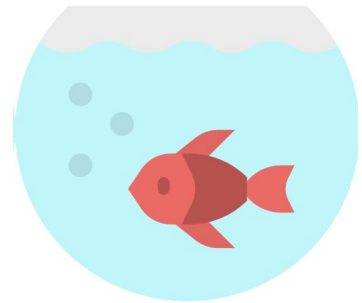




SCIENCE CLUB!

WELCOME BACK!



What will we do today?

1. Develop some helpful criteria for models
2. Update from Fresh Perspectives-
new evidence!
3. Use MEME to look at evidence and
revise the model
4. Whole group debrief

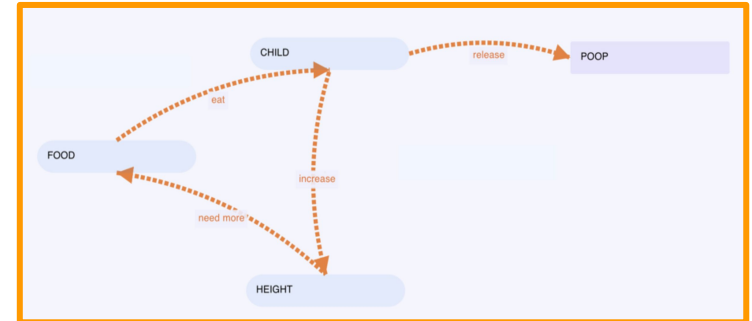


Recap: Scientific Models

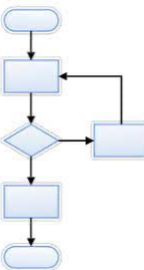
Scientific models represent (show) how something in the world works. They help scientists *explain* and *predict* how something works.

For example, a model of how a child grows:

- *Explains:* how a child grows
- *Predict:* what a child needs to grow



Models are *simplifications*.



Criteria for Good Models

To solve this mystery, we need to make a model that shows what happened and why.

- To do that, we need some criteria that will help us make and evaluate good models.
- Criteria are standards that scientists use to judge good scientific models.

Examples of criteria for good models are:

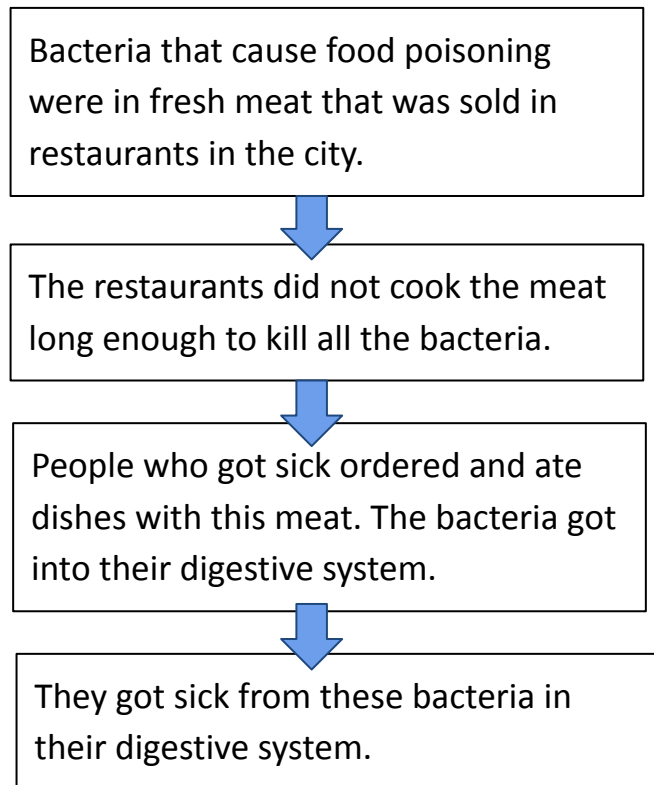
- a) Supported by evidence (no contradictory evidence)**
- b) Shows all steps in process**
- c) Understandable**
- d) Consistent (doesn't contradict itself)**

We will look at some models and decide which is better and why!

