Name_____

DATA Nugget

Does the heat turn caterpillars into cannibals?

Featured scientist: Kale Rougeau (they/them) from Louisiana State University

Research Background:

Around the world, temperatures are rising from **climate change**. This is a hot topic for scientists because warmer temperatures could make diseases spread a lot faster. Many diseases spread by the foods we eat. With warmer temperatures, metabolisms increase, and organisms need to eat more food to survive. This increases the risk of eating something that will get them sick.

Kale in the lab setting up an experiment with fall armyworms.

When Kale started graduate school, they joined a lab that studies how climate change affects the spread of disease in **fall armyworms**, a type of caterpillar. Fall armyworms are an agricultural pest known for destroying corn, soybeans, and other crops worldwide. In the summer, they move into fields and rapidly chow down on crops. It's often reported by farmers that it seems as though fall armyworms can remove all the leaves from a cornfield overnight! Believe it or not, their huge appetite leads them to another food source – they will even turn into **cannibals** and eat each other!

Once Kale started graduate school, they became interested in how cannibalism can increase disease spread in warmer temperatures. Fall armyworms can get infected with a special type of virus called a **baculovirus**. Baculoviruses are a group of viruses that infect insects, especially caterpillars. They are highly specialized, meaning that each baculovirus usually only infects one species.

If a fall armyworm eats a fellow fall armyworm that is infected, it can be deadly. In fact, the disease causes their body to completely liquify into a puddle of pure virus! This baculovirus is so effective that farmers even use it to help control infestations in their

fields. Since this specific baculovirus only infects fall armyworms, it is safe to use on crops without worrying about effects on humans or other living things.

A fall armyworm cannibalizing a smaller one during the experiment.

A fall armyworm that has been liquified due to a baculovirus infection.

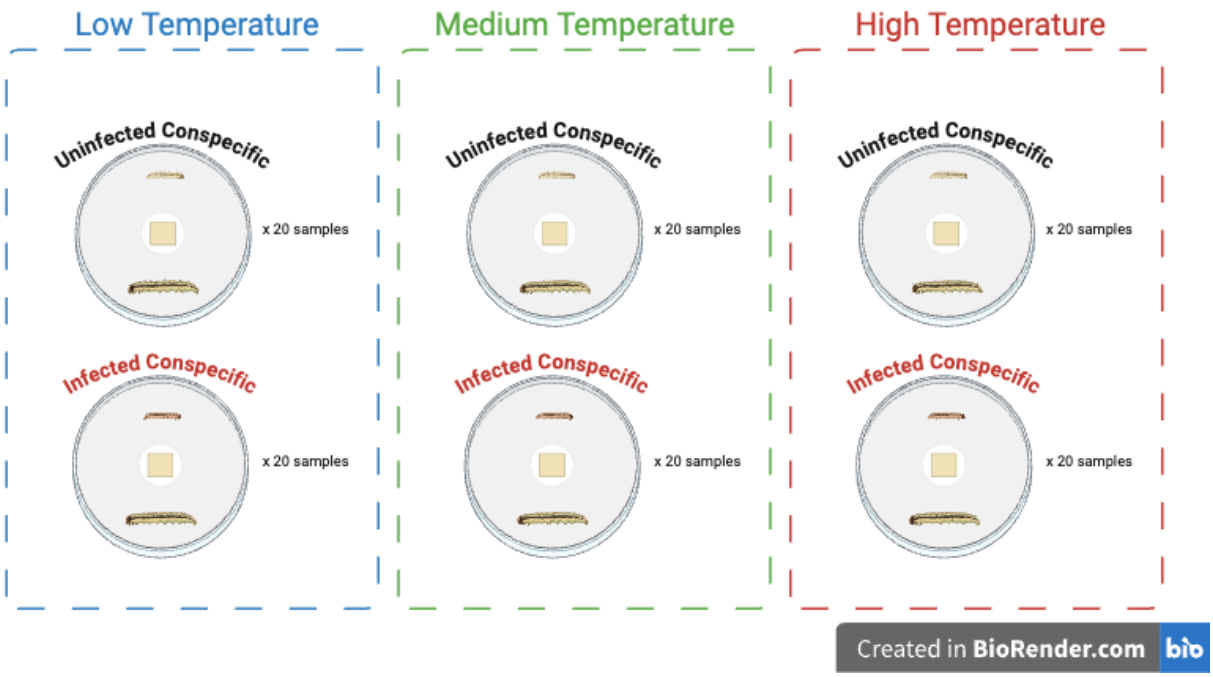
To study how cannibalism can affect disease spread, Kale designed a set of experiments. They thought that when temperatures are higher, the larvae's metabolism would increase and make them hungrier caterpillars. Increased appetite could then lead to more cannibalism. As a result, more larvae would be eating others that are infected, further spreading the deadly baculovirus.

To test these ideas, Kale set up small Petri dishes and placed one big fall armyworm in each dish as the focus of each trial. Kale added a piece of insect food and a smaller fall armyworm to each dish. This way, the larger caterpillars had the option of eating the insect food, cannibalizing its smaller friend, or munching on both.

To see if temperature had an impact, Kale set up three treatments at low, medium (ideal), and high temperatures. They assigned 40 Petri dishes to each temperature. To test changes in disease transmission, half of the smaller caterpillars were infected with baculovirus, and half remained uninfected.

Kale predicted that fall armyworms at higher temperatures would cannibalize more because they need more food to keep up with an increased metabolism. They also predicted that fall armyworms that eat an infected caterpillar would be more likely to become infected at higher temperatures.

