Abstracts for the 27th Annual Loudoun County Regional Science and Engineering Fair

March 13, 2008
Dominion High School

Sponsored by Orbital Sciences Corporation
RSEF Categories

100 Animal Sciences  
200 Behavioral & Social Sciences  
300 Biochemistry  
400 Cellular & Molecular Biology  
500 Chemistry  
600 Computer Science  
700 Earth & Planetary Science  
800 Engineering: Materials & Bioengineering  
900 Engineering: Electrical & Mechanical  
1000 Energy & Transportation  
1100 Environmental Management  
1200 Environmental Sciences  
1300 Mathematical Sciences  
1400 Medicine & Health Sciences  
1500 Microbiology  
1600 Physics & Astronomy  
1700 Plant Sciences

For detailed category descriptions visit the ISEF website at:  

Project Numbering
For exhibition, all projects are given a number. The first series of numbers indicates the category & project number. The letter represents the school. The last numbers indicate the student’s grade. For example project 1103V10 is the third project in Environmental Management, the student attends Park View High School and is in 10th grade.

School codes:

W- Briar Woods  
B-Broad Run  
D-Dominion  
F- Freedom  
H-Heritage  
C-Loudoun County  
L-Loudoun Valley  
V-Park View  
P-Potomac Falls  
S-Stone Bridge  
I-Harmony Intermediate
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Phylogeographical Analysis of Cricket Mating Calls
Devin J. Bowers and Aliya L. Jamil
Academy of Science, Sterling, Virginia

Male crickets use various songs for various mating rituals, such as courting. To see if location has an effect on mating songs, we first collected 4-6 field crickets from five different locations in the Northern Virginia/Washington D.C. area. Only three of these locations were tested. We then recorded 42 calling songs and 49 courting songs (approximately 5 calling songs and 5 courting songs from each cricket.) We will be analyzing various characteristics of the songs, such as the interval between trills and the rate of chirps. Results from each location will be compared to results collected from the two other locations we tested from. We believe that these crickets are all Gryllus pennsylvanicus. In order to verify this, we will run DNA electrophoresis on the crickets we recorded. This will also be performed in order to see if any difference in the mating songs was caused by behavioral differences or genetic differences. If the crickets have different songs and are of different species, then this supports the theory of behavioral evolution. We will compare our results with similar research being conducted with crickets in Singapore and Malaysia.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
4. This project is a continuation of previous research. □ Yes □ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

I/we hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research.
I/we also attest that the above properly reflects my/our own work.

[Signature] 2/20/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Ants Behavior to Cinnamon
Amna Ehsan
Potomac Falls High School, Loudoun County
Sterling, VA

The purpose of this experiment was to keep ants out of the house. People have been wondering if cinnamon repels ants and if it is a way to keep ants away. The ants were put in an aquarium, which was 61cm wide and 25.4cm high. Then one of the three cinnamonans were put next to the ants. The ants were timed for 20 minutes and then measured for how far the ants went. The experiment was repeated 20 times with each cinnamon. The data that was collected from the experiment was that the Cassia Cinnamon is the best one to use to keep ants away. The mean for the Cassia Cinnamon distance was 27.865 centimeters. The mean for the Ceylon Cinnamon was 15.67 centimeters. The mean for the Indonesian Cinnamon was 10.645 centimeters. The conclusion was that cinnamon does repel ants. It will keep ants away from people's houses. Just put Cassia Cinnamon by the ants or by the door and ants will not come. Cassia Cinnamon is the regular cinnamon that is labeled cinnamon at the store.

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Potentially hazardous biological agents:
☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☐ Yes ☐ No

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4. This project is a continuation of previous research. ☐ Yes ☐ No

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Amna Ehsan 2/1/08
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The Adaptive Significance of Thanatosis in Nasonia
Nyssa-Marie Finegan
Dominion High School, Sterling, Virginia

Thanatosis in animals is a state of tonic immobility that can last from a few seconds to a few hours. It is used both as an anti-predator response and as a response to physical stimuli.

The purpose of this research was to determine ways that thanatosis can be induced in Nasonia vitripennis, a wasp. To determine thanatosis in Nasonia, a known method to induce this condition, touching the antennae, was used. The possible causes of thanatosis tested were exposure to a predator, a spider, and a sudden change in temperature. To test the response to spiders, the wasps were contained individually in test tubes that were placed in a bowl containing a wolf spider. For temperature change, the test tubes containing wasps were placed in ice water. The wasps were observed for thanatosis.

The null hypothesis stating that neither sudden temperature change nor the sight of spiders would induce thanatosis was partially accepted. While the wasps did not engage in thanatosis from the sight of spiders, there were occurrences of thanatosis from the change in temperature. These results indicate that thanatosis in Nasonia is used more as a response to physical stimuli than an anti-predator response. This may be due to the tendency of different parts of the wasps’ bodies to adjust to the temperature change at different rates. The antennae and legs may experience a threshold temperature at which thanatosis is induced. Further research would entail examining thanatosis in other species to determine the role it plays in survival.

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Potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

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Nyssa-Marie Finegan 2/15/08
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The Effect of Magnetism on the Number of Times a Fish Swims Around Its Bowl
Tara D. Haney
Stone Bridge High School, Ashburn, VA

Fish have been known to migrate in straight lines. Scientists believe the fish follow the Earth’s magnetic fields. This experiment tested to see if home aquarium fish are affected by magnetic fields.

The independent variable is the number of magnets and the dependent variable is the number of times the fish swim past the magnet. In the experiment, there were two fish bowls with one Comet Goldfish (Carassius auratus) in each. In the first time interval, one magnet was placed in the experimental group bowl and a black plastic strip was placed in the other (control). In the second time interval, another magnet or black plastic strip was placed in the bowl, and so on. The data collected was the number of times the fish swam past the magnet or black plastic strip in a ten minute period.

The results of the experiment showed that there was no correlation between the number of magnets and number of times the fish swim around the magnet. Most importantly, after the 7th trial, the magnet fish died. The data rejected the hypothesis, though, because there was a decrease in number of times the fish swam past the magnet or strip as the magnet number increased.

This data might differ because of energy levels of different fish. This experiment could be furthered by using many different fish or different species of fish.

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Potentially hazardous biological agents:

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Tara Haney 2/21/08
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Abstract Food Preferences and Communication of the Pavement and Red Carpenter Ant

Myles A. Hanger
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The food preferences and communication skills of Red Carpenter Ants and Pavement Ants were studied in this experiment by giving each species an inescapable environment with one food source for them to find. These were a starch, a sweet, and a control. This was to figure out what foods the ants preferred and, also, to make observations behaviors in communication. The Red Carpenter Ants should have preferred the sweet food sources (including the control) while the Pavement Ants should have preferred the starch one. While the food sources were switched out during each trial, the recorded data included the time it took for the ants to locate each food source, and the number of ants found on each one at the end of each trial. During each trial, the ants were to follow a path made of sugar water to one of the three food sources. Due to an issue while in long-term storage, the numbers of Pavement Ants dwindled. Also, the red ants appeared to stick to shadows in the bin and avoid light by any means necessary. Despite this, it appeared as if the red ants preferred the starch food source. Although, it was not possible to come to any conclusions with the Pavement Ants, as their numbers were too small to record the same data as the red ants. Neither of the species of ants seemed to use much contact communication and they were often following each other, flocking to certain areas in the testing bin.

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Potential hazardous biological agents:  □ microorganisms  □ rDNA  □ tissue  

2. Student independently performed all procedures as outlined in this abstract.  □ Yes  □ No

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Effectiveness of Inorganic and Organic Insecticides
Garrett M. Hansen
Potomac Falls High School, Potomac Falls, Virginia

The purpose of the experiment is to determine the effectiveness of organic and inorganic insecticides and discover the overall better buy of insecticides on the market. The problem the experiment will try to discover is how does an organic insecticide compare with the more harmful inorganic insecticides on the market? The first step in the experiment was to purchase crickets and place them into a small aquarium. In the aquarium a small water dish and small piece of egg carton should be left in with the crickets. Sixty crickets were taken out of the aquarium and placed into three separate containers, each containing twenty crickets. Each of the insecticides were sprayed into one of containers and then determines how much time was needed for the crickets to be terminated using a stopwatch. Each container was rinsed and the process was repeated twenty times. The data collected was the time that elapsed between application of the insecticides and termination of the crickets. After the experimentation, the results showed that the brand of TAT roach killer terminated the crickets in the shortest amount of time. The least expensive brand Raid took a little bit longer to terminate the cricket, but there was no lingering scent from the insecticide. Last was the Bugs ‘R’ Done that took the longest to terminate the cricket, but left a pleasant orange scent and is environmentally safe. From only observing the results, TAT is the most powerful insecticide that was researched. This experiment tested three types of insect killers to determine their effectiveness. The hypothesis was accurate because the more chemicals that were in the insecticide the faster it terminated the insect. The organic insecticide would take longer because it had fewer chemicals to assist the killer to be absorbed by the insect. The experiment of the insecticides has aided in discovering the differences between inorganic and organic insecticides.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects ☑ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☐ No

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The Effect of Caffeine on the Activity Level of Daphnia magna
John Mullen
Stone Bridge High School, Ashburn VA

Many people rely on energy drinks to help them wake up, keep them going, or help them concentrate on a difficult task. Energy drink companies increase caffeine amounts in their products, claiming that it helps in all of these categories. This experiment was done to see if the increasing levels of caffeine really help raise the activity level of the consumer.

The experiment used different concentrations of an energy drink and observed the activity level of Daphnia magna. This was done by recording the amount of 90 degree turns in a 30 second period of the Daphnia magna completed. The Daphnia magna were observed in Petri dishes with concentrations of an energy drink at 0%, 15%, 30%, and 45% with 0% as a control group. The results showed that the greater the concentration of caffeine was the higher the level of activity was shown.

The conclusions from this experiment were that a greater concentration of caffeine the greater the activity level of the consumer. These results did not support the hypothesis, after a statistical analysis of the data the null hypothesis was accepted. A continuation of the experiment would involve greater concentrations of caffeine to see if it will affect the consumer up until a certain concentration. Another subject more closely related to the human being such as Mus musculus might produce different more applicable results.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   - [ ] human subjects
   - [ ] vertebrate animals
   - Potentially hazardous biological agents:
     - [ ] microorganisms
     - [ ] rDNA
     - [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No
3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [ ] No
4. This project is a continuation of previous research. [ ] Yes [ ] No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): [ ] Yes [ ] No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research.
I/We also attest that the above properly reflects my/our own work.