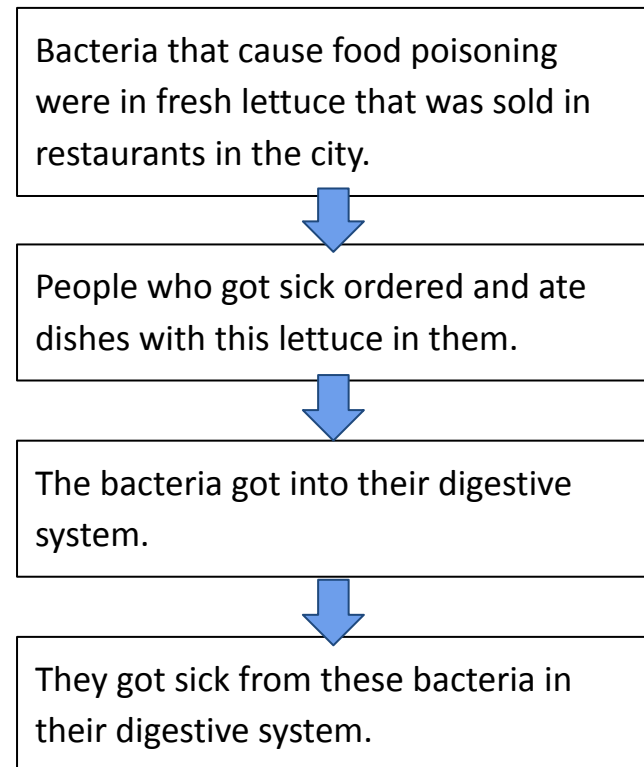


There was a huge outbreak of food poisoning in Bloomington. Health scientists developed two models of why the food poisoning occurred. Which model is better? Why?

Model A: Food Poisoning



Model B: Food Poisoning



Evidence 1: All of the people who got sick had eaten lettuce.

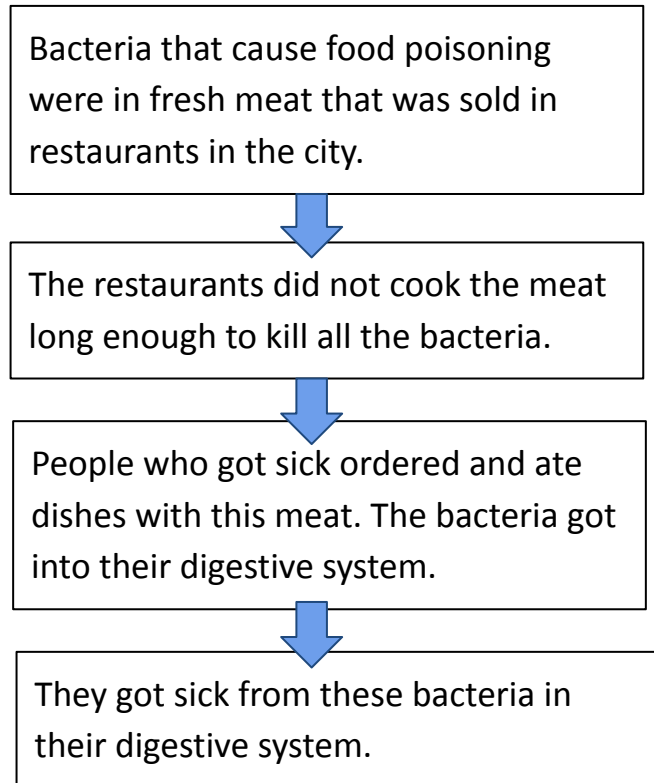
There was a
developed two m

Examples of criteria for good models are:

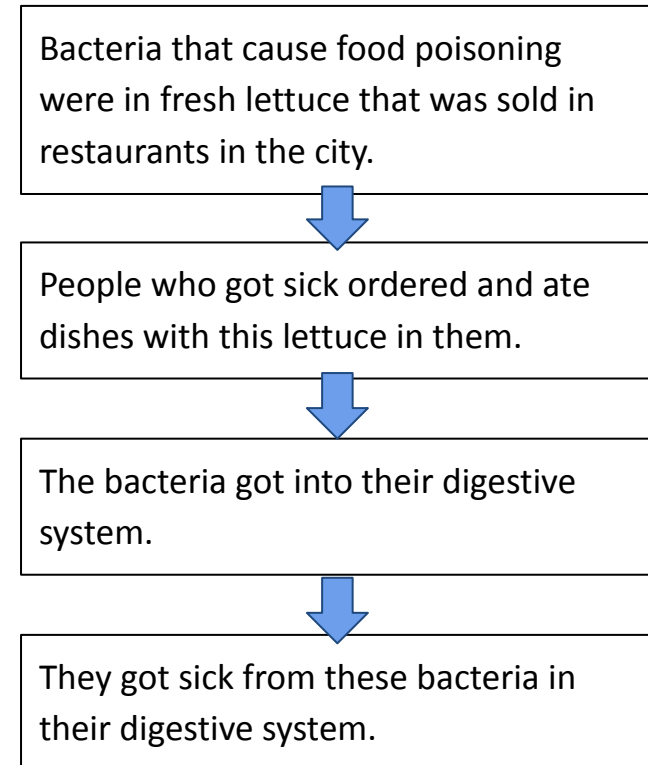
- a) Supported by evidence (no contradictory evidence)
- b) Shows all steps in process
- c) Understandable
- d) Consistent (doesn't contradict itself)

