CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Sarah Ayyad; Giselle Duran

Project Number

S2201

Project Title

The Effect of Folic Acid Uptake on the Fertility and Behavior of Zebrafish

Abstract

Objectives/Goals

This experiment was designed to test if taking the folic acid pills is the initial factor of their faster development and hyperactivity.

Methods/Materials

MATERIALS

10 female zebrafish and 12 males (bought from Petco), 15 gallon fish tank/aquarium for control, 7 four-gallon tanks (Petco), NaOH (1 liter), 50-50 meth water (1 liter), Nature Made Folic Acid 400 mcg (bought), pure folic acid (donated by Michael Quinlan from CLU), 10 mL Pipettes (from classroom), microscope (in class), small heater (from home), pestle and mortar , microcentrifuge tubes (class), centrifuge, air pump (bought from Petco), 8 bubbling stones and tubes (bought from Petco), High Performance Liquid Chromatography machine, LC 18 Column.

Methods:

Ten females and twelve males were randomly allocated to 15-gallon tank to be maintained at 25℃. The diets were prepared for the experiment to be fed to the zebrafish. The males were kept in the separate tank while the females were placed into different treatments at different concentrations of each pill (100 ppm, 5 ppm, 20 ppm, 10 ppm and 0 ppm). They were to be kept in separate tanks for about 2 weeks and then be set in at a higher temperature environment and water of about 78 degrees Fahrenheit.

For the HPLC analysis, the first trial was run with a LC- 18 column with a 10 minute retention time and a 4 minute post-time at 27 degrees celsius. The UV wavelength was 282 and the pressure was 400 bars.

Results

The higher concentration of folic acid allowed for more eggs to be produced and their behavior was also impacted. They were more alert than the fish in the lower concentrations. We know that the reason for their altered behavior and reproduction was due to the folic acid because the HPLC confirmed that the folic acid was being up-taken.

Conclusions/Discussion

The zebrafish experienced a change in behavior and fertility during and after the treatment. The fish in the higher concentration of 100 ppm were more alert as compared to the ones in the control group as well as in the tanks that were given lower concentrations. Since we computed a p-value of 0.000247, the small value indicates that we can reject our null hypothesis and we can safely assume that the alternative hypothesis can be held as true. The folic acid improved the alert behavior of the fish and also allowed for

Summary Statement

We studied the effects that folic acid would have on the reproduction ofzebrafish and how it would potentially affect the behavior of their offspring.

Help Received

Dr. Nikki Malhotra as a guide and lab provider

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Mirna H. El-khalily

Project Number
S2202

Project Title
Abscisic Acid Effects on Cell Proliferation

Abstract

Objectives/Goals
In accordance with the research I have gathered, Abscisic Acid, a plant hormone, has been shown to inhibit seed germination, or uncontrolled cell growth in plants. The objective of this experiment was to see if different concentrations of Abscisic Acid would inhibit uncontrolled cell growth in earthworms. My hypothesis was: If different concentrations of 1, 10 and 100 micromolar Abscisic Acid solutions are applied to 15 millimeter cuts on Lumbricus terrestris epidermis, then the 100 micromolar Abscisic Acid solution will have the greatest degree of proliferation inhibition, or largest cut length after a total of 4 days.

Methods/Materials
Measure out 0.004 grams of Abscisic Acid and dilute in 151.3 milliliters of distilled water to create a 100 micromolar solution. Increase the volume by 10-fold to obtain a 10 micromolar solution and by 100-fold obtain a 1 micromolar solution. Using a ruler, Dino Light microscope camera, and surgical scalpel, cut the earthworm about 15 millimeters (20 millimeters away from the anus). Using an eyedropper, place five drops of solution on the cut. Measure the cut length after 2 and 4 days.

Results
The 100 micromolar solution was shown to have the greatest average cut length of 11.8 millimeters after a total of four days, followed by the 10 micromolar solution, with an average cut length of 9.5 millimeters. The 1 micromolar solution had an average length of 8.2 millimeters and the control had the smallest average cut length of 6.0 millimeters after four days.

Conclusions/Discussion
In conclusion, my hypothesis was supported. The 100 micromolar solution had the greatest cut length, or degree of inhibition of epidermal cell proliferation in earthworms. With further research, I hope that we can apply Abscisic Acid as a potential solution to tumor formation.