Signature: John Mullen
Date: 2/19/23

Mullen, John

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Wasp Detectives: Conditioning Insects to Detect Chemicals
Eric L. Nguyen
Dominion High School, Sterling, VA

Security inspectors, police, government agencies, and safety administrations regularly use radiation-based devices and/or trained canines to detect explosives and chemicals. However, these methods are costly to manufacture and train, respectively.

The purpose of this research was to determine if Nasonia vitripennis, a parasitic wasp, could be used to detect melamine, a chemical harmful to animals recently found illegally in various pet foods. In one test, experimental Nasonia were exposed to melamine, honey, and water. Additionally, other experimental Nasonia were exposed to melamine, pet food, honey, and water. The hope was the wasps would associate the food source, honey and water with the stimulants and would subsequently be more attracted to them. Secondly, control Nasonia were exposed to the same mixtures as the experimental groups but no melamine was in the environment. The Nasonia were then placed in two connected tubes: one tube with testing conditions in it, the other empty and their movement observed.

The results showed that the null hypothesis, Nasonia cannot be used to indicate the presence of melamine, was supported and refuted. The melamine trained Nasonia were not significantly more attracted to melamine than control Nasonia, but the melamine and pet food trained Nasonia were significantly more attracted to pet food than Nasonia trained with only pet food. This suggests that Nasonia cannot detect melamine, but are deterred from it. Hence, aversion to the melamine could in fact, be an indicator of melamine and the wasps could be used to indicate its presence or lack thereof.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents:
   □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
4. This project is a continuation of previous research. □ Yes □ No
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Nguyen, Eric

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Strength vs. Camouflage: The Evolutionary Tradeoffs of Pigmentation in Bird Eggs
Devon N. Reed
Dominion High School, Sterling VA

One of the most important issues all wild animals face is survival. Egg strength in birds is one of the primary factors that determines whether a young chick survives to hatch. Since egg pigmentation varies with bird species, it was the intent of this research to determine whether pigmentation played a role in the strength of the shell. Fifty-four eggs from a total of eight species were tested. Each egg was measured for mass and volume, and tested for resistance using a puncture machine. Statistical analysis in a t-test indicated that the null hypothesis, that pigmentation would play a role in the strength of the shell, was supported and refuted. There was a significant difference in strength between dove eggs and all other species tested as well as in quail eggs and all other species. White dove eggs were quite fragile, as were pigmented quail eggs. Pigmentation appears to play more of a role in camouflage, hence hiding and protecting young developing bird embryos. Further research would entail the investigation of feeding regiments for various birds to determine whether protein and vitamin content play a role in strength and pigment deposition.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

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4. This project is a continuation of previous research. □ Yes □ No

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[Signature]
Finalist or Team Leader Signature

[Date]
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between Chronic Renal Disease and Anemia in Cats
Payton Rhymes
Freedom High School, South Riding, Virginia

The purpose of this experiment was to determine a rough percentage of the feline patients at Parkway Veterinary Clinic that would develop anemia form previously diagnosed chronic renal disease. When the kidneys enter the chronic stage of renal disease, or failure, this means that the kidneys are slowly deteriorating and will eventually fail. In other words, there is no way to cure the disease unless a transplant is performed. As a result of cellular damage, the kidney releases creatinine into the blood stream. Creatinine is a toxin and serves as a marker for kidney damage. Because the cells are damaged, they cannot produce erythropoietin, which is necessary for red blood cell production, and results in anemia.

The test group was taken from all the cats of ten years of age and older who had blood tests taken between July 7, 2007, and December 23, 2007. Blood samples were drawn and handled by veterinarians and veterinary technicians only. The experimenter conducted a data analysis of the blood test results and did not handle any animals or blood products. After collecting the data, the experimenter divided the patients into three sub-groups: cats with no abnormalities, cats with elevated blood urea nitrogen (BUN) and/or creatinine levels, and cats with elevated BUN and/or creatinine levels with other parameter abnormalities.

The results did not completely support the hypothesis. There is simply not enough data to come to a more accurate conclusion. If the study used more test subjects, then the hypothesis could be accurately tested. Of the data that was present, it has been concluded that 60% of the patients will develop anemia in those patients.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects ☑ vertebrate animals

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☑ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☑ No

4. This project is a continuation of previous research. ☑ Yes ☑ No

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Payton Rhymes 2/17/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
This experiment is designed to determine what color would be most successful in attracting an abundance of Coccinellidae (ladybugs). The colors tested were green, yellow, and white because finding out what color attracts ladybugs can help bring them into gardens, which can be very beneficial because they can eat all the plant-devouring aphids that destroy garden plants.

Conducting this experiment included constructing a choice chamber with different color combinations with green, yellow and white. Ladybugs were placed onto the choice chamber and every 10 minutes the number of ladybugs on each color was recorded. After experimentation the yellow and green colors had attracted the highest number of ladybugs. The green color’s highest numerical average was 6.3. The yellow color’s average was 6.0 and the white color’s average was 5.5. The experimental results initially supported the experimental hypothesis because it stated that ladybugs are attracted to flowers that have petal colors of green. Furthermore it was previously known that ladybugs would be successfully attracted to umbrella shaped flowers such as dill, angelica, and wild carrot & yarrow. Those flowers respectively have the petal colors of green, yellow, and white. Further research could include the attraction of ladybugs to other things besides color such as smell or taste.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. Yes □ No
3. Student worked or used equipment in a site other than school, field or home. Yes □ No
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Enzo Rios
Finalist or Team Leader Signature
2/20/08
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Artificial Ultraviolet Patterns on the Attraction of the Common Honeybee, Apis Mellifera

Carl Scaggs
Stone Bridge High School, Ashburn, VA

The purpose of this project was to determine whether or not the ultraviolet patterns found on a flower had an effect on the number of bees attracted to a flower. The information gather would benefit beekeepers by letting them know which flowers would be the most efficient for honey production.

The patterns found on flowers are formed by a group of chemicals called DIPs, for deoxygenated isoprenylated phoroglucinols, that are naturally found in the petals of flowers. The patterns are only seen in ultraviolet light because the DIPs absorb all but ultraviolet wavelengths. The patterns are unique to each flower but there are groups. The two most common patterns are the bull’s eye and stamen’s only. These patterns, which were painted onto artificial flowers, were used in this experiment.

The results were obtained by counting the number of bees that landed on each flower cumulatively over fifteen minutes. From the results obtained and the consequent analysis on the data, the patterns were proven to have a profound affect on the attraction of the bees. T-tests were run to ensure the relevance of the data to the original hypothesis and the data was proven statistically relevant.

The original hypothesis was supported through the statistical analysis done on the raw data collected. This project could be improved by keeping the bees in a static environment. Throughout the testing, many environmental variables had an effect on the bees including; temperature, time (angle of the sun), wind speed and direction, and barometric pressure.

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   Potentially hazardous biological agents:
   [ ] microorganisms [ ] rDNA [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

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[Signature]
Findlsta or Team Leader Signature

[Date]

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship of Honeybees and Color
Tyrell M. Walker
Broad Run Highschool, Ashburn, Virginia

How do honeybees, one of the insects we depend upon most, see the world? Bees pollinate a majority of the food we eat, yet many people know next to nothing about these insects. Honeybees are amazing; having a meticulous, functional, and pragmatic organizational system allowing for maximum output.

This study examines how they see the world. Using clear containers of sugar water on top of pieces of red, yellow, or blue origami paper, this study shows which of these colors bees are attracted to the most. The dependent variable is how many times the bees visit a color each trial, while the independent variables are the pieces of colored paper with the clear sugar water dishes. In this way, the color preference of honeybees can be measured.

The experiment supported the hypothesis: if the color was closer in the spectrum to the ultraviolet, then the honeybees will be attracted to it more. This experiment yielded results that blue was visited much more than the colors in the spectrum closer to red, which bees cannot see. The results showed that the clear control and red were visited least frequently, then yellow, with blue being the most frequented. This is also the order the colors would be represented in the light spectrum. Accordingly bees indeed can see color, and even have color preference. Since their vision is centered more towards blue, blue was the color that interested them the most.

However, this does not answer all the questions about these miraculous insects. Is the color preference of each colony, or even each bee, independent, or is blue the preference that all bees share? Perhaps preference is based on the flowers in the area, and this certain colony had blue flowers nearby. These questions can only be answered with further research.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  □ human subjects  □ vertebrate animals
   Potentially hazardous biological agents:
   □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract.  ✔ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home.  ✔ Yes  □ No

4. This project is a continuation of previous research.  □ Yes  ✔ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  □ Yes  ✔ No

We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. We also attest that the above properly reflects my/our own work.

[Signature]  1/22/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The purpose of this experiment was to discover whether fingerprints are inherited from the mother or father. To discover this, I went and bought black, non-toxic, and washable ink. I then created a chart to collect the fingerprints and keep track of whose fingerprints they were. I then collected eight boys, eight girls, and their parents’ fingerprints. As I was taking the fingerprints, I wrote down what type of fingerprint each item was. This prevented confusion later on. I then compared each finger on the same hand of the offspring to that of the mother and father and recorded the total amount of similarities. For it to have counted as a similarity, it must have been the same exact type of print, been on the same finger, and have been on the same hand. Next, I added up the similarities and compared the total amount that had more similar to their mother’s and the amount that had more similar to their father’s and determined whether more people inherited fingerprints from their mothers or their fathers. I then also compared the results of the boys versus the girls to see if gender played a role. Based on my results, it appears that it did. I discovered that the boys in my data inherited their fingerprints mostly from their mothers. Girls inherited them from both parents equally. My statistics rejected my project, but I did discover that fingerprints do show a trend leaning to inheritance from the mother and not the father.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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[Signature]

Date: 1-30-08

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<th>Title</th>
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<td>Wollett, Megan</td>
<td>The Correlation Between Cultural Mores and Emotional Response</td>
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Does Gender Effect Visual Cognition?
Paul Bartholomew
Heritage High School, Leesburg, Virginia

The purpose of the experiment was to test the effects of gender on visual cognition. Visual cognition can be linked to task orientation and business management.

To test the human subjects, there was a video clip, which each subject had to watch. The video clip is of people passing basketballs, during which there was a gorilla that passes through the center. Each human subject was asked how many passes they counted and if they saw the gorilla. The data had a massive turn out, 56 people were tested. The males had more people have the accurate pass count than females. Also, the males had more subjects that saw 'something' or they saw the gorilla. Unfortunately, only a small amount of people actually saw the gorilla.

