Name(s)

Ryan S. Belkin

Project Number

J2301

Project Title

The Path to Immortality: The Effect of Albuterol, Atorvastatin & Erythromycin on the Lifespan of Caenorhabditis elegans

Abstract

Objectives/Goals
The objective of this experiment is to determine if the medications: albuterol, erythromycin, and atorvastatin, all of which slow down mitochondrial function, have a positive impact on the lifespan of C. elegans, a nematode.

Methods/Materials
C. elegans worms were separately incubated in the medications: albuterol, erythromycin, and atorvastatin at a concentration of 10 micrograms/ml at the start of the L1 phase of their life cycle. The worms were closely monitored and manually counted using a microscope on a daily basis throughout the duration of their lifespan.

Results
I found that albuterol, erythromycin, and atorvastatin all increased the mean lifespan of C. elegans by 3.4, 2 and 1.7 days respectively, compared to the control group.

Conclusions/Discussion
The medications albuterol, erythromycin, and atorvastatin all affect mitochondrial function and ultimately decrease the amount of oxygen-free radicals produced during cellular respiration. Since oxygen-free radicals are implicated in the aging process, their reduced production counteracts the aging process, thereby leading to increased longevity. If applied to a human being, then the average human being's life span would change from 79 to at least 101 years of age. Additionally, 20% of the worms in the albuterol group lived extraordinarily longer compared to other long-living albuterol worms, which raises the possibility that a mutant albuterol-sensitive worm exists, allowing for longer life.

Summary Statement

By incubating C. elegans worms in medications that slow mitochondrial function, I demonstrated that albuterol, atorvastatin & erythromycin all significantly extend the lifespan of C. elegans.

Help Received

I designed and carried out the experiment by myself at home. Professors Rothman and Joshi from the Department of Molecular, Cellular & Developmental Biology at UCSB met with me to discuss my experimental design and to provide the worms and petri dishes. I got help in understanding the statistical

Name(s)	Project Number
Isabel L. Bruce	**J2302**

Project Title

Commercial vs. Organic Farming: Effects on Night Time Pollinator Presence and Diversity

Abstract

Objectives/Goals

Major pollinators such as bees and butterflies which contribute to the yield and quality of leading crops globally are declining in dismaying quantities. Scientists believe many factors may be implicated in this population decline, including habitat loss, pesticide use and climate change. These threats may also apply to night pollinators such as moths and beetles, who have recently been identified as equally important as the bees and butterflies. Pesticides used in commercial farms are suspected to pose a threat not only to pests, but also to beneficial insects. I wondered if night pollinators might exhibit less diversity and fewer numbers near commercial farms versus in the vicinity of organic farms. I hypothesized that night pollinator diversity and numbers of night pollinators would be lower near commercial farms compared to in the vicinity of organic farms.

Methods/Materials

Two farms with similar microclimates and crops but 45 miles apart were chosen for field research, a certified organic farm and a commercial farm. Both were vineyards. Using a light trap to attract insects, night pollinator diversity and numbers were documented and compared over a total of 18 field hours distributed over 8 night visits and 2 day visits during the winter of 2017-2018.

Results

More moths were documented near the organic farm than in the vicinity of the commercial farm. At the organic farm five different orders were represented and at the commercial farm three different orders were present. At each farm, the orders Lepidoptera, Coleoptera and Diptera were seen; the orders Araneae and Hymenoptera were seen exclusively at the organic farm. I saw more moths and overall night pollinators at the organic farm. The numbers of beetles at each farm were too small to analyze.

Conclusions/Discussion

Using a model comparing organic versus commercial farms as a surrogate measure of pesticide presence, I found that pesticides may have a negative correlation to the number of moths and overall nighttime pollinator diversity in an area. I saw more moths and more variety of pollinators at the organic farm compared to the commercial farm. Further research is needed to evaluate the effects of pesticides on nighttime pollinators, and appropriate measures need to be taken to protect these important contributors to pollination.

Summary Statement

I studied and documented night pollinator numbers and diversity near local vineyards.