Summary Statement
My project applies Abscisic Acid, a plant hormone, that has been shown to inhibit seed germination, or uncontrolled cell growth, to epidermal cuts in earthworms in hopes of utilizing this hormone as a potential solution to tumor formation.

Help Received
Mrs. De La Cruz provided supervision and guidance; Mother bought supplies and helped with display board

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alexandra R. Garcia

Project Number
S2203

Project Title
The Neural Limitations of Small Invertebrates

Abstract

Objectives/Goals
According to scientific research, the only animals capable of feeling pain are those that can feel fear, anxiety, distress and terror, similar to what humans feel when we receive noxious stimuli. Contrary to popular belief, new research implies that it is possible that certain invertebrates can feel anxiety. The purpose of this experiment was to observe species of invertebrates and place them under extensive stimuli to see if they exhibit anxious behavior.

Methods/Materials
Brine shrimp was selected for this experiment, an invertebrate that it normally attracted to light. Electrical shocks were used as the stress-inducing stimuli for the purpose of creating an anxious environment. The brine shrimp were first placed in a container that was half dark and half light, and their natural behavior in the container was observed. The shrimp were then moved into a separate container where they received mild electrical shocks. After, they were placed back into the half dark container where they were observed to see if there was a difference in their behavior.

Results
Naturally, brine shrimp are more attracted to lighter areas than darker areas. This was observed when the brine shrimp were placed in the container that was half dark and half light. After the brine shrimp were exposed to stress-inducing stimuli in the form of electrical shocks, their behavior in the half dark container changed slightly. On average, more brine shrimp preferred the darker side of the container after experiencing the electrical shocks than before they were exposed to them.

Conclusions/Discussion
Through experimentation, it was discovered that after exposure to the stress-inducing stimuli, more brine shrimp preferred to stay in the section that was dark. This suggests that brine shrimp, which were originally believed to have too simple a neural system to express anxiety, may in fact possess the ability to exhibit the common signs of anxiety or depression. If further research is conducted in this area and the results are similar, the implications may call for a restructuring of the way in which invertebrates are regarded.

Summary Statement
Small invertebrates may posses the ability to exhibit anxiety and depression, which implies the ability to feel pain.

Help Received
Parents assisted in gathering and aquiring materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Megan S. Handley

Project Number
S2204

Project Title
Apoptosis in Drosophila Germline Stem Cells

Abstract

Objectives/Goals
Apoptosis carries out the task of eliminating damaged cells through programmed cell death, and is therefore crucial in maintaining the health of the body. Here, we explore the limits of the germline stem cells (GSCs) of drosophila (fruit flies) through both an application of stress (starvation), and heat shocking. The main goals of my experiment are:
- To study Drosophila
- To experiment with new methods of inducing apoptosis
- To find out if p53 is expressed in germline stem cells (GSCs) upon starvation stress
- Discover the minimum time needed for the occurrence of apoptosis upon heat shocking {i.e., for the Reaper (rpr) gene}

Methods/Materials
To induce apoptosis by starvation, flies are starved for a few days, and then analyzed under the microscope. And, in inducing apoptosis through heat shocking, we monitor the time it takes for the drosophila to display multiple morphological hallmarks of apoptosis after the introduction of a heat shock promoter. This indicates the minimum heat shocking time necessary to induce apoptosis in drosophila.

Results
From our research, we conclude that starvation is not a strong stimulus; although it is effective and an increase in starvation time causes an increase in p53 expression. Also, we found that 5 minutes is sufficient in beginning to induce apoptosis within the Drosophila ovaries.

Conclusions/Discussion
In other research, it has been found that radiation stress is a strong stimulus in activating the p53 protein (Wylie et al., 2014). From our research, we conclude that starvation is not as strong a stimulus; although it is effective and an increase in starvation time causes an increase in p53 expression. Also in other studies, 90 minutes of heat shock rpr promoting has proven to indicate apoptosis (Abdelwahid et al., 2007), whereas we have found that 5 minutes is sufficient in beginning to induce apoptosis within the Drosophila ovaries.

Summary Statement
Apoptosis carries out the task of eliminating damaged cells through programmed cell death. Here, we explore the limits of the germline stem cells of drosophila (fruit flies) through the application of stress/starvation and heat shocking.