Through the data and graphs it seemed that the males would have a better visual cognition, but the data was only the half of it. The inferential statistics are to show that the data is either be chance supporting the null hypothesis) or is substantial. The null hypothesis: The means of the two groups would be equal, was supported. The means of the groups were similar, within .5 of each other. After the testing and the statistics were over, it was shown, that the males and females are not completely similar, but are not much different either. More research and experimentation needs to be done.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects
   □ vertebrate animals
   Potentially hazardous biological agents:
   □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes □ No

4. This project is a continuation of previous research. □ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☑ Yes □ No

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Finalist or Team Leader Signature: Bartholomew, Paul
Date: 2/16/09

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between Human Memory and Identification of Crime Suspects

Jen Dang
520 Evergreen Mill Road, SE - Leesburg, VA 20175

This experiment tested the relationship between human memory and the identification of crime suspects. As a result, the purpose of this experiment was to figure out if an eyewitness to a crime would be able to correctly identify the perpetrator of the crime if put in a situation where the distractions are similar.

To carry out this experiment, the test subjects were shown a board for a short amount of time with the perpetrator's picture on it along with other random pictures, which served as the "distraction" to the "witnesses". Afterwards, they had to write down everything they could remember about the "suspect." Then, the "witnesses", or test subjects had to choose which "suspect" they thought was on the board.

The ability to be able to correctly identify the perpetrator or not is measured by if the witness was correct or not in their choice as the "Suspect" that they thought "committed the crime," which in this experiment, means that that person was the one on the board. During the experiment, in highest to lowest order, most of the test subjects chose "Suspect #4" was the "perpetrator" followed by "Suspect #5," "Suspect #3," "Suspect #2," "Suspect #6," and "Suspect #1."

The outcomes of this experiment illustrate that the majority of "witnesses" were able to correctly identify the "perpetrator." The results of this experiment also showed that the at df=5, x²=59.82 which is bigger than the table value of 30.14, meaning the hypothesis was supported and the null hypothesis was rejected.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects
   ☐ vertebrate animals

Potentially hazardous biological agents:
   ☐ microorganisms ☑ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☐ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

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[Signature]
[Date: 2/19/08]

[Seal]

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Perfect Face: The Effect of Symmetry on Facial Appeal
Maggie Fletcher
Loudoun Valley High School
Purcellville, Virginia, USA

Symmetry by definition is “beauty of form arising from balanced proportions”. Cultures
dating back to ancient Greece have used symmetry in artwork to appeal to the human
brain’s occipital lobes and increase visual appeal. The purpose of this experiment is to
determine whether symmetry in facial features increases visual appeal. It is hypothesized
that in fact asymmetrical facial features are considered more attractive due to the human
tendency to be engrossed with unique features.

In this experiment, two subjects were photographed. Their photos were downloaded into
Adobe Photoshop, and altered to produce symmetrical pictures. One picture had left-
sided symmetry, one picture had right – sided symmetry, and the final picture remained
asymmetrical. The pictures were then placed on a poster, and forty individuals were
randomly interviewed to determine which photo was most appealing.

14 individuals concluded that the left symmetrical photo was most appealing, 8 individuals
concluded that the right symmetrical photo was most appealing, and 58 individuals
concluded that the asymmetrical photo was most appealing. Thus, there is a definite trend
that indicates asymmetrical facial features are more appealing than symmetrical facial
features.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL
that apply): ☑️ human subjects
☐ vertebrate animals

Potentially hazardous biological agents:
□ microorganisms
□ rDNA
□ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑️ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑️ No

4. This project is a continuation of previous research. ☑️ Yes ☐ No

5. My display board includes non-published photographs/visual depictions of
humans (other than myself): ☑️ Yes ☐ No

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I/We also attest that the above properly reflects my/our own work.

Margaret Fletcher
Finalist or Team Leader Signature February 19, 2009

Fletcher, Margaret

This embossed seal attests that this project is in compliance with all federal and state laws and
regulations and that all appropriate reviews and approvals have been obtained including the
final clearance by the Intel ISEP Scientific Review Committee.
The purpose of this research was to determine if there was a relationship between the amount of bacteria on a person’s hand and his or her moral standard, with the thought that people of higher moral standards will have less bacteria on their hands. Moral standards were measured by the administration of the Heinz dilemma, a scenario posing complicated moral questions to the test-taker. Answers were analyzed to classify the individual into a specific moral level: pre-conventional, conventional, and post-conventional. Each level contains stages: Stage One, Obedience and Punishment Orientation, and Stage Two, Individualism and Exchange, make up the pre-conventional level. Stages Three and Four, Good Interpersonal Relationships and Maintaining Social Order, respectively, are classified as conventional morality. Stage Five, Social Contract and Individual Rights, is characteristic of post-conventional morality. After completion of the questionnaire, bacterial samples were obtained from each subject’s hands, cultured for several days, and counted daily. After testing, the majority of participants were classified as Stage Four, close to the expected result. Also, men scored consistently higher in morality than women, in accordance with the fact that the Heinz dilemma is psychologically gender-biased due to its emotional scenarios. The bacterial counts were as expected for participants testing at the first three moral stages, decreasing in number as the moral stage increased. Interestingly, participants in Stages Four and Five did not have the expected amount of bacteria. Hence, this research indicates that there may be a subconscious “cleansing” in individuals of higher morality, based on bacteria counts.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☒ human subjects ☐ vertebrate animals

Potentially hazardous biological agents:

☒ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

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4. This project is a continuation of previous research. ☐ Yes ☒ No

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Katherine Holmberg
Finalist or Team Leader Signature
2-20-08
Date

Holmberg, Katherine

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Money, Marketing and the Power of Persuasion: Does Higher Cost Equal Better Taste?
Maureen Howard
Loudoun County High School, Leesburg VA, 20175

A test involving six products was done to reach conclusions regarding the measured impact of marketing, particularly, does higher cost equal better taste? Three unidentified pairs of six similar (three brands and three generic/store generated) products were offered to 50 random participants in a "Blind Taste Test" on January 26, 2008 at the Giant Food Store on 61 Catoctin Circle N.E., Leesburg, VA 20175. The three pairs of products were chocolate chip cookies, cheese crackers and saltine or soda crackers. Each person was asked to sample the three pairs of similar products and to select which item of the pair tasted better, not knowing which items were brand or generic. Each person was given a bottle of water to cleanse his or her palate between samples. The brand name products, which included Chips Ahoy cookies and Ritz crackers were chosen as tasting better slightly more often. However, the generic saltine cracker was chosen as tasting better than the brand, and by the widest margin. Given the nature of the testing, which was performed at a singular time, statistical analysis was limited to essentially percentage differences between cost and taste choices. The conclusion reached is that more money spent on brand name products does not necessarily result in better taste for the consumer.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☒ human subjects Potentially hazardous biological agents: 
   ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue 
2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No 
3. Student worked or used equipment in a site other than school, field or home. ☒ Yes ☐ No 
4. This project is a continuation of previous research. ☐ Yes ☒ No 
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☒ No 

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research.
I/We also attest that the above properly reflects my/our own work.

Maureen Howard
Finalist or Team Leader Signature 2/14

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205C10
Howard, Maureen
Hailey Huebner
Arithmetic Variation: Does a Language Affect Calculations?
Loudoun Valley High School
Purcellville, Virginia

A language is a system of visual, auditory, or tactile symbols of communication and the rules used to manipulate them. The purpose of this experiment is to determine if language has an effect on mathematical calculations by varying the number of phonemes and the number structure between two languages - English and Chinese. English has a more complex structure in general than Chinese. The hypothesis is that a more complex number structure and more phonemes would lower the performance score in arithmetic calculations, meaning students in America would have a lower overall score than students in China.

Two sets of test questions for each level, upper elementary and lower elementary. Both sets have the same operators but different operands. One set (Set A) had numbers with fewer phonemes and the other (Set B) had more phonemes. Type 1 will be for the lower elementary level and Type 2 will be for the higher elementary level. Schools in both China and the US will be involved. Once the subjects took the tests, their tests were scored and analyzed.

The hypothesis was supported in the findings. Chinese students overall did better than American students because their language is more simple and has fewer phonemes than English.

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Hailey Huebner 2/20/08
Finalist or Team Leader Signature Date

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The Relationship Between Repetition and the Speed of Color Identification
Melissa Jackson
Heritage High School, 520 Evergreen Mill Road, Leesburg, VA 20175

In this experiment, participants were given four different lists of color words to read aloud and were timed as they read. The second, third, and fourth lists had color words printed in an incongruent color, and were therefore more difficult to read than the first list, which had congruent color word pairs. The experimenter hypothesized that the participants would be able to read each successive list more quickly.

A total of nineteen high school students were tested. Each one was given a color blindness test. The experimenter gave them the lists one by one and each student was asked to read each list aloud as quickly as possible without making mistakes. The experimenter kept track of each participant’s times (in seconds) and number of mistakes.

It was found that the hypothesis was not supported. On average, the participants read List 2B fastest, then 2A, and finally 2C (List 1 was the fastest read since the words and ink colors were congruent). Using degrees of freedom equal to 36 and 0.05 as the level of significance, the difference between List 2A and 2B is considered to be statistically significant. Although they got faster between Lists 2A and 2B, the participants peaked and List 2C took them the most time to read.

If someone were to perform this experiment again, it would be recommended that more precautions be taken so that distractions such as other students walking through the halls and ringing lunch bells could be avoided. Also, if more participants were tested, more accurate results could be obtained.

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Melissa Jackson 2/15/08
Finalist or Team Leader Signature Date

207H10
Jackson, Melissa

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Red Hot or Cool Blue? The Effect of Music on the Psychological Thought of Color
Sarah Kyle
Briar Woods High School, Ashburn, VA, USA

The purpose of this experiment was to determine if music genre stimulated the thought of a specific color. Because color and mood are closely related, this could demonstrate the effect of genre on one's mood as well.

Forty-two high school students completed a survey while listening to 5 one-minute songs, each from a different genre (rock, classical, country, alternative, and jazz). The survey required the test subjects to record a color for each song they listened to. The data was graphed to compare the number of students who responded with similar colors. Responses to four of the five genres were deemed statistically significant (alternative was the only insignificant genre) using a chi-square test.

The results of this experiment supported the hypothesis. The mode color for the rock selection was red, suggesting an angry, fiery mood. The mode color for the classical selection was blue, which represents peace and calmness. The mode color for the country selection was yellow, which is generally linked to happiness and warmth. Finally, the mode colors for the jazz selection were purple and yellow. The two colors are unrelated except that both could symbolize liveliness.

This information joins the experiments done correlating color and emotion, and the experiments done correlating emotion and music. The correlation between music and color (suggesting the correlation between music and mood) could be a great tool in the world of modern psychology.

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Sarah Kyle
Finalist or Team Leader Signature

02/12/08
Date

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208W12
Kyle, Sarah
How does heart rate affect reaction time.

