div>		
#2. Glowing Cats <div></div>		
#3. Tadpoles <div></div>		
#4. Website <div></div>		
#5. Diabetes <div></div>		



20. Link Evidence 2 to each of the models, using the arrows. Then, individually, answer the two questions below.

What arrow did you draw between Evidence 5 and the Control Center Model? Write your reasons for your arrow choice.

Draw arrow  
Here:

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What arrow did you draw between Evidence 5 and the Instructions Model? Write your reasons for your arrow choice.

Draw arrow  
Here:

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### Model Evaluation

21. Discuss in your pairs:

A. Which model is better, based on the evidence so far (circle one)? The Control Center Model or the Instructions Model?

B. How well does the better model fit your class's criteria for good models? Discuss as many criteria as you can.

22. Discuss in your pairs: Are there changes you could make to the better model to make it even better? Make any changes to the better model in the space below.

Individually write your reasons for the changes you made.

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## The Function of the Nucleus

18. Individually, answer these questions:

a. What is the function of the nucleus?

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b. What would happen if you took the nucleus of a mouse egg and put it in a chicken egg?

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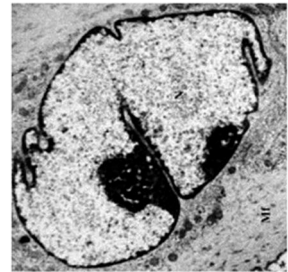
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c. Some muscle cells have more than one nucleus.  
How would muscle cells with more than one nucleus be different than cells that have only one nucleus?



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