Help Received
I was a participant in the Research Mentorship Program at UC Santa Barbara (summer 2014).

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Dustin A. Hartuv

Project Number

S2205

Project Title

Correlation between Habitat Quality, Abundance, and Diversity of California Birds

Abstract

Objectives/Goals

The goal of the experiment was to identify whether species (of birds specifically) thrive more efficiently in higher habitat qualities. This was conducted because of inconsistent data conclusions in previous studies on habitat quality.

Methods/Materials

Materials for the study include a copy of Peterson Field Guide to Birds of Western North America, Fourth Edition, and one pair of Bushnell 7x35 binoculars. In an eight week period between November 30, 2014 and January 25, 2015, I observed ten species of common birds native to the Coastal sage scrub habitat in three different qualities of habitat: highly degraded, restoration in progress, and existing native, all found along the Palos Verdes Peninsula. Each habitat was observed once per week, for twenty minutes each.

Results

After the eight weeks, I averaged the amount of birds counted and found that with the exception of the house finch and the spotted towhee, all of the species of birds had the highest numbers in the restoration in progress habitat.

Conclusions/Discussion

These results most likely stem from the fact that types of feeding does not stay constant within different species of birds. As such, birds feeding on insects in open areas may thrive more efficiently in a restoration in progress habitat rather than a bird feeding on seeds. This information can be used to both quickly and efficiently raise the numbers of endangered species by correctly identifying whether one species thrives better in a specific habitat.

Summary Statement

The focus of the project was to identify whether ten common species of birds native to the Coastal sage scrub habitat are more likely to thrive in a highly degraded, restoration in progress, or existing native habitat.

Help Received

Father helped take pictures of the birds; conservancy worker helped find locations for the habitats.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Ian V. Hughes

Project Number

S2206

Project Title

Half a Billion Year Old Bed Bugs? The Biology and Ecology of Two Extinct Genera

Abstract

Objectives/Goals

The globally distributed Ediacara biota is comprised of the oldest macroscopic organisms on Earth. They lived on shallow sandy sea bottoms between 575 and 543 million years ago. Most of the taxa are enigmatic and difficult to classify with living animals. Scientists have suggested these organisms to be fungi, arthropods, echinoderms, extinct phyla and other organisms. This research project examines the extinct genera bilaterally symmetrical Spriggina and Parvancorina to constrain their biology and ecology through the testing of three hypotheses: 1) that these organisms grew allometrically like modern bilaterian organisms and the genus Spriggina added segments like modern segmented organisms; 2) that these organisms has size frequencys similar to those of modern continuously reproducing marine invertebrates; and, 3) that these soft bodied organisms were made of different materials and thus exhibit different types of deformations.

Methods/Materials

To test these hypotheses, length, width, frequency and aspects of deformation of each specimen of the two genera were measured from rubber latexes that were made in the field.

Results

Data show that the genus Parvancorina exhibits an exponential or allometric growth like all other marine invertebrates. The genus Spriggina however, showed a linear growth line indicating isometric growth. This is not found in marine invertebrate bilaterians and is a very uncommon method of growth. Both taxa have right skewed size frequency distributions consistent with continuous reproduction. Segment insertion in Spriggina is surprisingly, not governed by size. Finally, Parvancorina was more commonly deformed than Spriggina.

Conclusions/Discussion

These data demonstrate that although Spriggina is bilaterally symmetrical, it does not exhibit bilaterian growth strategies. In contrast, Parvancorina was likely biologically more similar to modern bilaterians than Spriggina. Examination of deformation properties indicate that the two genera were likely made of different material, though neither were biomineralized.

Summary Statement

This project examines two enigmatic 550 may extinct genera in order to test their possible affinities with modern bilaterians

Help Received

This project was conducted with the help of both the University of California Riverside Geology Department.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Isha Mehrotra; Rohan Mehrotra

Project Number

S2207

Project Title

Effect of Natural Compounds Curcumin and Nicotinamide on a-Synuclein Accumulation in a C. elegans Model of Parkinson's

Abstract

Objectives/Goals

The goal of our project was to test if nicotinamide and curcumin, two natural compounds, are viable treatments for Parkinson's disease. We assessed the effects of nicotinamide and curcumin on the amount of a-synuclein in C. elegans after treatment, then compared these results to the effects of Levodopa, a commercial Parkinson's drug.