By Jessica M. Micheli
Park View High, Sterling VA

This experiment was looking at heart rate and reaction time. The question was how does heart rate, which is controlled by a very important muscle (the heart), affect reaction time, which is controlled by a very important organ (the brain). Results of this experiment could also help society, for example, if someone is deciding when to drive they could determine when it is best based on their heart rate. The hypothesis made was that if heart rate increases, then reaction time will decrease. Ten boys and ten girls were asked to participate in this experiment, with permission from their parents. First, their pulse was taken with a blood pressure cuff and their reaction time was taken by running a test online at www.topsports.com. Next the participant jump rope for ten minutes. Afterwards, their heart rate and reaction time was retaken. After doing the statistics, you could see take the hypothesis that was made was supported. The participants' heart rate increased, of course, and their reaction time decreased as well. The statistics done was a paired, quantitive T-test since the experiment was looking at the differences in reactions time (the reaction time taken before the participants jumped rope and after participants jumped rope) since it was already established that having them jump rope would get their heart rate up.

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Jessica Micheli 2/5/08

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The Effect of Music on Running
Daniel Nesbit
Loudoun Valley High School, Purcellville, VA, Loudoun County

Music has potential to have profound influence over the mind and body. The purpose of this study was to examine the influence that music can have in combination with running. During the experiment, each runner ran sets of 800m listening to country, classical, rap or no music at all. Classical was selected due to its general lack of consistent tempo, while rap, and to an extent country were selected for the inclusion of a consistent tempo. The independent variable was the type of genre being tested; consequentially, the dependent variable was the time of each 800m run.

The data of the experiment showed that the averages of the runs with no music were slower than the averages of the run with music. Overall, out of the three genres, rap had the fastest averaged times, followed closely by country and then classical. The results supported the hypothesis that rap will make a runner have the fastest times. The data concludes that music has an effect on running; the use of music makes the timed runs faster. Rap and country had the greatest influence because of their consistent prescience of tempo, which encourages the listener to speed up. Given a larger variation of songs and genres, what would the results indicate?

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Daniel Nesbit
Finalist or Team Leader Signature

L-20-08

Date

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Immigration and Socioeconomic Status: Possible Discriminatory Development of Homeowners' Association Covenants
Kyle D. O'Donnell
Dominion High School, Sterling, VA

Homeowners’ associations (HOAs) have, for many generations, been a means to control the stability and desirability of neighborhoods especially in areas of suburban growth in America. It has been suggested that governing councils are abusing their powers over the community in order to discourage and even prevent the entry of minority groups.

The purpose of research was to determine whether recent trends in immigration have prompted homeowners’ associations to enact covenants (the binding documents of the community) that could possibly restrict the eligibility of a potential buyer due to his or her ethnicity and the customs thereof. HOAs’ demographic and location information were recorded and their covenants read during which a list of possibly ethnically-excluding covenants were analyzed.

Control states analyzed were those not associated with high immigration populations while the analysis of experimental states included border states and those of rapid growth. The null hypothesis, that the demographics and location of homeowners’ associations would not have any bearing on the amount of ethnically-excluding covenants in their binding documents, was refuted.

There were more specifically worded exclusionary covenants in the experimental states than in the control states. Those covenants that were not specifically worded in an ethnically exclusionary manner appeared to have the implied intent of excluding a particular group of people. This research indicates the need for HOAs to thoughtfully examine covenant-making procedures to determine what is good for the community versus what may be ethnically exclusionary. This, in turn, may create more cohesive communities with less internal strife.

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   - human subjects
   - vertebrate animals

2. Student independently performed all procedures as outlined in this abstract.  
   - Yes  
   - No

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   - Yes  
   - No

4. This project is a continuation of previous research.  
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   - No

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   - No

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Signature: Kyle O'Donnell  
Date: 02 - 20 - 08

211D12
O'Donnell, Kyle
The Effects of Recess on Test Scores
Chrystal N. Oden
Loudoun Valley High School Purcellville, VA 20132

To determine whether recess has an effect on test grades timed two minute addition tests consisting of 40 problems were given to 4 third grade classes at Mountain View Elementary, a total of 77 students. Each class was given a timed test before a 15 minute recess and directly after to verify any effects recess has on test scores. The hypothesis states that when an ample amount of recess is provided for third grade students, grades will be greater than that of students who aren’t allowed recess.

To perform the experiment permission from the principal and teachers were obtained and on December 12, 2007 and January 9, 2007 tests were given to each class to take before and after recess. Average test score percentages were taken for both trials before and after recess, and the average improvements after recess were taken for each class during each trial. Results was averaged and compared on bar graphs. The hypothesis went unsupported. During Trial 1 the total average percentage answered correctly before recess was 57.25% and after recess 52.56%. Average improvements for students were -0.6 points. For trial 2 averages before recess was 56.51% and after 56.98%. An average improvement of 0.18 points was recorded. In all, before recess 56.88% of questions were correct and after 54.77%, while the average improvement was -21 points.

To improve on this experiment a larger sample size could be used with more trials and a varying amount of recess lengths and length of time before and after recess before taking the test could be implemented.

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The Effects of Color on Short Term Memory Retention
Alaina P. Rhee
Loudoun County High School, Leesburg, VA

The experiment performed was designed to test whether or not the addition of color to standard black and white text would increase a participant’s short term memory retention. A typed list of 20 randomized words in black and white text was presented to the participant, who was then given 2 minutes to study and memorize the presented words. The participant was then asked to recount as many words as he or she could remember, and the trial was repeated another two times. The participant also received three other lists of randomized words, this time in red font, and the procedure was repeated. Thirty students participated in this study, and at the conclusion of the testing, the amounts of correctly remembered words out of twenty were documented for each participant and each trial. The averages of correctly remembered words out of twenty were taken for both black and white text and colored text, where they could thereafter be compared through a graph, (labeled Participant Test Results) which appeared to show a steady trend favoring the hypothesis, which stated that the addition of color would have a significant effect on short term memory retention. However, when a t-test was administered, determining whether the results were statistically significant, the t-test established that there was no statistical significance made by the addition of color to the black and white text.

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The Effect of Age on Visual Short-Term Memory
Rachel K. Roth
Briar Woods High School, 22525 Belmont Ridge, Ashburn VA, 20148

This project was designed to determine the effects aging has on the visual short-term memory (VSTM) of humans. VSTM is a fairly recent subject of study, and little research has gone into measuring the variations of VSTM capacity between different age groups. The hypothesis was that those participants under the age of 21 would have a higher VSTM capacity than those 21 and over. This project was performed by creating two tests: the first measured the participants’ ability to remember rapid changes in color using abstract shapes, while the second measured the participants’ ability to determine various changes in an environment. Both tests were scored from 0 to 8. The mean scores of the first test were 5.3 for those under 21 and 5.5 for those over. This was not significant. In the second test, the mean was 2.6 for those under 21 and 3.4 for those over, a significant difference. The results supported the null hypothesis, that those 21 or over had higher VSTM capacity in terms of changes in an environment. The results demonstrated that color VSTM is independent from location and movement. One question that could be studied further is why those over 21 had a better VSTM. In the future, the experiment could benefit from more specific age groups.

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[Signature]
Finalist or Team Leader Signature

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The Effect of Cell Phones on Reaction Times
Micah Slawson
Park View High School, Sterling, VA

Cell phones seem to be one thing in our community that we’ll never miss, but cell phones also seem to be the reason for a lot of car accidents. The purpose of this experiment is to test reaction time and to see if reaction time changes when on a cell phone, therefore helping to rule against cell phones while driving. In this study, forty subjects were to be tested on both a control and a phone test. The control test is a stop light that tells you when to click and records your reaction time to its commands. In the phone test, the same test was used but the results were taken after the subject had an ongoing conversation, lasting five minutes, with a person on a cell phone. Twenty of the test subjects took the control first then the phone test, and the other twenty took the phone test and then the control to prevent boredom. The major findings of the experiment found that there is a small margin of increase (.46) that is a change throughout the reaction time. Because this is such a small number, this is not enough to reject the null hypothesis (which is that cell phones cause a decrease in reaction time) but this little number could possibly lead to many accidents throughout the United States.

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Micah L. Slawson
Finalist or Team Leader Signature
2/4/08
Date

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The Correlation Between the Moon Phases and Human Anger

Nathaniel A. Tonelli
Heritage High School, Leesburg, Va

The purpose of this experiment is to determine if there is indeed any significant relationship between the moon phases and human anger. The idea first originated from the theory that the high and low moon tides could control something like a baby’s birth. The hypothesis of the experiment is that the disproportionate number of serial killers/ test subjects would be born on a full moon. It seemed like an odd hypothesis at first, but after some supporting data was discovered, the experiment seemed plausible. Perhaps if we knew what effect the moon had on us, if any, then we could know more about these “effects” and what causes them.

First, some identifiable variables were needed for the experiment, as a result the moon phases and human anger became the outcome. Due to the fact that anger is an obvious quality to detect in a person, it was an easy emotion to choose to see if the moon had an effect on it. Statistically speaking the final figures showed that there was not a significant connection between the two variables. However, another question that arose from the study is whether or not the moon has an effect on a different type of emotion, or possibly a personality trait? Perhaps the moon has more of an influence on us than we know.

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Nathaniel Tonelli
Finalist or Team Leader Signature

216H10
Tonelli, Nathaniel

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Battle of the Sexes: Memory
Marcy Wheeler
Heritage High School, Leesburg, VA

The purpose of this experiment was to determine whether males or females have a better short-term memory. It also investigated if pictures or words affected the efficiency of their memory. Results for this experiment could be used to guide career paths that better suit males or females.

The experiment was done by testing 30 males and 30 females, separated into two different groups. In the first group, 15 males and 15 females were shown 15 different objects. In the second group, the remaining 15 males and 15 females were shown 15 different words. After being shown the items, the subjects were asked to repeat as many objects that they would remember back after a one minute break.

After the subjects were tested, the results indicated that overall females have a more accurate memory. Although males exhibited a slightly better average in the picture section, there was a substantial difference in the word group, suggesting that females have a better memory. T-tests showed that there was a significant difference between the mean of males' memory and the mean of females’ memory.

To improve this experiment more subjects could be tested to reinforce the results. Also, a third group, using verbal cues, could be added to the experiment to support the conclusions.

