Name_____

DATA Nugget

Bon Appétit! Why do male crickets feed females during courtship?

Featured scientist: Biz Turnell from Cornell University

Research Background:

In many species of insects and spiders, males provide females with gifts of food during courtship and mating. This is called **nuptial feeding**. These offerings are eaten by the female and can take many forms, including prey items the male captured, substances produced by the male, or parts from the male's body. In extreme cases the female eats the male's entire body after mating! Clearly these gifts can cost the male a lot, including time and energy, and sometimes even their lives.

So why do males give these gifts? There are two main hypotheses explaining why nuptial feeding has evolved in so many different species. First, giving a gift may attract a female and improve a male's chance of getting to mate with her, or of fathering her young. This is known as the **mating effort hypothesis**. Second, giving a gift may provide the female with the energy and nutrients she needs to produce young. The gift helps the female have more, or healthier, offspring. This is known as the **paternal investment hypothesis**. These two hypotheses are not mutually exclusive – meaning, for any given species, both mechanisms could be operating, or just one, or neither.

Mating pair of Hawaiian swordtail cricket with macrospermatophore on the male (left). The male and female (right) are marked with paint pens for individual identification.

Name_____

Biz is a scientist who studies nuptial gifts, and they work with the Hawaiian swordtail cricket. They chose this species because it uses a particularly interesting example of nuptial feeding. In most other cricket species, the male provides the female with a single package of sperm, called a **spermatophore**. After sperm transfer, the female removes the spermatophore from her genitalia and eats it. However, in the Hawaiian swordtail cricket, males produce not just one but a whole bunch of spermatophores over the course of a single mating. Most of these are smaller, and contain no sperm – these are called "micros". Only the last and largest spermatophore to be transferred, called the "macro" actually contains sperm. The number of micros that a male gives changes from mating to mating.

From some of their previous research, and from reading papers written by other scientists, Biz learned that micros increase the chance that a male's sperm will fertilize some of the female's eggs. Also, the more micros the male gives, the more of the female's offspring he will father. This research supports the mating effort hypothesis for the Hawaiian swordtail cricket. Knowing this, Biz wanted to test the paternal investment hypothesis as well. They wanted to know whether the "micro" nuptial gifts help females lay more eggs, or help more of those eggs hatch into offspring.

Biz used two experiments to test the paternal investment hypothesis. In the first experiment, 20 females and 20 males were kept in a large cage outside in the Hawaiian rainforest. The crickets were allowed to mate as many times as they wanted for six weeks. In the second experiment, 4 females and 4 males were kept in cages inside in a lab. Females were allowed to mate with up to 3 different males, and were then moved to a new cage to prevent them from mating with the same male more than once. In both experiments Biz observed all matings. They recorded the number of microspermatophores transferred during each mating and the number of eggs laid. If females that received a greater number of total micros over the course of all matings produced more eggs, or if their eggs had a higher rate of hatching, then the paternal investment hypothesis would be supported.

Scientific Question: What is the role of nuptial feeding for paternal investment in the Hawaiian swordtail cricket?

What is the hypothesis? Find the two hypotheses in the Research Background and underline them. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies. Having two alternative hypotheses means that more than one mechanism may explain a given observation. Experimentation can determine if one, both, or neither hypotheses are supported.

Name_____

Scientific Data:

Use the data below to answer the scientific question:

Female ID	Experiment	Total "Micros" Received	# Eggs Laid	Proportion Eggs Hatched	# Eggs Hatched
BBB_F	1 - Field	20	30		29
BGB_F	1 - Field	23	22		20
BYB_F	1 - Field	16	22		17
GBG_F	1 - Field	33	17		17
GGG_F	1 - Field	19	13		12
GRG_F	1 - Field	12	10		8
GWG_F	1 - Field	29	21		19
GYG_F	1 - Field	27	23		22
WBW_F	1 - Field	24	15		14
WGW_F	1 - Field	43	28		27
WRW_F	1 - Field	34	9		9
WWW_F	1 - Field	39	26		26
YBY_F	1 - Field	22	29		27
YGY_F	1 - Field	9	23		21
YWY_F	1 - Field	47	26		26
YYY_F	1 - Field	33	20		20
AGA_L	2 - Lab	14	2		2
AYA_L	2 - Lab	13	17		12
BAB_L	2 - Lab	19	19		17
BBB_L	2 - Lab	17	13		11
BGB_L	2 - Lab	18	23		12
BRB_L	2 - Lab	20	20		17
BYB_L	2 - Lab	17	28		24
GAG_L	2 - Lab	16	15		13
GGG_L	2 - Lab	17	21		16
GYG_L	2 - Lab	12	11		9
RAR_L	2 - Lab	15	18		14
RWR_L	2 - Lab	13	22		21
WAW_L	2 - Lab	14	17		13
WWW_L	2 - Lab	16	7		4
YAY_L	2 - Lab	20	21		18
YGY_L	2 - Lab	9	8		5
AGA_L	2 - Lab	14	2		2