Methods/Materials

We used C. elegans, a nematode, as the model organism. Specifically, strain NL5901, which expresses human a-synuclein protein fused to yellow fluorescent protein, was used. (The a-synuclein protein is responsible for the death of dopamine-producing neurons in Parkinson's disease.) Our study examined the effect of curcumin and nicotinamide on the fluorescence intensity of a-synuclein in C. elegans, and compared them to the effect of levodopa (the commercial drug). We used two methods to measure fluorescence of the protein. In Trial 1, the worms were imaged after treatment under a fluorescence microscope, and the fluorescence in the images was quantified using ImageJ software. In Trial 2, fluorescence of the worms was directly measured after treatment using a microplate reader machine.

Results

Our study showed that curcumin and nicotinamide reduce the fluorescence intensity of a-synuclein as effectively as levodopa. Control, curcumin, and levodopa NL5901 worms were measured for their a-synuclein protein accumulation. In Trial 1, after 96 hours, nicotinamide reduced fluorescence by 64.2%, curcumin reduced fluorescence by 55.5%.and levodopa reduced fluorescence by 47.6%. The most effective compound was nicotinamide, then curcumin, then levodopa. However, all compounds were competitive in reducing a-synuclein. In Trial 2, after 96 hours, nicotinamide reduced fluorescence by 43.6%, curcumin reduced fluorescence by 49.8% and levodopa reduced fluorescence by 65.7%. The most effective compound was levodopa, then curcumin, then nicotinamide. However, all compounds were again competitive.

Conclusions/Discussion

This means that curcumin and nicotinamide are viable treatments for Parkinson's disease, which achieved the goal of the project. This also implies that Parkinson's patients should eat foods high in curcumin and nicotinamide, and that drugs should take advantage of the benefits of these compounds. These findings encourage further investigations on nicotinamide, curcumin, and other natural compounds as possible therapies against Parkinson's disease.

Summary Statement

This project showed that curcumin and nicotinamide, two naturally derived compounds, are effective targets for treatment of Parkinson's disease.

Help Received

Used fluorescence microscope and microplate reader from Biocurious, an amateur community lab

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Cheyenne E. Newallis

Project Number

S2208

Project Title

An Examination on the Factors that Contribute to Egg-laying of Pacific Swell Shark (Cephaloscyllium ventriosum)

Abstract

Objectives/Goals

Information on factors affecting their breeding season in both captivity and the wild are not well known in the literature. Being informed about breeding seasons of sharks is important to conservation efforts, allowing appropriate protections to be put in place. This study investigates what factors contribute to the egg-laying behavior of C. ventriosum, with the goal of further understanding their breeding season while in captivity. The hypothesis of this project is that longer photoperiods will trigger an increase in the frequency of egg-laying.

Methods/Materials

Eggs were collected, tagged, and recorded weekly for a period of one year.

Results

There was no statistical significance between the number of fertile eggs laid and day length.

Conclusions/Discussion

There are several possible explanations for a lack in correlation. Day length stimulates the maturation of the C. ventriosum reproductive organ (Wiebe,1968). However, it is possible that the community holding tank is not receiving the full effect of day length exposure. The aquarists close the tank lids at a consistent time everyday, so the sharks may never experience a true #breeding season#. There is also a built in awning that reduces sunlight. It is equally possible that the sharks do not experience a cue to stop laying eggs. Since the sharks are kept in fairly constant ideal conditions in captivity, they may not be experiencing any cues that mark the change in seasons. Future research could explore effects of day length and could examine the shark male to female ratio, or examine individuals to infer their ages and to see which sharks are laying eggs. Continuing research on this topic is important because many sharks are critically endangered. Finding out what causes them to lay eggs can promote healthy husbandry practices and knowledge of how to protect this crucial species. Promoting shark conservation is a necessary part of keeping the ocean ecosystems healthy.

Summary Statement

This research was to attempt to find a cue to the mating season of the Pacific Swell shark (Cephaloscyllium ventriosum).