Name_____



A visual example of the experimental treatments. In each Petri dish there is a large fall armyworm, a small fall armyworm (also called conspecific), and a chunk of insect food. Each combination had 20 samples set up in the same way. *Image created in BioRender.com.*

Scientific Question: How do warmer temperatures affect fall armyworm cannibalism and disease transmission?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Name_____

Scientific Data:

Complete the table and use the data below to answer the scientific question:

Temperature Treatment	Virus Treatment	# Cannibals	# Infected	% Cannibalized	% Infected
low	uninfected	5	0		
low	infected	12	4		
medium	uninfected	9	0		
medium	infected	13	7		
high	uninfected	14	0		
high	infected	18	8		

Note: When calculating the percent infected, remember that only cannibals were vulnerable to infection.

What data will you graph to answer the question?

Independent variable(s): _____

_____

Dependent variable(s): _____

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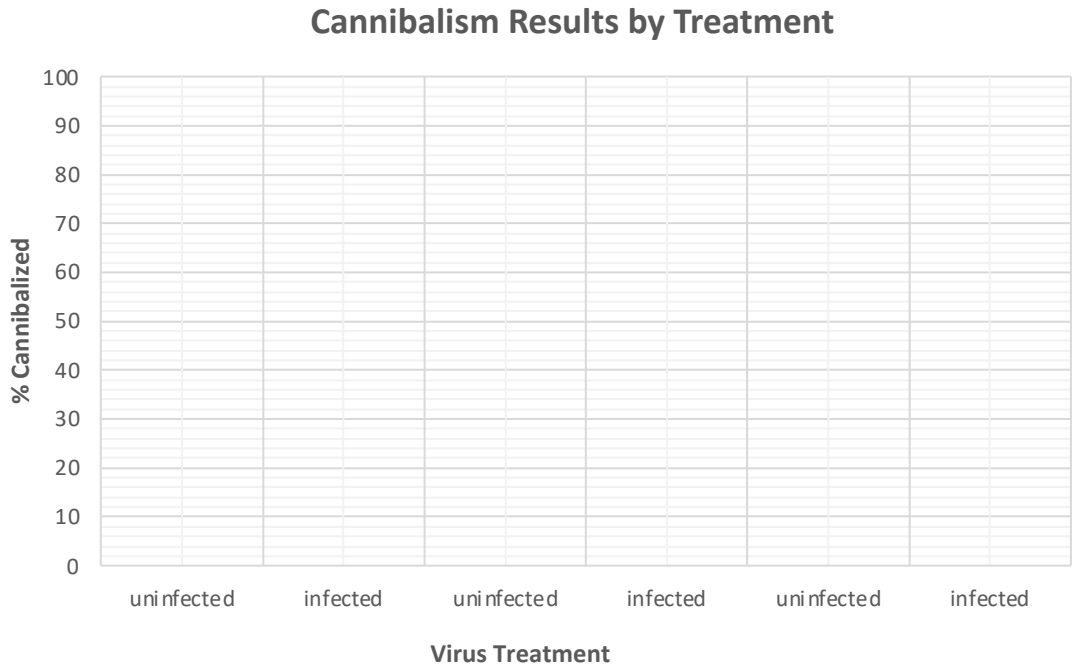
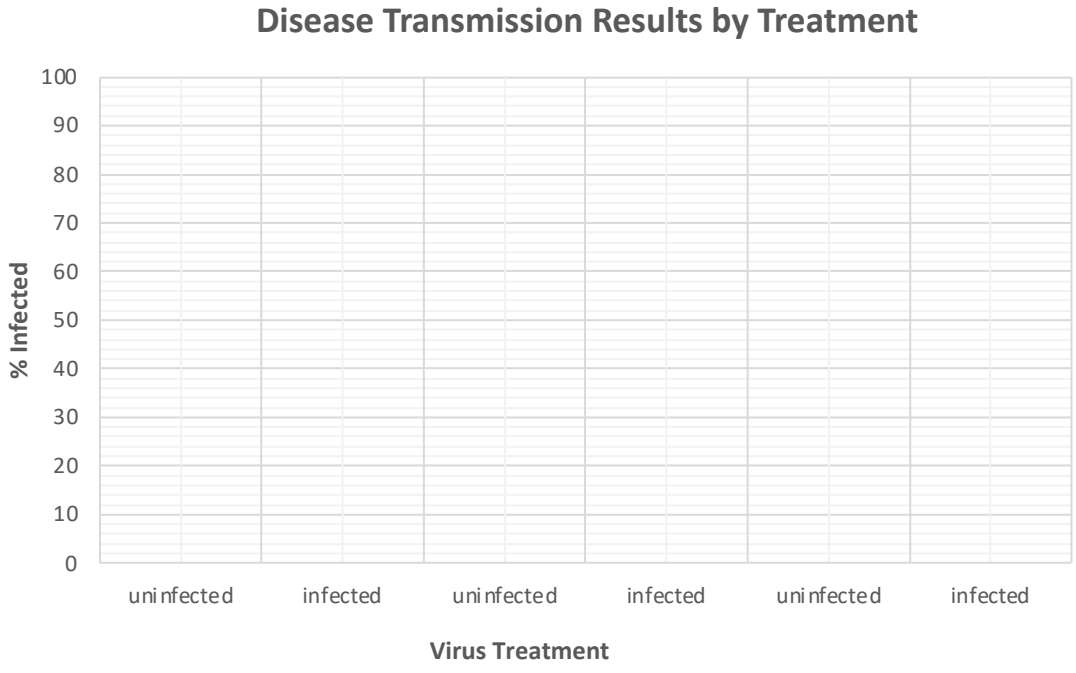
Name_____

Draw your graphs below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.





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Interpret the data:

Make a claim that answers the scientific question, how do warmer temperatures affect fall armyworm cannibalism and disease transmission?

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the relationship between temperature and metabolism.

Name_____

Did the data support Kale's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Kale's research? How do your questions build on the research that has already been done?