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Potential hazardous biological agents:
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   □ rDNA
   □ tissue

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Marcy Wheeler
Finalist of Team Leader Signature 2 -12-08

217H10
Wheeler, Marcy

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The effect Scientific Literacy has on the General Public's Influence of the Progression of Science
Lauren A. Withers
Loudoun County High School, Leesburg, Virginia

The problem being investigated was that scientific advances are being held up because of public controversy. The purpose of this experimentation was to show that if the general public was more scientifically literate than they would change their opinions on current scientific issues and this would affect the advancements of science. A series of surveys were given to fifty-seven people of various ages. A survey of personal characteristic questions, such as age and gender, and a survey addressing five current scientific issues with a mixture of a fact and opinion questions was given to each person. Then after reading an informative insert on each on the issues, the exact same survey was taken again. This was used to determine if they changed their stance on an issue after gaining knowledge about it. After being analyzed with a regression \( y = -0.274x + 3.143 \), a calculated model significance of \( p = 0.01 \), and a slope and intercept significance of \( p < 0.05 \), it was concluded that there was a significant relationship between scientific literacy and the number of opinions a person changed on issues. The model showed that as scientific literacy increases, where a person stood on an issue was less likely to change. It also showed that for those who were not scientifically literate, they would change more of their opinions. Some other factors that may have played a role are gender, age, geography, college attendance, religion, sources used to stay informed, field of work, active involvement in issues, and importance placed upon scientific literacy. These results support the hypothesis that if the general public gained knowledge and were scientifically literate, they would think differently about where they stood on an issue and this would negatively or positively affect the advancements of science.

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Lauren A. Withers
Finalist or Team Leader Signature
2/11/08

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Withers, Lauren

218C10
The Correlation Between Cultural Mores and Emotional Response
Megan Wollett
Dominion High School, Sterling, VA

Emotions are restricted in various cultures. Several cultures have values or rules that determine how conversations take place; who initiates them, the proper eye contact, whether or not there is a bow involved, etc. The purpose of this research was to determine whether or not there was any correlation or relationship between ethnicities and an individual’s emotional response. This was tested via the use of a nine question survey using pictures including different racial groups, various age groups, as well as inanimate objects.

The survey participants identified themselves as Caucasian, Hispanic, Black, Asian or Pacific Islander, and Other, which consisted of all other ethnicities. It was determined that differences in survey answers, slight or major, occurred between various races depending on the type and nature of the question. For example, Caucasian and Blacks associated remorse more with a picture of someone of Middle Eastern descent while Asians associated remorse more with the picture of a black person. While there was no major differences in the association of pity towards an individual amongst the different ethnicities.

The conclusions of this research show that surveys and other forms of public opinion or input should not be biased toward a certain ethnic group. Test or survey developers should take multiple factors into consideration such as ethnicity and age or ethnicity and gender. This would ensure a fairer, less partial survey system and would provide answers that may be more valid and paint a more accurate picture of a society’s opinions.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects  ☐ vertebrate animals  ☐ microorganisms  ☐ rDNA  ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes  ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes  ☑ No

4. This project is a continuation of previous research. ☐ Yes  ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes  ☑ No

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Megan Wollett  02/20/2008
Finalist or Team Leader Signature  Date

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<td>Deducing by What Means <em>Nasonia</em> Locate <em>Sarcophaga</em></td>
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<td>306F10</td>
<td>Teos, Karen</td>
<td>The Relationship Between Temperature and Sugar Content of an Apple</td>
</tr>
</tbody>
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Deducing by What Means Nasonia Locate Sarcophaga
Heather R. Ellis
 Loudoun County Academy of Science, Sterling Virginia, United States

In order to determine the method by which Nasonia, a parasitoid wasp locate the pupae of Sarcophaga, the prey organism in which they lay their eggs, an experiment was designed that would identify the pigments found in the eyes of the Nasonia as it was hypothesized that Nasonia use UV light detection as the means to locate Sarcophaga. The eye pigments would be isolated using chromatography and compared to the pigments found in the eyes of Drosophila isolated by the same method because Drosophila are known to have the ability to see UV light.

The only results that have been yielded so far are preliminary chromatograms of eye pigments of Drosophila of the wildtype, sepia, and white eye strains. The pigments have not yet been identified or compared with those of Nasonia as data is still being collected.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals Potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☑ No

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5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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I/We also attest that the above properly reflects my/our own work.

Heather Ellis
Finalist or Team Leader Signature 02-20-08

Ellis, Heather
The Effect of Milk Type On Milk Freshness
Ashleigh Hammer
Loudoun Valley HS, Purcellville, VA

This project was conducted in order to show the relationship between the type of milk and its ability to remain fresh over two weeks. Three types of milk were used; two percent, one percent, and skim. Two tests were performed on each group to ensure accuracy. A cup of milk from each group was placed into a transparent container, and then measured once a day for two weeks. The groups were measured according to their pH level. When the pH level drops below 5.8 bacteria has affected it. The closer the milk is to a level of 7.0 without going over the fresher it is. Other factors affecting the milk are temperature, quantity, amount of light it is exposed to, and the storage container. In conclusion to the experiment, the butterfat content was found to have a profound effect on milk freshness. The two percent milk contained the most butterfat and had the lowest pH level at the end of both tests. The skim milk had the lowest butterfat content and had a pH level closer to 7.0 than any other group. My hypothesis stated, "If two percent, one percent, and skim milk are placed in a refrigerator for two weeks, then the skim milk will remain the freshest longer." In my findings I found my hypothesis to be correct. It was proved by the butterfat content of the milk. After carrying out the experiment, we could further analyze the data by altering the temperature, lighting, quantity, and storage.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects  Potentially hazardous biological agents: □ vertebrate animals □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
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Ashleigh Hammer 1/14/08
Finalist or Team Leader Signature Date

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The Relationship Between an Apple's Position on a Tree and the Vitamin C the Apple Contains

Sabiha Ladak
Freedom High School, South Riding, VA

The objective of the experiment was to determine if an apple’s position on a tree affects how much vitamin C the fruit will have.

Apples were picked from the top, bottom, middle, and sides of a tree (the independent variable) and their vitamin C levels were obtained using an iodine indicator solution (the dependent variable). Five milliliters of the indicator solution were dropped into each of the four test tubes, and one apple from each area of the tree was juiced. Ten drops of each apple’s juice were placed into their corresponding test tube, and they were ranked from one to four based on the color of the solution. One meant the solution was the lightest and had the most amount of vitamin C, while four meant the solution was the darkest and contained the least amount of vitamin C.

The results showed that the hypothesis was not supported because the apples from the sides of the tree did not contain the most vitamin C, and sunlight did not seem to affect vitamin C levels. The null hypothesis was accepted, and after completing the Chi-square test, it was easy to see that vitamin C levels of apples are not related to where the apples come from on a tree.

To improve this experiment, one may want to pick the apples earlier in the year when the weather is milder and there is more sunlight, or even try using a different type of apple to see if results are similar. For further experimentation, vitamin C levels could also be found in other fruits or vegetables to see if sunlight does affect vitamin C levels in other foods.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ potentially hazardous biological agents:
☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

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Sabiha Ladak 1/31/08
Finalist or Team Leader Signature Date

303F10
Ladak, Sabiha

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Manure from Grain Fed vs. Grass Fed Cattle as a Fertilizer
Murray, Adam R.
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

Manure nutrient levels were investigated by collecting samples from grain fed and grass fed cattle. Grain fed cattle samples were taken from two different farms (S3-B, S4-B, S8-B, S9-B, and S10-B). Samples S4-B, S8-B, S9-B, and S10-B were from one farm and sample S3-B was taken from another farm. Two different fields were used to acquire the grass fed cattle samples (S1-F, S2-F, S5-F, S6-F, and S7-F). Samples S1-F and S2-F were taken from the same field and samples S5-F, S6-F, and S7-F were taken from a different field. The two fields had different grass compositions. All samples were sent to a certified, commercial lab for nutrient analysis. Nitrogen (N), phosphorus (P), and potassium (K) levels were analyzed and recorded in kg/metric ton. Grain fed cattle manure was predicted to have a higher nutrient content when compared to grass fed cattle manure. The grain fed cattle group averaged 4.42 kg/metric ton of N (median= 4.6 range= 3.35-5.35), which is 1.83 units higher that the grass fed cattle group average of 2.59 kg/metric ton (median= 2.85 range= 1.95-3.2) of N. A t test was run (P=0.05, df=8, calculated t value of 4.1) indicating a significant difference between the two groups on the 95% level of significance. The grain fed cattle group had an average P level of 2.68 kg/metric ton (median= 2.5 range= 1.8-3.9), 1.52 units higher that the grass fed cattle group average of 1.16 kg/metric ton (median= 1.1 range= 1-1.5). A t test was run (P=0.05, df=8, calculated t value of 4.3) indicating a significant difference between the two groups again on the 95% level of significance. The grain fed cattle group had an average K amount of 1.06 kg/metric ton (median= 1.1 range= 0.9-1.3), which is 0.22 units lower than the grass fed group average of 1.28 kg/metric ton (median= 1.2 range= 1-1.7). A t test was run (P=0.05, df=8, calculated t value of 1.6) indicating no significant difference between the two groups on the 95% level of significance.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   [ ] human subjects  
   [ ] vertebrate animals  
   [ ] Potentially hazardous biological agents:  
   [ ] microorganisms  
   [ ] rDNA  
   [ ] tissue  

2. Student independently performed all procedures as outlined in this abstract.  
   [ ] Yes  
   [ ] No  

3. Student worked or used equipment in a site other than school, field or home.  
   [ ] Yes  
   [ ] No  

4. This project is a continuation of previous research.  
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5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
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I/We also attest that the above properly reflects my/our own work.  

[Signature]
Feb. 10, 2009

Finalist or Team Leader Signature  
Date  

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Comparison of Body Mass Index in Vegetarians and Non-Vegetarians
Aishwarya Pradhan
Briar Woods High School, Ashburn, VA

The aim of this study was to compare the body mass index (BMI) of vegetarians and non-vegetarians to support the hypothesis that vegetarians have a lower BMI and thus, are healthier. However, the results of this study did not support the hypothesis completely. 50 people in each group were asked to complete a questionnaire about their diet, activity, age, gender, height and weight. The data was used to calculate the individual BMI and the averages of the groups were compared. The main independent variables for the experiment were the two types of diet preferences. It was seen that BMI for vegetarians was not lower than that of non-vegetarians. However, it showed that a greater percentage of individuals that fell in the healthy BMI category were vegetarians – 48% as against non-vegetarians-40%. The non-vegetarians mostly led a active lifestyle with 74% of the sample having a daily exercise routine for at least 45 mins and 3-5 days a week as compared to the vegetarians who had just 40% of the sample engaged in a exercise routine. Thus, it would be safe to say that the reason for the unexpected result can be attributed to the sedentary lifestyle of the vegetarians representing 60% of the sample group as against 26% in non-vegetarians. This study brings to light an important fact that even though the vegetarian diet is healthier than the non-vegetarian diet, being high in fiber and low in fat, it is important to have an exercise routine on a daily basis. Thus, the hypothesis could be supported if the vegetarians increased activity level in their daily lifestyle.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑ human subjects  ☑ vertebrate animals  

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes  ☑ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes  ☑ No

4. This project is a continuation of previous research. ☑ Yes  ☑ No

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Pradhan, Aishwarya

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Many people suffer from either type one or type two Diabetes. Because they have Diabetes, the person must watch what they eat to make sure the sugar content does not rise too high or fall too low. This experiment is a Biochemistry project that is trying to prove whether or not the condition (temperature) of an apple affects the amount of sugar input into the body.