Help Received

Researched at Cabrillo Marine Aquarium

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Samantha N. Noor

Project Number
S2209

Project Title
Analysis of Maturation of Rana pipiens in Correlated Radiated Environments

Abstract

Objectives/Goals
The primary objective in this experiment was to observe the effects of radiation on the growth of a developing organism. Tadpoles of Rana Pipiens were studied and observations in development and behavior were noted for a standard period of ten weeks. The null hypothesis would be that radiation does not induce any significant growth within tadpole growth. The alternative hypothesis would be that the tadpoles developing in the radiated water will show stunted growth to that of the regulated water, proving that everyday radiation exposure is detrimental to the health and growth of organisms.

Methods/Materials
I created three separate tank environments to develop 6 tadpoles over a standard duration of 10 weeks. Initially the tadpoles were randomly allocated in a container. I then exposed one tank to 4 minutes of radiation exposure, one tank to 8 minutes and one tank with no radiation exposure. Radiation was induced through a convectional microwave oven. By a thermometer, I waited until the water was at room temperature of 20 C. The tadpoles then by groupings of 2 were assigned to each separate tank. Water would be dechlorinated, desalinized and exchanged on a weekly basis, length would also be recorded with a cm scale, and any observations in activity noted.

Results
When analyzing trends from the data, tadpoles with no exposure to radiation developed faster than those that were exposed. All tadpoles initially began at 2.3 and 2.4 cm, yet in the end, the largest tadpole grew to 5.4 cm, and the smallest to only 4.2 cm, proving a disparity of 1.2 cm length. When analyzing percentage growths, the largest tadpole showed a 125% growth increase, with the smallest only showing a 75% increase. The exposure to radiation also increased stimulation within tadpole activity and induced peculiar feeding and behavioral patterns.

Conclusions/Discussion
Through the course of this experiment, it was evident that radiation did have a significant effect on the growth and development of Rana Pipiens. In this experiment, the control group tadpoles that grew in the regular water grew at a justly faster rate than those developing in the radiated water. As for both experimental groups, the group with 4 minutes of radiation exposure grew slightly faster than the group with 8 minutes of radiation exposure. Even as their grow rates were not dramatic, it was notable that radiation did have an overall effect on the tadpole's development.

Summary Statement
This project intends to analyze and overlook the growth and development of Rana Pipiens in relation to varied sets of radiated water in order to better understand the long term effects of radiation exposure on a developing organism.

Help Received
I would like to thank my family, my science teacher, and as well as Research Scientist Dr. Nazmul H. Khan of Roswell Cancer Institute for their efforts and contributions towards this project.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Yunsu Park; Steven Zhou

Project Number

S2210

Project Title

Exploring the Learning Behavior of Pogonomyrmex barbatus Ants in the Absence of Pheromonal Cues

Abstract

Objectives/Goals

Our objective was to find if pogonomyrmex barbatus ants are able to remember their surroundings by going through several trials without the help of pheromonal cues

Methods/Materials

There will be 20 pogonomyrmex barbatus ants, each separated in 2 groups (group A, group B). Group A will be in a choice chamber that contains two choices (sides) and a center, each individually separated by a wall. The North side of the choice chamber contains 0.5 ml of honey, while the South side has nothing. after the honey is inserted the ants will be put at the center and then the walls will be removed from the chamber, allowing the ants to choose a side. when the ants finish deciding (the North side of the chamber is the right choice since the ants will want to acquire food due to hunger), the data will be recorded where each ants were (North or South), and the ants will be removed to a separate container for us to clean out the pheromonal cues with a watered paper towel(the honey will be always at the North side). This will be done 5 trials for 5 days (these trials will be the learning process for the ants). Group B will be kept in a 5 degree C container with food (apple)(group B is not able to learn), while group A under goes these trials for 5 days. On the 6th day group A and B will go though 5 trials.

Results

The raw numbers show that for the trained group of ants (group A), more ants chose the side with the foods during the experimental runs, whereas the untrained ants (group B) were evenly dispersed. We examined this data using chi square analyses. In all but one trial for the trained ants, the chi square test proved to be significant. Every trial for the untrained ants had an insignificant chi square value. We also performed a T-test for the two populations. The calculations proved the t test value was also significant.

Conclusions/Discussion

the results from the experiment supported our hypothesis that ants can comprehend and retain information about their environment and make appropriate future decisions without pheromonal cues. Both the chi square and the t test analyses showed that their behavior in consistently choosing the chamber with honey was not likely due to chance. From this, we inferred that the ants were able to process and commit characteristics of the environment to memory after previous exposure.