Help Received

Name(s)	Project Number
Tayler Ericksen; Madelyn Gilbert; Emily Turczak	**J2303**

Project Title

How Magnet Strengths and Water Temperatures Affect the Regeneration of Planarian

Abstract

Objectives/Goals

The objective for this is to discover which temperature of water combined with which strength of magnet would increase the rate of regeneration in planarian.

Methods/Materials

Petri dish 35mm dia, brown planarian, magnets 3 different strengths, water 3 different temperatures, microscope, scalpel, and liver. Cut planarian into thirds and place in petri dish. Measure cut planarian regeneration over several days.

Results

During the 12 trials we compared the data of planarian regeneration for each petri dish. The room temperature water with the lowest strength magnet was shown to be the most effective.

Conclusions/Discussion

The conclusion of the room temperature water with the lowest strength magnet showed more effectiveness than any of the other trials. Therefore, the lowest strength magnet in room temperature water produced the best result.

Summary Statement

We discovered the effects different magnet strengths and water temperatures have on planarian regeneration.

Help Received

Our Science Teacher Mrs. Shelby Little. Prof. Muller at California State University of planarian diets how different temperatures of water effect their growth and how they are able to regenerate. Prof. Ross at California State University.

Name(s)

Abigail W. Goodman

Project Number

J2304

Project Title

B Flat Bee: Does Wingbeat Frequency Predict Honeybee Flower Shape Selection?

Abstract

Objectives/Goals
I wanted to learn if the wing beat frequency (WBF) of honeybees can predicts their morphology and thus determine what shape of flower the bee pollinates.

Methods/Materials
I recorded honeybees on different flowers using a portable recorder on a microphone stand, and then used a Fast Fourier Transform tool to determine the wing beat frequency (WBF) to see if different WBFs were associated with differently shaped flowers.

Results
My results found that 2 similarly open-faced flowers had close average wing beat frequencies (WBF), while a flower that requires a narrow, smaller body, had a higher average WBF.

Conclusions/Discussion
The result suggests that acoustic analysis to determine average wing beat frequency in a colony could suggest which crops that colony would optimally pollinate. This could be important for farmers and apiarists to lower costs. It may also benefit native bee species by reducing the length of time honeybees pollinate resulting in less competition for pollination.

Summary Statement

My project tests the ability to use acoustic analysis to match honeybees with the flowers they morphologically fit.

Help Received

I received help from my science teacher and parents in thinking about this project, getting to places to record honeybees, and learning to use tools to get the wing beat frequency from sound recordings of honeybees.

Name(s)	Project Number
Pranav Gupta; Prakrit Jain	**J2305**

Project Title
Cuticle Sensitivity to UV Light in Uroctonus mordax Scorpions

Abstract

Objectives/Goals
Under UV light, scorpions fluoresce a bright bluish-green. A popular conjecture is that this allows them to sense UV light with their cuticle. Sensing UV with their cuticle would allow scorpions to find cover and hide from predators more effectively. The goal of our experiment is to see if they have this ability, which we feel is a strong hypothesis because scorpions are expert at finding cover, and cuticle sensitivity to UV light would be a good explanation for this strength.

Methods/Materials
We traveled to UC's Hopland Research and Extension Center to collect ten Uroctonus mordax scorpions for our experiment. We kept them in plastic boxes with cover and leaves for a month before starting the experiment, so they become accustomed to their new environment. During our experiment, we needed to determine if scorpions could find cover without eyesight whenever UV light was present. However, if scorpions were still finding cover in the dark, it would suggest that the scorpions are instead finding cover by using sensory organs, such as those known as pectenes. To achieve this, we devised the following experiment: The scorpions would be put in a box with a UV light, then video recorded and timed until they found cover. We conducted three trials with ten scorpions in each, (1) UV light is on, and scorpions are not blindfolded; (2) UV light is on, and scorpions are blindfolded; and (3) UV light is off.