health scientists
odel is better? Why?

Model A: Food Poisoning



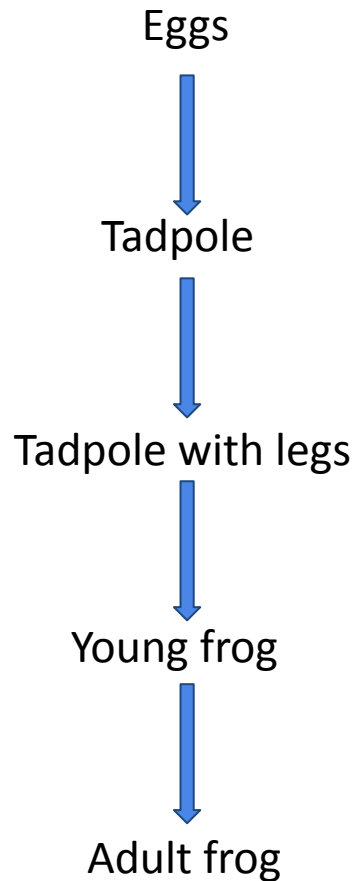
Model B: Food Poisoning



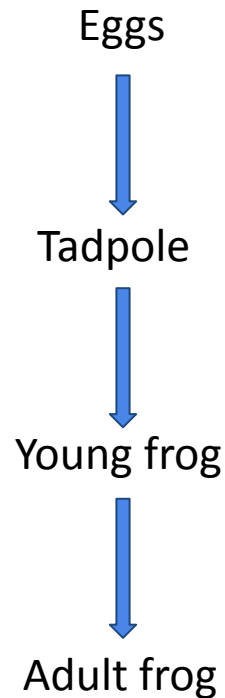
Evidence 1: All of the people who got sick had eaten vegetables.

Which of these two models best explains how tadpoles transform into frogs?

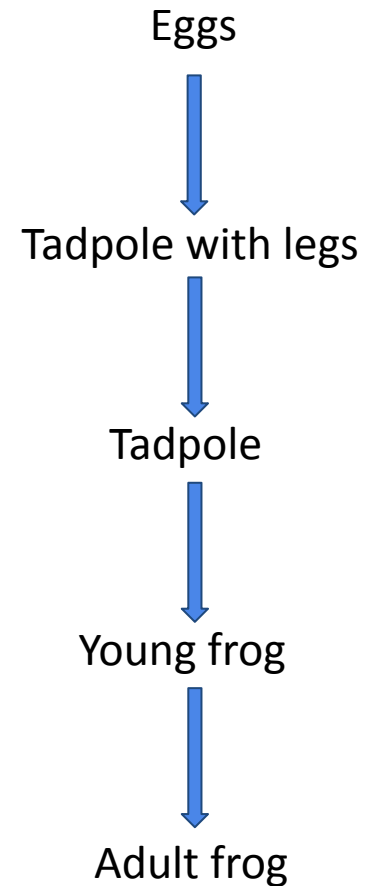
Model A



Model B



Model C



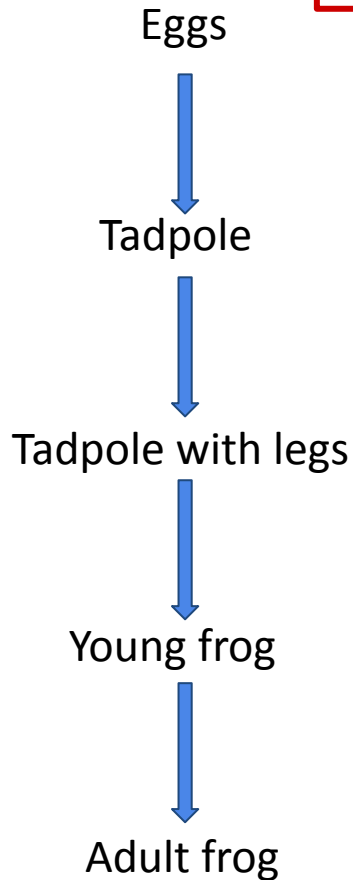
Which of the

Examples of criteria for good models are:

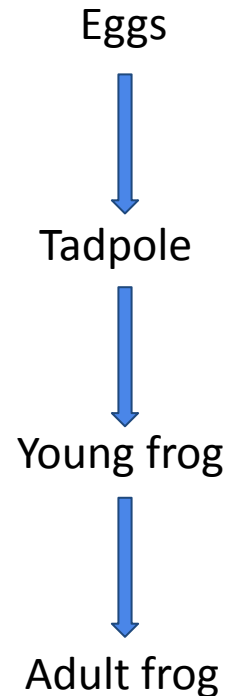
- a) **Supported by evidence (no contradictory evidence)**
- b) **Shows all steps in process**
- c) **Understandable**
- d) **Consistent (doesn't contradict itself)**

transform into frogs?

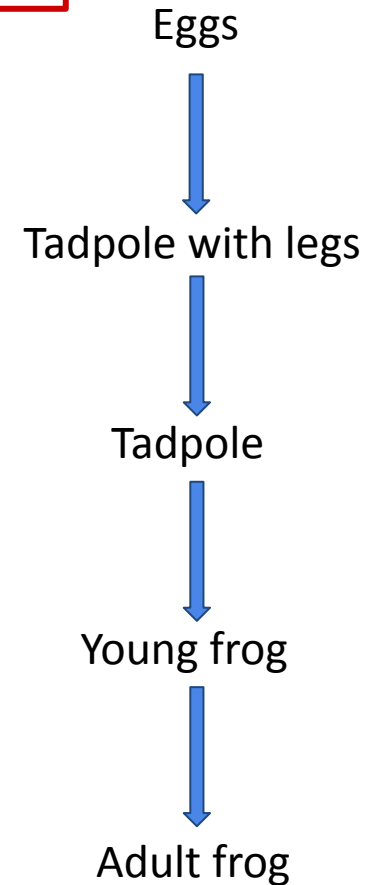
Model A



Model B



Model C

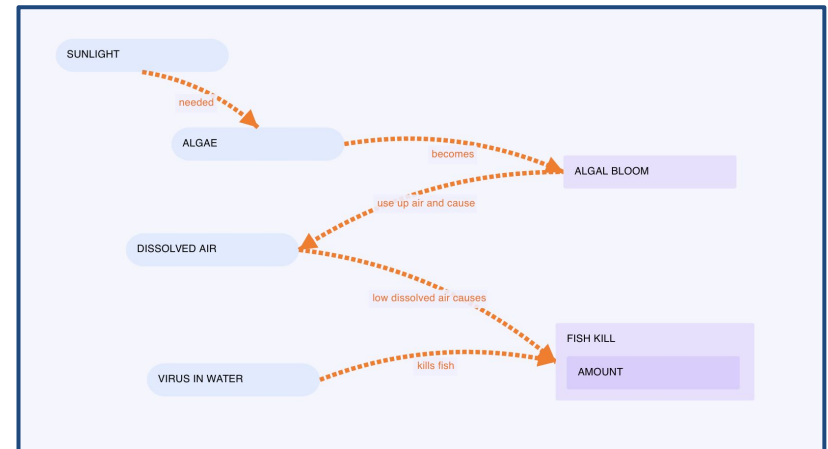


Updates

We added some evidence into MEME based on your questions.

Please evaluate the evidence, revise the model, and make sure the model meets the criteria.

If you have new questions and requests for evidence let us know!



Examples of criteria for good models are:

- a) **Supported by evidence (no contradictory evidence)**
- b) **Shows all steps in process**
- c) **Understandable**
- d) **Consistent (doesn't contradict itself)**



Discussion

- Do we need to make changes to the criteria list?
- We need to update Fresh Perspectives on what we did today. What should we tell them?
- After today, what questions do we still have?