Summary Statement

The capacity of a group of pogonomyrmex barbatus ants to learn its environment without pheromonal cues

Help Received

Jane Zhou helped us understand the use of a T-test

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Lauren M. Polyakov

Project Number

S2211

Project Title

A Worm's Life:The Social Network: A Study of the Effects of Social Interaction on Regeneration of Lumbriculus variegatus

Abstract

Objectives/Goals

The objective was to determine whether the presence of one Lumbriculus variegatus affect the regeneration abilities of another Lumbriculus variegatus.

Methods/Materials

Segmented worms, Lumbriculus variegatus, were used. 4 plastic containers, each labeled A through D, were filled with natural spring water. Each contained had 15 individual small compartments. Plastic pipettes were used to extract worms for measuring with a ruler. A scalpel was used to cut worms. A magnifying glass X4 was used for observation and a camera used for photographing. a ruler with white paper was used to measure growth.

Results

The worms kept in isolation demonstrated regeneration rate of 36.23%, which the three groups of worms engaged in social interactions regenerated at the rates of 45.25%, 45.69%, and 33.48%, respectively for groups C1, D1, and D2. Group B regeneration rate was lower than that of Groups C1 and D1, and was higher than D2. Results pointed to difference in regeneration rates perhaps by factors other than social interaction. All of the worms, regardless of the environment and social interaction, survived over the course of the experiment. Last year's experiment, with no social interaction, had a survival rate of around 50%.

Conclusions/Discussion

It appeared that "social interaction" or presence of another worm had no effect on the regeneration rates of the worms. The isolation group (Group B) demonstrated a regeneration rate lower than that of Groups C1 and D1, it was higher than that of D2. So, if social interaction affected regeneration, one would expect D1 and D2 to have similar rates, since they were kept together. Further, compared to last year's experiment, it was noticed the survival rate of worms was significantly higher, 100% compared to just 50% last year. This may be due, in part, to social interaction or to larger physical size of the containers used in the experiment.

Summary Statement

Whether the presence of one Lumbriculus variegatus affects the regenerative abilities of another Lumbriculus variegatus.

Help Received

Father helped buy supplies and set up camera.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Cameron S. Robertson

Project Number

S2212

Project Title

A Crab for All Seasons: Examining What Affects Distribution and Abundance of Emerita analoga in the Monterey Swash Zone

Abstract

Objectives/Goals

The objective of this project was to determine what factors affect Pacific mole crab (Emerita Analoga) location and distribution within the swash zone throughout the year.

Methods/Materials

The Pacific mole crab populations at Asilomar Beach in Pacific Grove, CA were surveyed along five transects of a 12 meter stretch of beach. The swash zone length was determined through observation and measurement with a tape measure upon arrival at the beach. Based upon swash zone length, the midpoints for the upper, middle, and lower swash zones were calculated. Cores (6-inch diameter) were taken to a 10 cm depth at each of these midpoints along each of the five transects. The sand sample was then filtered through a sieve that separated adults (>9mm), recruits (3-9mm), and juveniles (<3mm). Crab size was determined by measuring the carapace with calipers. Gender was determined for all adults by careful examination under the telson. Data was collected at both high and low tides over several days of each of the seasons (June 2014 to April 2015).

Results

Of the 994 mole crabs sampled and measured, 73% were recruits, 12% were males, 11% were females, and 4% were females with eggs (FE). The majority of the males, females, and FE were found during high tides while most recruits were found during low tides. Except for FE crabs, all other crabs were present in all seasons. Recruits were most abundant during the summer and spring. Males and females were most abundant in fall and winter. Females with eggs were predominantly found in spring. Location within the swash zone for each group of crabs varied with the season. The majority of females were found in the lower and middle swash zones in spring and summer, but shifted to the upper swash zone in fall and winter. More males were found in the lower swash zone in summer and fall, but then spread evenly to all areas in winter and spring. More recruits were found in the lower swash zone in the spring, while the rest of the year most were found in the upper and middle swash zone.

Conclusions/Discussion

The results supported my hypothesis. Season and tidal height play large roles in the location of Emerita Analoga in the Monterey swash zone. Additionally, while size and gender do not appear to be factors in the location within the swash zone, they are related to the abundance of Emerita Analoga throughout the year due to the normal life cycle of these invertebrates.

