

Changing Colors of Butterfly Wings



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Scientific experiment preformed by:
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Monarch butterflies are known for their brilliant orange wings, but our group decided to try and change the wing color of these beautiful butterflies. We wanted to see if the color of the food source affected the butterflies' wing color. In order to do this we fed nine monarch butterflies three different color nectar over the course of two weeks. We hoped that by feeding them blue, green and non-colored nectar, the butterflies' wing colors would change. However, after a total of six feedings, we did not see any significant color change in their wings. We are uncertain if this is because of the high mortality rate of the monarchs during our experiment, making it difficult to run a proper experiment, or if the monarchs are just not affected by the dyed honey water. However, through this process we have learned many valuable things about the monarch butterfly; how it eats, how much, and how often. Also, living with these organisms everyday for two weeks was a very unique experience. They are much more active than any of us had ever thought. They wake up early, go to bed late, and flutter around their cages at all times. Overall having the monarchs live with us was a wonderful learning experience.

Before we could start our experiment, we needed to do a little research on what and how butterflies ate. We started with what we knew which was that adult monarch butterflies eat some form of nectar. However, we needed to do further research to find out how we could make the nectar and how we would administer it to them. So, we went to the Internet, which we found to not be very helpful. None of the sites gave us a direct formula for making nectar and none gave any ideas about how to administer the nectar to the butterflies. So we went to our professor Dr. Michele Koomen who has done extensive

research with these organisms and she was able to provide us with the information we needed. As a group, we hypothesized that changing the monarch butterflies food source to blue or green would in turn make the wing color of the monarch blue or green. Our null hypothesis was that changing the color of the monarch's food source would not affect their wing color in any way. Making the food source and its color the independent variable and the response of the wing color the dependent variable. None of the past experiments are relevant to our topic, where they looked at Monarch wing color, but they did look at the Monarchs. This shows that there are many different types of experiments allowing us as teachers to let our students explore many different options of experimentation.

With Michele's guidance, we made up three different batches of nectar, each containing a ratio of 20% honey and 80% water. Dr. Koomen locally produced the honey and the tap water was always warmed and retrieved from the faucet. In the two jars that would contain colored nectar, we placed three drops of blue food coloring into one, three drops of green into the other, and left the last one without any color as our control group. Then we poured each bottle of nectar into three separate dishes for the butterflies to eat.

We began our experiment with nine monarch butterflies, but unfortunately we experienced many expirations throughout the experiment. Our original plan was to have three butterflies feed from the clear nectar, three from the blue, and three from the green. However often times our numbers would vary and we would have three clears and only two blues or vice versa. Even though we could not keep this part of our experiment constant, we worked very hard to ensure that every feeding was done the same way. The butterflies were fed every other day for two weeks (six feedings in all), they were always

fed at the same time of day (between 4:00 pm and 4:30 pm), and always in the same location (On Robyn's desk, in front of the window, in Rundstrom hall). As far as the actual feeding procedure, these are the steps that were carried out each day;

- Since we used the same nectar for every feeding, it had to be stored in the refrigerator to prevent fermentation. However monarch butterflies prefer the nectar to be warm, so before each feeding, we filled three large containers with luke warm from the faucet and set the jars filled with nectar in each for three minutes to allow them to heat up.
- After the nectar was warm, we poured the liquid from each jar into three separate petri dishes.
- Starting each time with the clear group, then the blue and then the green, we carefully reached our hands into screen cages where they were housed and removed the butterflies by gently holding onto their wings. We then had to assist the butterfly with its feeding by guiding its proboscis out with a small unraveled paper clip and placing it into the nectar. We repeated this withal three colored groups so that all of the butterflies were eating at the same time.
- In order to keep track of each butterfly, we marked each of their wings with a fine tipped sharpie on the lower left hind wing (We used numbers 1-3, using tally marks). Then we timed how long each butterfly eat and documented that information.
- In order to measure the change that occurred in each butterflies wings, we took pictures of them during each feeding. We saved the pictures and documented the

date and feeding number for each picture so that we could compare the pictures and note any change later on.

- After each butterfly was done feeding we carefully picked them up by their wings and placed them back into their designated cages. We kept them in the same spot (on the far side of the room, against a wall, across from a window with direct sunlight).

We decided that the best way to display our results using a chart documenting each butterfly's weight, and the amount of time that each fed for as well as any change in wing color. To measure the weight, we put each butterfly in a white packet put them onto a scale (weighing out the packets weight) and then recorded the data. We measured feeding time with a stopwatch, from the time that the butterflies' proboscis went into the water to the time that they removed it and began to move around. Tint color was determined by our observations as well as comparing the photos we had documented from each feeding. From there we could pick "no change", "slight change" or "significant stage".

1.

10/31/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	Sick did not eat	no change
#2 Blue-Male .3g	8 min	no change
#3 Blue-Male .2 g	7 min	no change
#1 Green- Male .3g	8 min	no change
#2 Green-Female	7 min	no change
#3 Green- Male .4	7.5 min	no change
#1 Clear- Male .6g	Dead	no change
#2 Clear- Female .2g	6 min	no change
#3 Clear-Female .3g	7 min	no change

2.