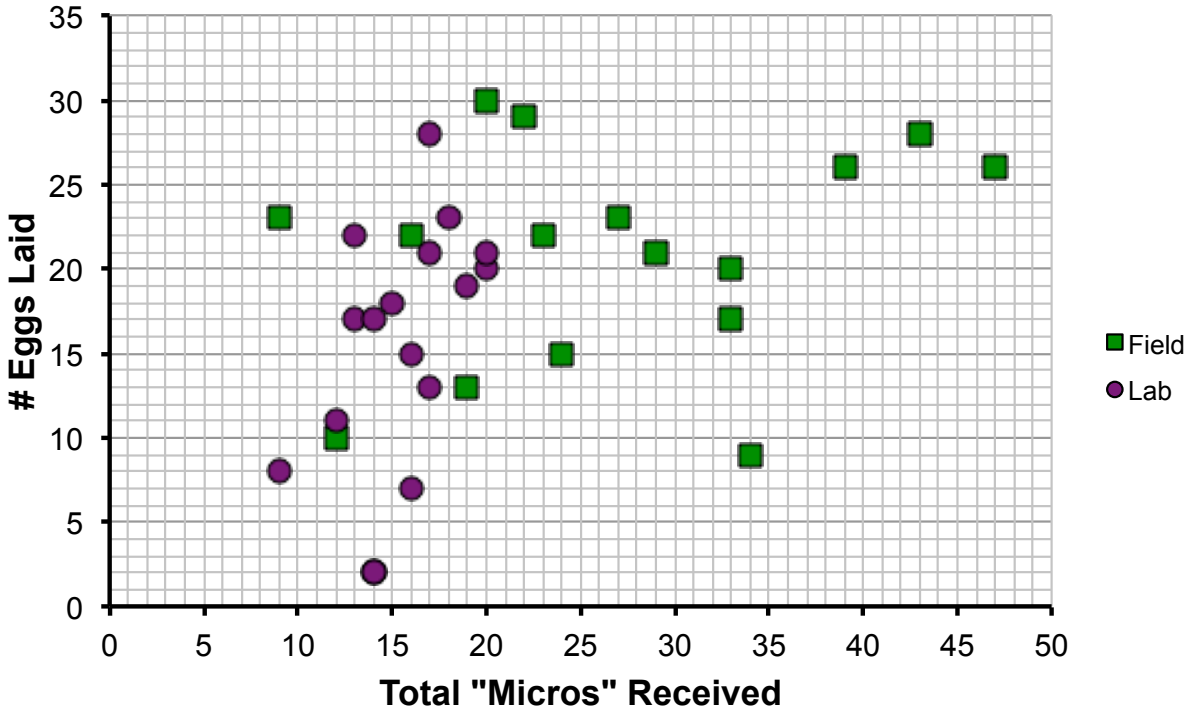
What data will you graph to answer the question?

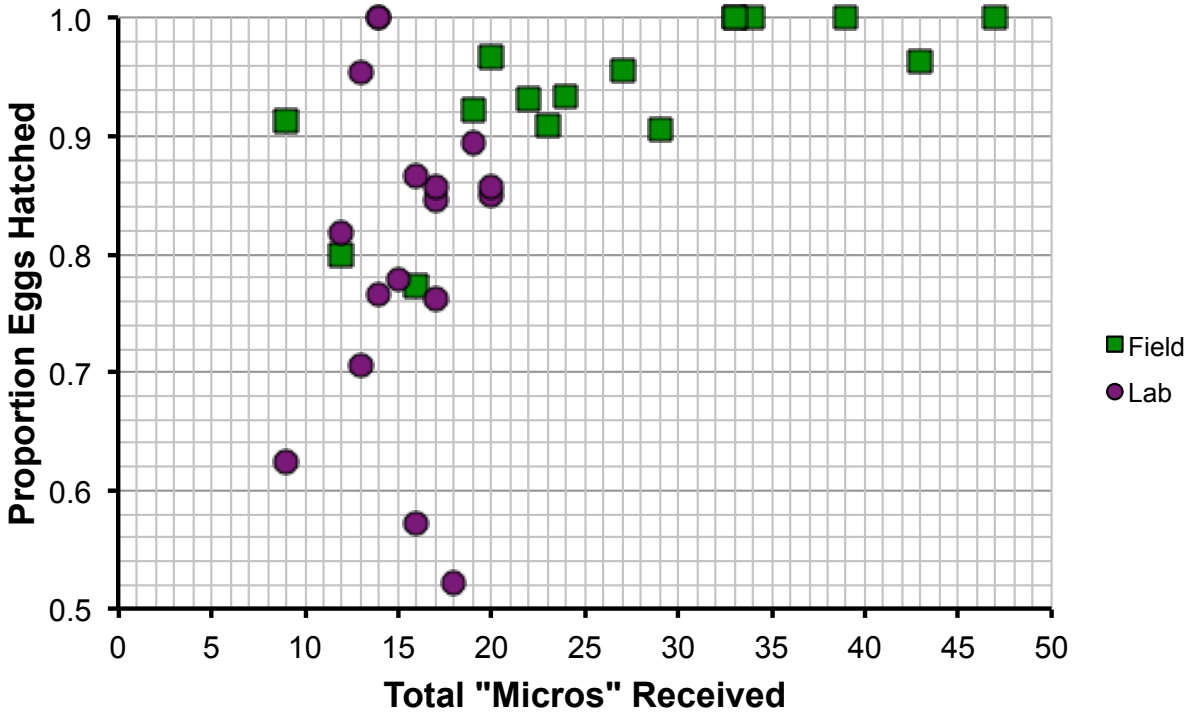
Independent variable: _____

Dependent variables: _____

Name_____

Below are graphs of the data:





Name_____

Interpret the data:

Make a claim that answers the scientific question.

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

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about nuptial feeding in Hawaiian crickets.

Name_____

Did the data support the paternal investment hypothesis? Use evidence to explain why or why not. If you feel the data was inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question do you think should be investigated? What future data should be collected to answer your question?