Summary Statement

This project is about the annual movements of Emerita Analoga and factors that affect their migration within the swash zone throughout the year.

Help Received

Emily Gottlieb, LiMPETS coordinator for Monterey Bay and Santa Cruz areas, answered questions and provided historical data. My family helped with data recording at the beach. Staci Bynum (environmental science teacher) loaned me equipment for data collection.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Caleb Smith

Project Number

S2213

Project Title

Creation of a Drosophila melanogaster Strain Capable of Discovering Lifespan-Extending Genes in the Hsp22 Pathway

Abstract

Objectives/Goals

The objective is to genetically engineer a line of flies that are capable of highlighting the genes responsible for extending lifespan in the Drosophila melanogaster#s #Hsp22# genetic pathway. This line of flies can help scientists not only learn about the Hsp22 pathway, but also help scientists learn about the mechanisms of aging in the Drosophila.

Methods/Materials

This experiment utilizes crosses of varying Drosophila lines in order to create a final strain of flies with the capability to fluoresce brightly when a gene that is part of the Hsp22 pathway has been over-expressed. Each subsequent cross adds the genetic #building blocks# that are needed to create the final strain.

Results

A line of flies was bred that have a mechanism that randomly over-expresses genes in the fly, and if those over-expressed genes are part of the Hsp22 pathway, the fly will fluoresce brightly under fluorescent light.

Conclusions/Discussion

Because the Hsp22 is thought to play a key role in the lifespan of the Drosophila, it is imperative that scientists discover the actual genes that make up this pathway. These flies are an invaluable tool that scientists can use to shed more light on the questions, # Why and how do Drosophila age?# and #How can lifespan be increased in the Drosophila.# More importantly, the flies open the door for scientists to discover even more about how humans age, as well as how human lifespan can be increased.

Summary Statement

A line of flies was created that makes it easy for scientists to discover genes that make up the lifespan-extending Hsp22 pathway in the fruit fly.

Help Received

Mentor from USC taught me techniques

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Grace E. Thompson

Project Number
S2214

Project Title
Goldfish Pattern Learning

Abstract

Objectives/Goals
The objective of this project was to determine if, in a period of thirty days, goldfish will learn a pattern they must swim through to get food. The hypothesis was that, in a period of thirty days, goldfish will learn a pattern they must swim through to get food.

Methods/Materials
A maze was constructed from several pieces of plexiglass and submerged in water in a fish tank. Forty five goldfish were then tested over a thirty day period to determine if they would learn the pattern of this maze when motivated by food. On day one of testing goldfish were individually placed into the start of the maze at the same time that food was placed in the end of the maze. The time it took for the fish to complete the maze and the number of wrong turns they made were recorded as data. On days two through twenty nine the fish were individually guided through the maze with a plexiglass paddle; food was placed in the end of the maze as they started it on days two through ten, but not placed in the end of the maze until the fish had reached it on days eleven through twenty nine. On day thirty the procedure from day one was repeated with each fish; however, the food was not placed in the end of the maze until the fish reached it. The time it took for the fish to complete the maze and the number of wrong turns they made were again recorded as data. The data from day thirty was compared with that from day one to determine if the goldfish had learned the pattern of the maze.

Results
Results show that, in a period of thirty days, goldfish will not learn a pattern they must swim through to get food. A few fish did show improvement in one or both categories of observation; however, most did not. In addition, while the average time it took for a goldfish to complete the maze did decrease by a slight margin, the average number of wrong turns made by a goldfish increased by 60%, demonstrating that the goldfish had not learned the pattern of the maze.

Conclusions/Discussion
In a period of thirty days goldfish will not learn a pattern they must swim through to get food. Some individuals showed improvement in both categories of observation indicating that perhaps given a longer test period they would have in fact learned the pattern of the maze; however, these fish are the minority of the sample tested, and in the given thirty day test period no goldfish successfully learned the pattern of the maze they needed to swim through to get food.

Summary Statement
This project is about the ability of goldfish to learn and recall patterns.