10/29/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	3 1/2 min	no change
#2 Blue-Male .3g	6 min	no change
#3 Blue-Male .2 g	4 min	no change
#1 Green- Male .3g	6 min	no change
#2 Green-Female	6 min	no change
#3 Green- Male .4	7 min	no change
#1 Clear- Male .6g	6.5 min	no change
#2 Clear- Female .2g	7 min	no change
#3 Clear-Female .3g	6 min	no change

3.

11/2/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	6 min	no change
#2 Blue-Male .3g	8 min	no change
#3 Blue-Male .2 g	dead- new 7 mins	no change
#1 Green- Male .3g	8.5 min	no change
#2 Green-Female	6 min	no change
#3 Green- Male .4	8 min	no change
#1 Clear- Male .6g	dead- new 6.5 min	no change
#2 Clear- Female .2g	dead- New 6 min	no change
#3 Clear-Female .3g	8 min	no change

4.

11/5/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	8 min	no change
#2 Blue-Male .3g	7 min	no change
#3 Blue-Male .2 g	8 min	no change
#1 Green- Male .3g	8.5 min	no change
#2 Green-Female	8 min	no change
#3 Green- Male .4	7 min	no change
#1 Clear- Male .6g	dead	no change
#2 Clear- Female .2g	10 min	no change
#3 Clear-Female .3g	dead	no change

5.

11/7/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	8 min	no change
#2 Blue-Male .3g	dead	no change
#3 Blue-Male .2 g	12 min	no change
#1 Green- Male .3g	7 min	no change
#2 Green-Female	7.5 min	no change
#3 Green- Male .4	8 min	no change
#1 Clear- Male .6g	dead	no change
#2 Clear- Female .2g	dead	no change
#3 Clear-Female .3g	dead	no change

6.

11/9/2007	Feeding Time	Tint Change
#1 Blue-Female .2g	5 min	For all blue there
#2 Blue-Male .3g	dead	was a slight change.
#3 Blue-Male .2 g	5 min	we also noticed that
		there was blue stuff .
#1 Green- Male .3g	5 min	on side of cage.
#2 Green-Female	6 min	
#3 Green- Male .4	5 min	No change
#1 Clear- Male .6g	dead	no change
#2 Clear- Female .2g	dead	no change
#3 Clear-Female .3g	dead	no change

With the experiment that we designed there was not any statistical information that we were able to test. Our experiment had no measurements or other categorical data that correlated with our null hypothesis that we have proved to be true. There was categorical data, such as the weight and feeding times, but they were not the main goal of the experiment leaving them with no statistical significance. In this experiment, the statistics are not the main focus. The focus is on the color scales that were created to measure the color change of the Monarch wing.

To summarize what we have learned, as a whole here is that performing one experiment does not give you a definite answer in science. Some experiments need to be worked on for many years in order to just be able to slightly prove a hypothesis. In our

specific experiment we learned that working with a live animal as your testing individual, things like expiration happen. We also learned that when we perceived the monarchs to be sick they would not eat. They are very active during the day and quiet at night, due to the fact that they are not nocturnal animals. Monarchs also fed longer towards the end of the experiment, but we do wish that we would have done more research on their way of eating. We also were able to touch and see more of the parts and colors of the adult, because of our close encounters with them. It bettered our understanding of the physical make up for the organism.

As future science teachers all of this information is greatly needed in assisting us to become better teachers. Projects and experiments are able to give students hands on experiences with science. We want students to get the most out of their learning and with these multiple process experiments they are able to learn many concepts. With our specific experiment, it will allow us to become more knowledgeable about the Monarch Butterfly's eating habits, along with living habits. As teachers, we always need to be learning as well so, that we can be as informed as possible for our students.

If we were to do this study, there are a few things that we would change. We experienced a lot of death among our butterfly population so if we were to repeat this experiment, we would like to try and get to the bottom of all of these expirations. Perhaps, the butterflies had a disease, so next time we could make sure that the butterflies do not have a disease before we put them into our experiment. We could do this by checking them for any type of spore disease or letting them live a few days to make sure that they are healthy before inducting them into our experiment. This goes along with our second change, which would be using older butterflies. The butterflies that we received

were very young, most just out of the pupa; perhaps we needed to give them time to grown strong before we put them through the stress of an experiment. We would also use more butterflies next time, maybe five or six instead of only three. That was if a few die, we would still have some sort of population to work with. Lastly, we had noticed that the butterflies seemed very restless in their small living space so maybe adding a plant or some sort of foliage would make their environment better and lengthen their life span.

There were just two limitations in this experiment, the first of course being the death of all of the butterflies. The fact that so many kept dying, nine in fact, made it very difficult to run a consistent experiment. By adding new butterflies to replace the ones that had died made it hard to truly judge the ability of the colored nectar changing their wing color. Each butterfly was feed for different amounts of time and by the end of the experiment, we did not have any of the original butterflies. We also thought that it was probably very stressful and possibly harmful for the butterflies to be handled as much as they were. However this is a limitation, because there is no other way besides touching them to feed them. We thought that all of this human contact was potentially harmful, yet unavoidable.

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References (APA):

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"On my honor, I pledge that I have not given, received, nor tolerated others' use of unauthorized aid in completing this work."

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