To determine the amount of sugar content in an apple, a refractometer was used. After placing a group of apples in different locations (freezer, oven, and room temperature), the apples were turned into juice, and then used to determine the amount of brix (sugar). As the temperature increased, the amount of sugar availability increased about 3% more than the apples in room temperature.

From the start of the experiment, it was purposed that with an increase in temperature the amount of sugar would also increase. This hypothesis was supported by the evidence, however it was also noted that the brix increased about 3%.

Consuming a regular apple at room temperature is more convenient than munching down a baked or frozen apple.

Do other fruits show the same statistics and out come like the apple? To further expand on this experiment, it would be better to test more than one type of fruit, so that the idea of temperature, increases the amount of sugar.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   □ human subjects  
   □ vertebrate animals  
   □ Potentially hazardous biological agents:
      □ microorganisms  
      □ rDNA  
      □ tissue

2. Student independently performed all procedures as outlined in this abstract.  
   ✓ Yes  
   □ No

3. Student worked or used equipment in a site other than school, field or home.  
   □ Yes  
   ✓ No

4. This project is a continuation of previous research.  
   □ Yes  
   ✓ No

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   □ Yes  
   ✓ No

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Karen Teos  
2/4/08

Finalist or Team Leader Signature  
Date

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# Cellular & Molecular Biology (400)

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<td>402D12</td>
<td>Colley, Tara</td>
<td>Environmental Remediation Via Riboswitch Control of Microbial Chemotaxis</td>
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<td>403C12</td>
<td>Neuharth-Keusch, Danielle</td>
<td>The Suppression of VEGF Homolog pvf-1 in <em>C. elegans</em> via RNA Interference as a Research Model for Antiangiogenic Cancer Therapy</td>
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<tr>
<td>404D12</td>
<td>Urgel, Michael</td>
<td>Blocking Antibiotic Resistance Via siRNA</td>
</tr>
</tbody>
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Determining Phylogenetic Relationships of Wolbachia
Justin T. Alexander and Siddarth Dutta
Academy of Science, Sterling, Virginia, USA

The purpose of the investigation is to find phylogenetic relationships between the endosymbiont Wolbachia found in Virginian insects, with those in Singaporean insects, by comparing nucleotide sequences. Different insects were captured and classified down to order. The DNA was then extracted from the insects, amplified by PCR, and run through gel electrophoresis to determine positively infected samples. The positive Wolbachia results were sent out to a lab to be sequenced. The group successfully found the sequence of Wolbachia in a cranefly, but its nucleotide sequence has yet to be compared with one from Singapore.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  □ human subjects  □ vertebrate animals  □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract.  □ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home.  □ Yes  □ No

4. This project is a continuation of previous research.  □ Yes  □ No

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Alexander, Justin

[Signature]  2/29/08

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Environmental Remediation via Riboswitch Control of Microbial Chemotaxis
Tara L. Colley
Dominion High School, Sterling, VA

Riboswitches have been discovered to be the most ancient and basic forms of cellular control. These mechanisms consist of mRNA molecules which control the metabolic activity of cells by binding to a specific molecule. The intent of this research was to determine if the cheZ gene which controls the movements of the flagellum in Escherichia coli could be placed under the control of a substance that would turn the riboswitch on. Escherichia coli subjected to tyrosine were plated on petri dishes upon which small does of acetone, an environmental pollutant, was applied to the center. The control group of E. coli were not subjected to tyrosine. Growth was monitored and those bacteria subjected to the tyrosine exhibited chemotactic movements towards the acetone while those that were not subjected to tyrosine displayed kinetic behavior, random movements across the plate. Hence the null hypothesis, E. coli cannot be directed towards a particular chemical via riboswitch control, was refuted.

Easy remediation of soil contaminants on a large scale remains an issue in light of increasing industrialization. Controlling riboswitches and hence the movement of bacteria towards pollutants is something that merits continued research. Nonpathogenic strains of bacteria such as E. coli may well be good candidates for use in soil pollution remediation. If this can be controlled on a large scale, remediation efforts could be enhanced many fold.

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   □ microorganisms  □ rDNA  □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
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[Signature]
Finalist or Team Leader Signature

[Date]

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The Suppression of VEGF Homolog pdf-1 in C. elegans via RNA Interference as a Research Model for Antiangiogenic Cancer Therapy; Danielle A. Neuharth-Keusch; Loudoun County High School, Leesburg, VA

The process of RNA interference, or RNAi, is on the cutting edge of laboratory research; it provides an efficient and stable means of genetic suppression, a phenomenon never before achieved with great and lasting effects. The RNAi mechanism degrades target mRNA and results in full silencing of a target gene. RNAi provides a relatively quick and effective means by which to analyze genetic suppression for desired phenotypic effects with implications in Biomedical Research. The experiment performed is based on the methods of Professors Andrew Z. Fire of Stanford University and Craig C. Mello of the University of Massachusetts Medical School, accredited with the discovery of RNAi. The nematode C. elegans was used as a model system. Plasmid DNA was purified from E. coli and transformed into an RNAi feeding strain. The transformed E. coli was fed to C. elegans to achieve transfection of the RNAi mechanism. Induced worms were observed and DNA was purified and analyzed via RT-PCR. The research potential for RNAi has broad and significant implications. The suppression of growth factors in humans can potentially halt the uninhibited angiogenesis associated with the proliferation of cancerous tumors. The suppression of oncogenes can prevent cancer from developing in high-risk patients. RNAi is relatively new, however, and there is much to be learned. Current research has promising and far-reaching medical implications, and C. elegans provides a plausible experimental context to study the effects of genetic suppression in genes homologous to human phenotypes.

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2. Student independently performed all procedures as outlined in this abstract.  ✔ Yes  □ No

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Finalist or Team Leader Signature  Date

403C12
Neuharth-Keusch, Danielle

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Blocking Antibiotic Resistance Via siRNA
Michael Jay S. Urgel
Dominion High School, Sterling, VA

Since the introduction of antibiotics, society has relied on products to ward off bacterial infections and diseases. However, overuse has deterred man’s ability to ward off infections. Antibiotic resistance has shown itself particularly in the case of Methicillin-Resistant Staphylococcus aureas (MRSA). This bacterium has depreated immune systems, particularly those found in high school and college students where MRSA has unfortunately become common. The purpose of this research was to determine whether the use of post-transcriptional gene regulation could suppress the gene for antibiotic resistance in Escherichia coli. Escherichia coli was subjected to siRNA which bound to the mRNA sequence of the Multiple Antibiotic Resistance Type A gene (MarA). This, in turn, prohibited the mRNA from binding to the promoter to allow the expression of this particular gene. Both experimental and control bacteria (which were not subjected to siRNA) were than plated with an ampicillin disk. Hence, the null hypothesis, MarA gene in E. coli could not be controlled via siRNA, was refuted. The results showed that the control group was resistant to the diffused antibiotics. The experimental group represented capitulation to the antibiotics, exhibiting zones of inhibition, which exemplifies the submission of the E. coli to the antibiotics. Society’s drive to extend lives has posed unintended consequences by creating superbugs—antibiotic resistant strains of bacteria. The implementation of the use of siRNA merits further explanation. This research shows that bacteria that could be antibiotic resistant may be treated in a new, novel way hence extending life and curtailing infection.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): 
   - human subjects
   - vertebrate animals
   - Potentially hazardous biological agents:
     - microorganisms ✓
   - rDNA
   - tissue

2. Student independently performed all procedures as outlined in this abstract. Yes ✓ No

3. Student worked or used equipment in a site other than school, field or home. Yes ✓ No

4. This project is a continuation of previous research. Yes ✓ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): Yes ✓ No

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[Signature]
Finalist or Team Leader Signature
February 20, 2008

Date

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404D12
Urgel, Michael
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The effects of chlorine on carbon filters was tested by subjecting different brands of carbon filters, to different concentrations of chlorine. This experiment was designed to determine if different concentrations of chlorine affect the ability of a carbon filter to filter out chlorine, and if so, which carbon filter performed and filtered chlorine the best. The experiment was carried out using 3 different brands of carbon filters and 4 filters of each brand. The experiment was performed by putting solutions of 4 liters and 2.5, 5.0, 7.5, and 10.0 milligrams per liter in one of each of the three different types of carbon filters. Trials were performed and results were recorded in parts per million (ppm) until each filter reached its failure point. (A consistent reading of 4.0 or higher) After all tests were completed the results showed the part of the hypothesis was correct and part of it was not. The results showed that chlorine concentration does affect the efficiency of carbon filters. The higher concentrations of chlorine generally yielded failure point sooner than the lower concentrations did. It was interesting though that the Omnifilter produced a wide and random range of results in all trials, leading up to failure point. It was also interesting that when the Omnifilter was confronted with 10.0mg/l that it seemed to lower results and filter more chlorine out until it eventually spiked up to failure point. Another filter, a homemade one out of a BioBag and a funnel, did not filter out any chlorine what so ever. This happened with all concentrations of chlorine, and produced the worst results. The hypothesis was wrong in that the Omnifilter did not perform the best in filtering chlorine. It had trials that it performed well in, but the readings were very random. The Dupont pitcher filter on the other hand was very consistent and it gradually worked up to failure point. With the Dupont you could generally make an educated guess as to what reading was coming next. The Results of the experiment didn't turn out all of what they were expected.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - human subjects  
   - vertebrate animals  
   - Potentially hazardous biological agents:  
     - microorganisms  
     - rDNA  
     - tissue  
   - Yes  
   - No

2. Student independently performed all procedures as outlined in this abstract.

3. Student worked or used equipment in a site other than school, field or home.

4. This project is a continuation of previous research.
   - Yes  
   - No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):
   - Yes  
   - No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research.
I/We also attest that the above properly reflects my/our own work.