Results
The scorpions were expected to find cover 100% of the time in Trials 1 and 2, and they did 90% and 80% of the time, respectively. In Trial 3, the scorpions were not expected to find cover, because the UV light was not on, and only one of the ten scorpions found cover, giving the trial a 90% success rate.

Conclusions/Discussion
We concluded that scorpions are, in fact, able to find cover by sensing UV light with their cuticle, because they could find cover whenever UV light was present, but not without it. This can be used as evidence for future studies in (1) Preventing unwanted human-scorpion interaction; (2) Studying other organisms that fluoresce, such as harvestmen; (3) Determining the reason scorpions fluoresce; and (4) Studying UV response in arthropods, such as pollinators.

Summary Statement
We determined that scorpions can sense UV light using their cuticle, an ability they can use to find cover.

Help Received
Ms. Peng, Lauren Esposito, Eddie Dunbar, Ken-ichi Ueda, and several other entemologists

Name(s)	Project Number
Nina Hubrich; Elsie Sorenson	**J2306**

Project Title

The Behavioral Sciences of the California Condor

Abstract

Objectives/Goals

The purpose of this project is to discover more about the California Condor social behavior and hierarchy. We want to know who is the most dominant and why, and how their dominance hierarchy affects the other Condors.

If there is an alpha Condor who controls the feeding group, they will influence the rest of the Condors as they feed. The alpha will typically be an older male, because the alpha male decides to be more dominant and protective over the food. Also, the wild Condors are most likely to be more aggressive.

Methods/Materials

The constant of the project was to observe feeding behavior on Wednesday and Thursday mornings. The control was the online Condor Camera which is is accessible to anyone and shows Condors in their natural habitat as they eat. It is accessible on a website called ventanaws.org, and the actual camera is located in Big Sur. Big Sur was where the collection of the data happened. The independent variable in the experiment were the interactions, where a Condor is dominant over another. The dependent variable was the Dominant Condor gender, age, and if they were raised captive or wild.

The way the responding variables were recorded was from observing the Condor social behavior through the same public Condor Camera mentioned before.

Results

The results of this experiment were that the gender of the California Condor does not affect dominance. The result for the age, was that adults normally portray dominant behaviors over other adults, rather than young or elderly Condors. The results also showed that the captive raised Condor are shown to be more dominant than the wild raised Condors.

Conclusions/Discussion

The results show that the hypothesis is wrong. If this experiment would be repeated again, the focus would be on both who was the submissive Condor, and the more dominant one, instead of only focusing on which Condor is more dominant.

Summary Statement

The project is about which California Condors are dominant based on their recorded behaviors and findings that gender and age do not matter and captive raised Condors are shown to be more aggressive toward wild raised Condors.

Help Received

Some help received was from our Science teacher Alex Hofsteen, who guided us through the project, our professional contact Kelly Sorenson provided us with help and information, lastly we were provided help from our parents to grammar check our work and pay for supplies.

Name(s)	Project Number
Elizabeth M.B. Lindholm	**J2307**

Project Title

Focus On Me! Focal Species Participation in Group Foraging at Four Eastern Caribbean Islands

Abstract

Objectives/Goals
This study was conducted to expand the minute section of human knowledge that is dedicated to the ocean and marine life. Using the data collected, the behavioral patterns of tropical fish will be better understood. Most importantly, the more people are able to understand about the ocean and the marine life within it, the more they will be aware of their impact and willing to help.

Methods/Materials
This study was conducted at four different coastal places in the eastern Caribbean - Grand Turk, Turks and Caicos; Half Moon Cay, Bahamas; San Juan, Puerto Rico; and St Thomas, US Virgin Islands. The data were collected through diving while utilizing basic SCUBA gear and waterproof paper and pencils.

Results
There were three questions. The hypothesis for the first question, (Do all focal species have fish following them?), was that not all of the focal species will have "followers" because some of their natural habitats may not have other species occupying them or the fish that are present have no need of the extra resources. For the second question, (Which focal species participates the most in group foraging?), the hypothesis was, focal species that have a larger byproduct of their feeding will have more species of fish surrounding them due to the fact there will be more individual opportunities for each fish to save time and/or energy obtaining sustenance. This can also lead to a higher density of followers as well because the amount of leftover food will be able to support more fish, the hypothesis for the third question,(Which focal species have the highest density of fish surrounding them?).