Help Received
Employee at Lowe's hardware cut plexiglass into the pieces used to construct the maze.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Winnie C. Wang

Project Number
S2215

Project Title
Identification of Fly Groups through Microsatellite Frequency Analysis

Abstract

Objectives/Goals
Microsatellites are two to six base pair length sequences repeated up to hundreds of times within a genome. This project analyzes twelve different fly genomes to find a relationship between fly groups and their microsatellite distribution. The objective of the project is to create a Java program that counts the number of microsatellites and to use computational analysis to observe a pattern between the microsatellite distribution and the fly group.

Methods/Materials
Twelve fly genomes were obtained from the NCBI Flybase Database, and they were subsequently read into a Java program that counted the number of microsatellites and ranked each microsatellite by its prevalence in the genome. The output was then exported to Excel, where the results were graphed. The k-values were then compared among the fly groups for different microsatellite base lengths.

Results
The results reflected a negative exponential correlation between the microsatellite frequency and the fly group. The logarithmic frequency vs. rank was plotted, the k-value comparison indicated that microsatellite of length two was most accurate for group identification. The k-values of the melanogaster group ranged from -0.0798 to -0.0648, and the k-values of the obscura group ranged from -0.0431 to -0.0363.

Conclusions/Discussion
Because the k-values for fly species belonged to a certain range for each group, it is therefore possible to identify the group of an unknown fly with length two microsatellites. It can also be noted that microsatellites of length two are most frequent, and it may be possible that the microsatellite length for identification is species dependent. This test can be expanded to more advanced species, and if the correlation between microsatellite length and the group of species continues, then microsatellites can be a useful tool in species identification.

Summary Statement
This project demonstrated that microsatellite frequency of length two microsatellites can be used as a potential tool for identification of fly groups.

Help Received
Mrs. Nga Ngo was my advisor in this project, Mr. Joe Coglianese gave advice on Java data input, and Dr. James Li gave suggestions for methods of data analysis.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Brian S. Xia

Project Number

S2216

Project Title

Transgenerational Inheritance of Nutritional Programming of Longevity & Fecundity after Postnatal Dietary Manipulations

Abstract

Objectives/Goals

Unhealthy diets are one of the leading causes of non-communicable diseases (NCDs) which lead to 16 million premature deaths per year; maternal and childhood malnutrition alone is responsible for 11% of global disease burden and 35% of child death under the age of five. Optimizing early-life nutritional environment thus has the essential potential to combat the burden of NCDs and extend the human health and eventually longevity. This project seeks to examine whether appropriate postnatal dietary manipulations would influence (program) longevity and fecundity, and whether such nutritional programming of longevity and fecundity would be long-lasting and inheritable across generations through transgenerational inheritance.

Methods/Materials

In the parent generation (F0), virgin male and female flies were collected within 4 hours of eclosion, and placed on 3 different experimental diets with different protein/carbohydrate contents (i.e., LP, IP and HP or low-protein, intermediate-protein and high-protein diet) or a routinely used (or control) diet for 7 days as postnatal dietary manipulations. Then all the F0 flies and their F1, F2 and F3 offspring were maintained on the control diet all the time for lifespan and fecundity analyses.

Results

As compared with the control diet, postnatal treatments with both LP and HP diets shortened longevity significantly, while IP dietary ma-nipulation extended longevity significantly in the F0 and up to the F3 generation. In addition, LP reduced while IP diet increased fecundity across F0, F1 and F2 generations. The HP diet increased fecundity in all three generations, but the effect was barely significant in the F2 offspring (P=0.055).

Conclusions/Discussion

These observations demonstrate that (1) postnatal dietary manipulations may induce nutritional programming of longevity and fecundity in the F0 generation; and (2) such nutritional programming may be transmitted to the F1 generation through parental effects, and further transmitted to the F2 and even F3 generation through transgenerational inheritance. As stated in a recent review discussing transgenerational epigenetic inheritance, "the quality of the life of our grandchildren depends on our current actions and exposures." My observations therefore support the feasibility to improve reproduction, combat NCDs, and extend the human health and eventually longevity through optimizing the early-life nutritional environment.

Summary Statement

I employed several postnatal dietary manipulations to examine the transgenerational inheritance of nutritional programming on longevity and fecundity in Drosophila.

Help Received

My parents provided the ingredients to make the LP, IP and HP diets at home; Dart Neuroscience LLC provided the control diet and lab equipment for me to perform my experiments under the supervision of my adviser Dr. de Belle.