[Signature]
[Date]

501C10
Czupak, Christopher
The Use of Polymers in the Prevention of Fresco Degradation
Clara R. Everhart
Dominion High School, Sterling, Virginia

Cultural heritage, passed from generation to generation through art, was explored by Renaissance artists in creation of frescoes. These cultural icons have been damaged over time by human-produced pollutants such as incense and candle smoke. The purpose of this research was to determine the efficacy of glacial acetic acid in the cleaning of smoke-damaged frescoes. Small frescoes were created and uniformly exposed to damaging incense smoke. A glacial acetic acid and silica mixture was added to porous rice paper which was then placed on the fresco. The null hypothesis, that there would be no change in the condition of the damaged frescoes, was refuted. Ash residues were removed via the chemical cleaning process without major degradation of the frescoes themselves. Further research would entail the addition of pressure to aid in the application of the glacial acetic acid/silica into uneven crevasses of the frescoes. This research has indicated that the use of glacial acetic acid as an art cleaner is merited.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

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502D12
Everhart, Clara

Finalist or Team Leader Signature: Clara R. Everhart
Date: 2/15/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Salt on the Amount of Hydrogen and Oxygen Produced During Electrolysis
Cullen Fleming
Stone Bridge High School, Ashburn VA

Hydrogen is the future fuel of a greener world. The purpose of this experiment was to compare the relationship between salt water and the amount of oxygen and hydrogen produced during electrolysis. This experiment tried to determine that if the amount of salt was increased then the amount of hydrogen and oxygen would increase.

Procedures for this experiment were as follows: add increasing amounts of salt to a beaker of water, drop a 9-volt battery into the beaker, place a graduated cylinder full of water upside down over the battery in the beaker, let the experiment sit for 5 minutes, and measure how much gas was produced. The independent variable in this experiment was the amount of salt added. The dependent variable in this experiment was the amount of hydrogen and oxygen produced.

Results from this experiment showed that when salt was added to water before electrolysis that the amount of gas produced was greater than water that had less salt in it. However, when 4g of salt were added and 6g of salt were added there was no significant increase in the amount of gas produced.

In this experiment it was concluded that if salt is added to water it increases over the previous amount added, up to 4g of salt. However, when 6g of salt is added it does not have a significant increase over 4g of salt. Plans for further research are to study the effect of temperature of water on the amount of gas produced.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects Potentially hazardous biological agents:
□ vertebrate animals □ microorganisms
□ microorganisms
□ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes ☑ No

4. This project is a continuation of previous research. □ Yes ☑ No

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Cullen Fleming 2/20/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Different Antioxidants on the Oxidation-Reduction Reaction of Hydrogen Peroxide
Lesley Lugrinbill
Briar Woods High School, Ashburn, VA

In this experiment, five antioxidants, carotenoids using carrots, vitamin E using vegetable oil, vitamin C using blueberries, polyphenol using green tea, and a mixture of antioxidants using a dietary supplement called Golds Specifics Antioxidant Free Radical Formula, were tested using the decomposition of hydrogen peroxide to measure their anti-oxidation strength.

The effect of the antioxidant on the oxidation-reduction reaction was measured by the pressure (kPa) change inside the reaction test tube over an interval of 450 seconds, using a LabPro and Vernier Gas Pressure Sensor. After testing was completed and the averages were found, the hypothesis that the antioxidant supplement would have the largest effect on the oxidation-reduction reaction of hydrogen peroxide was proven correct when the null hypothesis that the antioxidant would have no effect was rejected using the t-Test.

Although the antioxidant supplement, with a P value of 4.06306E-09, had the largest effect, the green tea (P value=5.22898E-06) and blueberries (P value=0.0018788) had strong effects on the reaction as well, represented by a decrease in pressure change. The carrots and vegetable oil also appeared to have an effect on the oxidation-reduction reaction with P values of 0.004836461 and 0.00762538 but the data from these trials did not have consistent variance. It is also possible that other factors, such as the nonpolar property of vegetable oil, could have had an effect on the pressure change. Thus, antioxidant supplements are an excellent dietary option, but organic antioxidants, like green tea and blueberries, are suitable alternatives as well.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents:
   ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. Yes ☐ No

4. This project is a continuation of previous research. ☐ Yes ☐ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☐ No

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Lesley Lugrinbill 1/30/08
Finalist or Team Leader Signature Date

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The Relationship between Liquid Substances and their Absorbency in Man-Made versus Natural Fabrics

Lindsey Neimo
Briar Woods High School, Ashburn, VA

The purpose of this experiment is to determine which fabric, whether it is natural or man-made, is the most absorbent. By comparing the amount of grape juice and tomato sauce absorbed by each fabric in comparison to its absorption of water, polyester, plastic based fleece, and wool were the most absorbent. The results showed that all three of these fabrics were able to absorb almost, if not all, of the tomato sauce and grape juice. In the polyester comparison with grape juice,.98mL out of 1mL was absorbed. Wool with tomato sauce was remarkable because it absorbed the entire milliliter, as did plastic-based fleece. On average, the natural fabrics absorbed about .71mL of water, while the man-made fabrics on average absorbed only about .63mL of water. For the grape juice tests, the natural fabrics on average absorbed about 67% of the one milliliter and again, the man-made fabrics only absorbed less, with about 61% of the liquid absorbed. Finally, in the tomato test, the natural fabrics absorbed 76% on average, and the man-made fabrics absorbed 68%. Even though the results on average show that the natural fabrics absorb more, the polyester and plastic based fleece both absorbed 99% of each of the three liquids on average. These results help to show that the original hypothesis of the man-made fabrics being more resistant to any absorbing was incorrect. In conclusion, a quick mess can become a quick clean by using a polyester, wool, or plastic-based fleece rag.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals

Potentially hazardous biological agents:
□ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. Yes □ No

3. Student worked or used equipment in a site other than school, field or home. Yes □ No

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Lindsey Neimo
Finalist or Team Leader Signature
Date 3/1/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Acid Rain on D.C. Monument Materials

Smith, Andrew
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The amount of erosion caused by acidic water similar to acid rain was investigated by exposing 6 limestone samples, 2 of them treated with a protective coating, to 2 different water types. This was to determine if treating 2 limestone samples with a sealant would slow down the erosion caused by acidic water. In part 1, 6 limestone samples (2 treated) were exposed to acid water and distilled water. The 2 treated stones and 2 of the untreated ones were exposed to the acid water, while the 2 other stone samples were exposed to distilled water. Over the course of about 2 months, the stones were periodically checked for erosion by feeling along the surface for any “pits,” which were measured on a scale of 1-4, with 1 being no visible erosion and 4 being severe. The most that Group 1 (untreated-neutral) got was a 2, Group 2 (untreated-acid) was a 3, and Group 3 (treated-acid) got up to a 4 on the scale. These results supported the hypothesis that the limestone samples exposed to acid would erode faster than those exposed to distilled water, but refuted the one that the treated samples would erode slower than the untreated ones exposed to acid water. In part 2, the stones were cut in half using a wet saw and a caliper was used to measure the thickness of the eroded areas and compare them to the untouched areas. The pre- and post-test measurements gained from each sample roughly conformed to the erosion scale previously used. A t-test was run for the first 2 groups (P=0.1, df=2, and a calculated t value of 3.261 for acid vs. neutral) and it was concluded that the difference between acid water erosion and distilled water erosion was statistically significant. Another t-test for groups 2 and 3 (P=0.1, df=2, and a calculated t value of 1.133 for treated vs. Untreated) indicated that there was no significant difference between exposing acid water to a treated limestone sample and an untreated sample.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects  □ vertebrate animals  Potentially hazardous biological agents: □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes  □ No

4. This project is a continuation of previous research. □ Yes  □ No

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Finalist or Team Leader Signature ___________________________ Date ___________________________

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The Wash Effect on a Flame Retardant Fabric
Megan Vahsen
Loudoun County High School, 415 Dry Mill Road, Leesburg, VA, 20175, USA

The actual flammability of a flame retardant fabric was investigated by washing guaranteed flame retardant fabric swatches at seven different intervals of washings (from a group with zero washes to a group with sixty washes: each group by intervals of ten). The time it took for the swatch of fabric to ignite once 1.5 cm over an open flame was measured as the igniting time. The time it took for the fabric to self-extinguish after it was ignited was measured as the self-extinguishing time. If the fabric did not either ignite or self-extinguish, it was marked as so. The hypothesis that the flame retardant fabric would lose its flame retardant qualities before the group with fifty washes was not supported. In fact, a t-test was run (P=.05, df=18 and a calculated t-value of 3.8973) and the igniting times between the first group with zero washes and the last group with sixty washes had a significant difference. Because some swatches never ignited, an average time of how long the fabric was left to melt and finally marked as "did not ignite" was calculated (about 23 seconds) and used within the averages of the t-test. Another t-test was run (P=.05, df=12 and a calculated t-value of .25488) of the self-extinguishing times of the first and last groups, and concluded there was no significant difference between the actual self-extinguishing times. These results refuted the hypothesis. The safety of the flame retardant fabric was augmented as the number of washes increased shown from the significantly longer time it took for the fabric to ignite.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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Megan Vahsen 2/13/08
Finalist or Team Leader Signature Date

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Computer Science (600)

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Keystroke Fingerprints: The Use of Typing Behavior in Computer Security Systems
Sara Barta
Dominion High School, Sterling, VA

In the technological age that is the twenty-first century, computer security systems have become imperative to the confidentiality of personal information. Modern security systems have improved to include features that can identify individuals based upon a distinct typing pattern as well as a password. The intent of this research was to determine whether or not differences in typing patterns existed among different age groups and genders. If so, pattern-based security systems in schools may need to be re-evaluated if they are based on adult typing behaviors.

It was hypothesized that no significant difference in typing patterns among elementary students, high school students, and adults would occur, nor would there be any difference between genders. In order to identify the individual typing patterns, each subject typed a small paragraph into a program which calculated the words per minute, the number of mistakes, and the number of mistakes per minute. The data collected was analyzed via the t-test and the Pearson R correlation test to determine the significance of the differences in typing patterns among different age groups and genders.

The null hypothesis was both supported and refuted. There was a noticeable difference in the typing patterns of adults, teenagers, and children; there was no significant difference in the typing patterns of males versus females. Further research would entail the development of a security system that would identify individual keystroke patterns to prevent access to inappropriate websites, and the assurance of the protection of personal information for individuals.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☑️ human subjects
   ☐ vertebrate animals
   ☑️ microorganisms
   ☐ rDNA
   ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑️ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑️ Yes ☐ No

4. This project is a continuation of previous research. ☐ Yes ☑️ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☑️ Yes ☐ No

I/we hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/we also attest that the above properly reflects my/our own work.

Sara Barta
02/19/2008

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Comparison of Random Numbers Generated by Different Microprocessors
Kevin Chang
Broad Run High School, Ashburn, Virginia

The purpose of this project is to determine if the advancements of the microprocessors affect the random numbers generated by the computers. The objective is to confirm that the more advanced the microprocessors are, they would generate numbers that are randomly distributed. The two types of microprocessors used to be compared in this experiment are Windows Vista and Windows XP.