Conclusions/Discussion
All three hypotheses were supported with the proposed explanations probably being true as well. There are a couple possible reasons for the absence of followers in many cases. First, that specific focal animal could have been occupying a habitat where there were not any other fish that participate in group foraging. Another could be that that focal fish was not feeding at that moment, although there were some cases where they still had followers. The yellow goatfish were the most common focal species and they had the highest density of followers surrounding them. This may be due to both their larger size relative to other species, and the much larger size of their byproduct.

Summary Statement

This project aimed to explore the lesser known components of group foraging, specifically the participation of each focal species.

Help Received

None

Name(s)	Project Number
Victoria Marquez	**J2308**

Project Title

Surchin for Salinity

Abstract

Objectives/Goals
The purpose of this experiment was to determine whether more Purple Sea-Urchin eggs fertilized in 31 ppt, 34 ppt, or 37 ppt salinity levels. Higher salinity water forms when ocean water evaporates, leaving behind the salt. Lower salinity water forms when ocean water meets with a river, or another source of fresh water. This was important to test because, as scientists we need to know if animals will be able to reproduce or survive with global warming as an issue

Methods/Materials
The materials needed to conduct this experiment are 3 small beakers, 145.5 mL of seawater, 4.5 mL of fresh water, 0.2 g of sea salt, 1 microscope, Sea-Urchin eggs, Sea-Urchin sperm, 3 glass pipettes, and 1 refractometer. My independent variables were the different salinity levels used, which were 31 and 37 ppt. A few steps I took to conduct my experiment included, making the different salinity levels of thee water, transferring the gametes into the three beakers, waiting 45 minutes for the eggs to fertilize, and lastly examining and counting them under the microscope.

Results
The data demonstrates that Sea-Urchins had the highest fertilization rate in a 37 ppt salinity level, with an average of 27.3. This result was expected because 37 ppt salinity is the highest salinity level, since we live in California, the sun evaporates a lot of ocean water which leaves behind a higher amount of salt in the water. The 34 ppt salinity came in close second, with an average of 26.8 eggs fertilized. This demonstrates that the Sea-Urchins were also very comfortable in their regular salinity water, where they probably felt the safest. My results also show that the salinity level with the least amount of eggs fertilized was 31 ppt, with an average of 22.8. This big change in salinity level caused the Sea-Urchins to feel threatened, thus the fertilization rate was low.

Conclusions/Discussion
From my observations and data, I can conclude that the gametes fertilized more in the higher sea water because it is what they were most accustomed to, here in California, or in Los Angeles the hot sun often evaporates the water leaving behind more salt in the water.

Summary Statement
My project tests the fertilization rate of purple sea-urchins in different salinity levels.

Help Received
I made the different salinity levels of the water on my own, but I received help spawning the sea-urchins, I also received materials such as a microscope, and a refractometer.

Name(s)	Project Number
Natalia Padilla	**J2309**

Project Title

Danaus plexippus: Can People Help the Population and Keep Them off the Endangered Species List?

Abstract

Objectives/Goals

The Danaus plexippus (Monarch butterfly) is on the verge of gaining protection from the Endangered Species Act. In this investigation I wanted to learn if people could make a difference and help protect them. I also wanted to learn if the survival rate of Monarch butterflies raised in nurseries indoors would be higher than the rate of those in the wild.

Methods/Materials

In this investigation/experiment I began with 1 milkweed plant that had 3 eggs. I clipped the leaves with the eggs and set up a nursery in my kitchen. The nursery was a clear plastic container with a damp paper towel. I put the leaves in the container and waited for the eggs to hatch.

Once the larvae reached instar 2 I moved them to a second nursery where I fed them fresh leaves daily. When they reached instars 4 and 5 I moved them to a netted milkweed plant outdoors to pupate in a natural environment. Finally, I moved the chrysalis/pupa indoors until the butterfly eclosed, and after a few hours I released the butterflies outdoors.