Criteria List

- a) Supported by evidence (no contradictory evidence)
- b) Shows all steps in process
- c) Understandable
- d) Consistent (doesn't contradict itself)





See you next week!

Evidence

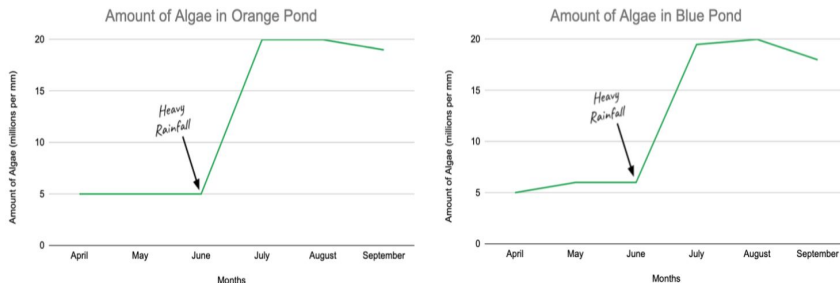
Now we will look at evidence in MEME!



Report on Algae Growth

Algae are living things that need to breathe oxygen dissolved in the water, just like fish and other sea creatures. Nutrients help algae grow. The more nutrients there are in the water, the more algae grow and reproduce. Often, after a heavy rainfall, nutrients wash into the pond from the surrounding land.

Scientists hired by FRESH Org wanted to find out if the amount of algae in the two ponds was the same or different. They measured the amount of algae in each pond once a month from April until September. They also noted that in early June of that year, there was a very big storm that washed a lot of nutrients into both of the ponds. The graphs below show the amount of algae in both ponds from April until September.



Dissolved Oxygen in Tanks

The Fresh Org team knows that fish, like all living things, need oxygen. They breathe oxygen that is dissolved in the water through their gills. They wondered whether the problem in the ponds had to do with the amount of oxygen in the water, and so asked some scientists to do an experiment to see how much dissolved oxygen fish need to be healthy.

The scientists set up an experiment to test how the amount of dissolved oxygen affects fish health. They set up 3 large tanks, each with a different amount of dissolved oxygen. They then placed the same number of fish (of the same type and size) in each tank and measured how fast they swam.

When fish are healthy, they swim around actively. When fish are not healthy, they experience physical stress and slow down or stop swimming.

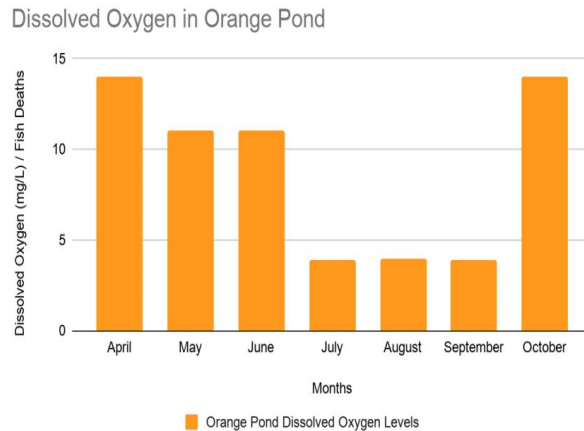
Amount of dissolved oxygen in the tank water	Swimming speed after 5 hours
Tank 1: Low Oxygen (5 mg/l)	Very slow swimming (indicating medium stress)
Tank 2: Medium Oxygen (7 mg/l)	Slow swimming (indicating low stress)
Tank 3: High Oxygen (10 mg/l)	Normal, active swimming (indicating no stress)

Evidence

Now we will look at evidence in MEME!

Dissolved Oxygen in Blue and Orange Pond

The FRESH Org panel hired scientists to measure the amount of dissolved oxygen in Orange Pond and Blue Pond once a month from April to October. The graphs below show the amount of dissolved oxygen in each pond during those months.



Report on Water Quality in Both Ponds

FRESH Org hired scientists to check the water quality in each pond. The scientists took samples from each pond and tested the water for viruses, bacteria, poisons, and very tiny pieces of trash that are known to harm fish. The table shows the results of the water quality check.

Water Quality Tests	Orange Pond	Blue Pond
Fish viruses	Negative	Negative
Fish bacteria	Negative	Negative
Poisons harmful to fish	Negative	Negative
Microscopic trash	Negative	Negative