Results

In my investigation my results demonstrated that Monarch eggs had a significantly better chance to reach maturity indoors vs. outdoors. Recent studies show that only approximately 4% of eggs laid become butterflies. The survival rate for eggs/larvae raised indoors was 93% (I collected 46 eggs and/or larvae and released a total of 43 butterflies). My results propose the idea that people CAN help the population, but it also raises questions, like "Can people help the population by just having more milkweed in their lawns?"

Conclusions/Discussion

In this study I was able to show that Monarchs raised indoors had a very high survival rate, 93% in my investigation, while the ones I left outside had a rate of 0%.

My investigation results matched recent studies that only 4% of eggs in the wild become butterflies (NONE of my Monarch eggs raised outdoors became butterflies).

My limited data proposes the idea that people DO have an impact on the Monarch population. I observed that the Monarchs outside didn't have a rate of success nearly as high as the ones indoors. It appears that people DO have an impact on the population and we CAN help the population. If more people got involved, perhaps we could stop the Monarch from being listed on the endangered species list.

Summary Statement

I raised Monarch butterflies to determine if humans can help the population by caring for them indoors until they eclosed.

Help Received

Name(s)	Project Number
Josiah D. Rowland	**J2310**

Project Title

How Different Foods Affect the Growth of Worms and the Soil They Live In

Abstract

Objectives/Goals
The objective of this study is to measure the length of the worms, reproduction, mass, and the nutrients in the soil.

Methods/Materials
Worms, soil, ruler, soil test kit, four food groups. Let several batches of the four food groups decompose for two months.

Results
At the end of the two months the fruit proved to be the most effective in the length, reproduction, and mass of the worms and nutrient quality of the soil.

Conclusions/Discussion
The worms that decomposed the fruit grew larger than the others fed a different diet, reproduced in greater numbers while also increasing in mass outweighing the other worms. The soil nutrients increased in all four test bucket, except for the Potential hydrogen in bucket two which contained newspaper. Worms having a larger mass had the most reproduction thus concluding worms in greater numbers and having a larger mass can consume more organic material than smaller numbers and worms with less mass.

Summary Statement
I wanted to show what type of organic material worms prefer the most.

Help Received
I built and performed the experiments myself. I did not receive any help.

Name(s)	Project Number
Skye D. Samuels	**J2311**

Project Title

Chicken Smarts: A Study of Memory, Learning, and Sensory Perception in Chickens

Abstract

Objectives/Goals
The objective of this project was to test the hypothesis that Chickens can learn to associate color with the location of their food.

Methods/Materials
Six chickens, were divided into two groups of three, a test group and control group. The testing environment was made up of a fenced-in 8 foot square, on concrete. Plastic bowls were placed in two corners of the square, diagonally across from one another. One bowl contained food. The other did not. For the test group, the food-containing bowl was red, and the other bowl was blue. For the control group, both bowls were blue. For 20 days, chickens were placed individually into the testing environment and observed. They were timed from the moment they entered, until they ate from the food bowl. On day 21, the bowls were switched and the chickens were, again timed, as above.

Results
The test group chickens had a significantly lower average time for finding their food, once the location had been changed. Only one of the control group chickens found the food.

Conclusions/Discussion
The test group chickens had a significantly lower average time for finding their food, once the location had been changed. This study supports the idea that chickens can learn to associate color with the location of their food.

Summary Statement

This experiment showed that chickens can learn, to associate a color with food location.

Help Received

My father helped me set up the test environment and taught me how to edit the raw video footage once testing was completed.

Name(s)	Project Number
Kensuke Shimojo	**J2312**

Project Title
Planarians: A New "Shadow Test" on Ultimate Ability of Survival

Abstract

Objectives/Goals
The planarian is known for its nearly almighty ability to fully regenerate its missing body parts. The objective is to find out how the animal can survive during regeneration, without some critical circuits, such as the light sensing system involving eyespots or the ganglia (the primitive neural system). Inspired by the latest findings (of the alternative, UV-based light sensing system), I specifically tested the hypotheses that adaptive behavioral functions (such as avoiding light) are restored much earlier than complete anatomical regeneration, and that the light sensing is switching from the eyespot-ganglia system to the more distributed, (possibly UV-based) system after dissection. To this end, I develop my own behavioral test called "shadow test."

Methods/Materials
Dugesia dorotocephala, or black planarians (up to 20), were dissected in different ways (horizontal or vertical), and raised in petri dishes with spring water. Each body part was put on the lighted side in a half-occluded petri dish, and video-recorded everyday to see if it would show light-avoiding locomotion (Experiment 1). Materials and methods are the same in Experiment 2, except that in the shadow test, an UV light and an UV-filtered, visible-range light sources were employed and compared.

Results
All dissected body parts, even the vertically dissected body part, showed behavioral avoidance of light 4 days after dissection, indicating early restoration of adaptive behavioral functions relative to the time needed for complete anatomical regeneration (Experiment 1). The comparison of UV vs. no-UV light conditions indicates a possibility of early switching after dissection, from the ordinary eyespot-ganglion based system to the UV-based, distributed system (Experiment 2).

Conclusions/Discussion
Different body parts restored adaptive behavior with different delays but long before completion of anatomical regeneration (Experiment 1). The results of Experiment 2 suggest that it is possibly owing to the alternative, UV-based light sensing system. These results underscore amazing degrees of redundancy (redundant light sensing systems) and flexibility (switching between them) that this species has acquired through evolution.

Summary Statement

I developed a new "shadow test" to address the ability of the planarians' body-parts to survive without the ordinary light sensing (eyespot-ganglion) system, results of which indicate amazing degree of redundancy and flexibility.

Help Received

I alone chose the topic, and conceived the idea and experimental methods (the "shadow test#, the vertical dissection, etc.). My father (a Caltech professor; cognitive neuroscientist) helped me to refine the hypotheses and the design; my mother (a Caltech experimental psychologist) helped me to conduct

Name(s)	Project Number
Sarah V. Stutsman	**J2313**

Project Title

Let Moths Illuminate the Way!

Abstract

Objectives/Goals
To verify which type of street light: Light Emitting Diode, High Pressure Sodium, Induction, or no street light, affects a moth's behavior more.

Methods/Materials
Set up a twin-sized bed sheet outside, placing a fluorescent lantern in the middle. Turn on the lantern an hour after sunset. After 30 minutes, note the number of moths attracted to the light. Check temperature, humidity levels, and barometric pressure with a thermometer and a barometer. Repeat in different locations with different types of street lights.

Results
On average, in the area with the Light Emitting Diode street light 4.3 moths were attracted to the fluorescent lantern, 2.3 moths were attracted in the area with the High Pressure Sodium street light, and in the areas with Induction and no street lights, 2 moths were counted. These results demonstrate that Light Emitting Diode street lights are better for moths and the environment in general.

Conclusions/Discussion
Through the many different trials used in this experiment, the environment with the Light Emitting Diode (LED) street light attracted the most moths. There are many different variables that should be taken in account. For example, the humidity and temperature levels, along with the phase of moon could have affected the moths' behavior each night. This experiment should aid in the battle to improve light pollution as it demonstrated which type of street light created less of a distraction to the moths. Moths have been avoiding light due to light pollution which affects the plants they pollinate and their predators.

Summary Statement

Due to moths' attraction rate to a fluorescent lantern being higher in an area with a LED street light rather than in areas with High Pressure Sodium, induction, and no street lights, the LED light is better for the environment.

Help Received

Michelle Stutsman (driving me around town); Tracy Martin (providing information about street lights); Tom Moody (directing me to Tracy Martin); Gloria Faus, Jeanette Fossum, and another neighbor (allowing me to perform my experiment on their lawns)

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Calvin Z. Sway

Project Number

J2314

Project Title

Tool Using Jays, Phase 2

Abstract

Objectives/Goals

The objective of this study was to test the problem solving abilities of Steller's Jays.

Methods/Materials

Using clear plastic containers mounted on a wooden box I built test devices. These devices required the Jays to solve an illogical problem by pulling a string attached to a pulley to bring peanuts within reach.

Results

My results proved my hypothesis wrong. I never got the Jays to solve the problem which required them to problem solve in an illogical/abstract way. They would always find a logical way to work around the problem and get the peanuts. Jays are successful with linear problems, but struggle with abstract problems.

Conclusions/Discussion

I was able to determine what the limitations of Jays problem solving abilities are. Jays can pray on the eggs of endangered birds like Marbled Murrlets. Using feeders that require the Jays to problem solve could prove useful to distract them and keep them away from nesting areas during the short Murrlet nesting season.

Summary Statement

I was able to determine the problem solving abilities and limitations of Steller's Jays

Help Received

None, I designed, built and tested by myself

Name(s)

Nicole T. Vanegas

Project Number

J2315

Project Title

Myrmecology: The Effect of Temperature on Ants' Ability to Locate Food

Abstract

Objectives/Goals
The purpose of this experiment was to determine the effect of temperature on the speed at which ants locate food.

Methods/Materials
Three ant colonies, one 30 degree Celsius room and one 19 degree Celsius room, and a timer. Three ant colonies rotated between the different temperature rooms were tested for the time it took to locate food.

Results
Two ant colonies were placed in a 30 degree Celsius room and one was placed in a 19 degree Celsius room. The colonies were rotated. Food was placed in a specific location and the colonies were observed for the time it took to locate the food. After fifteen trials in each temperature room, the 30 degree Celsius room had a faster average time than the 19 degree Celsius room.

Conclusions/Discussion
After fifteen trials, the results showed that the ants found the food much faster in the 30 degree Celsius room than in the 19 degree Celsius room. On average, when the colonies were in the 30 degree Celsius room they found the food in two hours, thirty-six minutes, and nineteen seconds. However, when the colonies were in the 19 degree Celsius room they found the food in three hours, forty-nine minutes, and twenty-three seconds.

Summary Statement

As observed through multiple timed trials, the ants, on average, located the food faster in the 30 degree Celsius room than the 19 degree Celsius room.

Help Received

I designed the experiment by myself, however my sister assisted me in placing the food in the two different rooms at the same time.

Name(s)	Project Number
Alessandro Villalvazo	**J2316**

Project Title

Ant's Behavior without Antennae

Abstract

Objectives/Goals

The objective of my project was to see how ants with no antennae or with only one antenna acted in a test of finding food.I also wanted to observe their natural behavior and hoped to find common behavioral traits between groups.

Methods/Materials

I tested their behavior and performance seeking ant food on a 1m long testing platform designed to resemble their natural environment that I created. I then observed the ant for five minutes per ant or until they reached the food. Their food sensing performance was measured by how long it took them to cross the 20cm, 40cm, 60cm, 80cm, and 1 meter mark toward the food source. For behavior, I observed for any behavior patterns in the groups to compare those tendencies with other groups.

Results

The results were that the control group had all ten ants cross 20cm, six ants cross 40cm, three ants cross 60cm, two ants cross 80cm, and two ants cross 1m. The group missing the right antennae had nine ants cross 20cm, three ants cross 40cm, two ants cross 60cm, one ant cross 80cm, and one ant cross 1m. The missing left antenna group had nine ants cross 20cm, seven ants cross 40cm, and two ants cross 60cm. The group missing both antennae only had six ants cross the 20cm line. The strongest behavioral triat I found was from the missing both antennae group, that trait was aggression

Conclusions/Discussion

I found evidence that ants not only use their antennae to sense food, but also that two antennae used together provide an advantage in making progress in the direction of the food source. There were a couple of things in which my research and data/results matched up.

Summary Statement

In this project I tested pogonomrymex occidentalis and their ability to find food when missing their right, left or both antennae, and also see any behavioral traits between each group.

Help Received

I did the whole experiment myself, the only assistance I recieved was from my science teacher to find good sources for my research.