The experiment is run by a program written in Java for the purpose of generating random numbers. It generates random numbers between one and ten and adds each random number to the sum for two million times, then divides the sum by two thousands in one run. Ten runs are performed for each microprocessor and the overall average for each run is obtained. The expected average is five thousand.

The data shows that the computer with the more advanced microprocessor (Windows Vista in this experiment) generated numbers more random than the computer with the less advanced microprocessor (Windows XP in this experiment). In addition, the average of one run of the less advanced computer varies within a much wider range.

The results between two computers were not significantly different. A possible reason might be that the time between the developments of two computers is not significantly long. Comparison of microprocessors developed at times further from each other may show a more convincing trend.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - human subjects
   - vertebrate animals
   - Potentially hazardous biological agents:  
     - microorganisms
     - rDNA
     - tissue

2. Student independently performed all procedures as outlined in this abstract.  
   - Yes  
   - No

3. Student worked or used equipment in a site other than school, field or home.  
   - Yes  
   - No

4. This project is a continuation of previous research.  
   - Yes  
   - No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   - Yes  
   - No

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Kevin Chang  
Finalist or Team Leader Signature  
2/06/08  
Date

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The Comparison Between Single and Dual Graphics Processing Units on the Performance Increase of Graphical Benchmarks in Frames per Second.
Zakkery G. Hassall
Stone Bridge High School, Ashburn, Virginia

The purpose of this experiment was to determine the increase in performance of computer graphics when a second video card was added to a computer. In addition the different types of frame renders, split frame rendering (SFR) and alternate frame rendering (AFR), were tested. The performance was tested using the many graphics tests within the benchmarks of 3DMark06, 3DMark 05, 3DMark 03, 3DMark 01, and Aquamark 3. Nvidia and Tech Hounds official data for the testing of the graphics increase conflicted. This project aimed to sort out the discrepancies of their data.

The experiment tested a single video card versus dual video cards of the exact same Graphics Processing Unit, in AFR and SFR, as the original to the motherboard. The next step was running benchmarks to measure the resulting number of frames per second.

Adding the second video card gave the computer about a 40% graphics performance increase. The amount of frames per second when adding a second video card showed a significant increase, but not as much as Nvidia had stated. People across the world had posted in forums as well as Nvidia had stated that an 80% performance increase could be found but that was not supported in this project. However the performance difference of SFR and AFR was not significant because they only differed by .37%.

Using two graphics cards had a 40% performance increase because it allowed the two cards to split the total workload. There was not much difference between SFR and AFR because they are different ways that the two cards interact with each other. Extensions on this project could include testing the performance increase using different components including motherboards, memory, processors, etc. to see if they limit the video card’s communication and data transfer rate.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects Potential hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue
   ☐ vertebrate animals
2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No
3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☐ No
4. This project is a continuation of previous research. ☐ Yes ☑ No
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Finalist or Team Leader Signature: 02/19/08

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603S10
Hassall, Zakkery
A Software Application To Test Human Perception Of Time

Brian D. Kuo
Potomac Falls High School, Potomac Falls, VA

Everybody hates to wait. Figuring out a way to make the time people spend waiting less boring would benefit many people. Time perception is a complex topic, and is hard to measure accurately. This project is a prototype software application that will help scientists determine what makes time "fly" and what makes time "crawl".

This application runs two tests, or "games" after receiving informed consent from a test subject. The first test is a "target-click game", designed to be stimulating and interactive. The second test, an "equation game", is designed to bore the subject, but provide minimal activity to keep the subject's attention. The application then asks the subject questions to understand their perception of time during each game. It then asks for demographic information, and stores all data in a file for later use.

This project uses an engineering method. First, a need was defined, and design criteria and requirements were developed. Next, a preliminary design was developed. Then, a prototype was developed and tested against the requirements. After review with a biostatistician, a second prototype was developed. This prototype passed all requirements tests, and meets the user's need for a repeatable method for testing human perception of time.

Future development should include beta testing (after ISEF approval), to improve on the psychology aspect of this application. Following beta testing, the actual psychological testing of human subjects should begin. The data collected by the application would be used to better understand how to keep waiting from being so frustrating.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

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Brian Kuo 2/11/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between the Number of Mega Pixels and Image Quality
Anna McQuitty
Freedom High School, South Riding, Virginia

Consumers buy cameras with 6, 8, and even 10 mega pixels in an attempt to take the best quality pictures. Many are unaware of the relationship between the mega pixel count and the quality of the image after it has been cropped. In order to test this relationship, an experiment was designed to address the question of does the mega pixel value of a camera really affect the image quality of a photograph?

Scientific research was used to test the following hypothesis. If a picture is taken at a higher number of mega pixels, then the image quality will be better when the photograph is cropped. The process included taking pictures of an intricate photograph along side a font scale created by the experimenter. A camera with 2, 4, and 6 mega pixel settings was used. In every trial, each picture was cropped (trimmed) using Adobe Photoshop CS2. Then, each was printed in 4"×6" and 8"×10" sizes. The prints were studied and compared to the original uncropped images that served as controls for the experiment.

A Chi-square statistical test was used to analyze the data in order to find variations in font size and clarity. The frequency distribution of the overall clarity for the 2, 4, and 6 mega pixel was significantly different from the frequency distribution predicted by chance.

The results of the experiment supported the hypothesis. The 6 mega pixel camera takes pictures of better quality, but, as shown by the results, the 2 and the 4 mega pixel were quite adequate depending on the photographer’s intent. Consumers may be spending money on a camera with more mega pixels than they need.

Through further study, the experiment could be tested again with a wider range of cameras, perhaps with different brands or higher mega pixel counts such as 10. Other aspects of photography could be tested as well, such as lighting, shutter speed, lense types, or a difference in the skill level of the photographer. This experiment serves as a point of reference for consumers who are in the market to buy a new digital camera.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   ☐ human subjects  ☐ vertebrate animals  ☐ microorganisms  ☐ rDNA  ☐ tissue
   Potentially hazardous biological agents:

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes  ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes  ☐ No

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I also attest that the above properly reflects my/our own work.

Anna McQuitty  2.7.08

Finalist or Team Leader Signature  Date

605F10 McQuitty, Anna

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Cryptosteganography: Improved Data Security
Kyle N. Morgan
Heritage High School, Leesburg, Virginia

This study investigates methods of hiding sequences of bytes into image files so that the image files will be parsed normally and the extraneous bytes will go unnoticed. Two results were found, each with advantages and disadvantages.

The first result involves simply appending the bytes to the end of an image file. There were two major disadvantages. First, the size of the file increases based on how large the hidden message is, so large messages could cause the file to take up an abnormal amount of space. Second, this method only works on JPEG images. The major advantage to this method is that the resulting image does not suffer from discoloration or loss of clarity.

The second result involves splitting up each colored pixel into three bytes, and changing the least significant bit to a desired value. Three UTF-8 encoded characters can be hidden within eight pixels. There are two disadvantages to this method. First, the image suffers from very slight discoloration. Second, the size of the hidden message can be limited by the size of the image. The major advantage to this method is the size of the file does not change at all.

Both results accomplish the same task, but each have different advantages and disadvantages. The second result is generally better for most purposes, but cannot be used to conceal extremely large message, which is when the first result is usually the better option. Furthermore, the second result could be adapted for other types of multimedia files.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents:
   □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work.

[Signature]
Finalist or Team Leader Signature 2/21/08 Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
## Earth & Planetary Science (700)

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<td>How Weather Affects Satellite Signals</td>
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</table>
Page left blank intentionally.
The Effect of Increasing Carbon Emissions and the Temperature
Bice, Nathanael W.
Broad Run High School

Over the years the amount of snowfall in the Ashburn area has seemingly decreased. This observation has sparked the idea that possibly the temperature is rising and preventing the rain to freeze enough to become snow. Due to the fact that the carbon emissions in this area have increased over the years, more heat from the sun has been trapped in the atmosphere. This is the reason the temperatures have been rising in the past years.

In this experiment there has been research into the past 44 years’ average temperatures. This data was then placed in a table for analysis. A Pearson r test was performed to find the correlation between the temperature and the time. An average measurement for each month, year, season, and half year since 1963 was taken. The data was then graphed on a line graph. The independent variable is the time at which the temperature measurement was taken. The dependent variable is average temperature at each measurement.

In this study it was concluded that the hypothesis was supported. The carbon emissions have increased and so has the average annual atmospheric temperature. This increase in temperature is not linear and therefore cannot be predicted accurately.

In closing there are several questions that have yet to be answered by this experiment. First and foremost, how do we prevent or slow the effects of the carbon emissions? Second, how do we counteract the effects that we are already experiencing, if possible? These are very good questions not answered by this project. Also there is a possible human error in several areas of the project.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research.
I/We also attest that the above properly reflects my/our own work.

Nathanael Bice 02/04/2008
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Urbanization on Yearly Average Temperature
Angie Cerimele
Heritage High School, Leesburg, VA

The purpose of the experiment was to identify a positive relationship between the urbanization of a rural area to urban area change and its effect on the yearly average temperature.

Population data was collected from the U.S. Census Bureau from both Loudoun County and Arlington/Alexandria counties. Years of 1960-2000 were looked at for Loudoun County and years 1940-2000 were observed for Arlington/Alexandria County. This data was then compared with the yearly average temperature data collected from the National Climate Weather Center in corresponding years. Data was analyzed and numerous tests were conducted such as the T-test and Pearson R, which both rejected the null hypothesis. Most importantly a positive correlation was concluded between the increasing urbanization and yearly average temperature to end a very successful experiment.

A topic question brought up was: Does albedo change also effect the yearly average temperature, and if so in which ways? This question could provide solid proof as to why several urbanized areas have a higher temperature trend than other areas surrounding its nearest borders. Lastly, another topic question that was imposed upon as the experimentation went on was: Will the yearly average temperatures remain to steadily incline as the growth in well populated areas also increases? Could this be the new beginning of a global melt-down?

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I/We also attest that the above properly reflects my/our own work.

Angie Cerimele
Finalist or Team Leader Signature 2/19/08

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The Relationship Between Temperature and The Mass of Crystals

Ryan Finnegan
Heritage High School, Leesburg, Virginia, United States of America

The project relates to salt crystals and how their mass varies based on the environment they are formed in. The experiment included three different temperature environments in which salt crystals were formed to test which environment would produce the crystals with the highest mass. The hypothesis formed before the experiment was "If the temperature of the surrounding area of the salt crystal is increased, then the mass of the salt crystal will be greater."

The dependent variable was the mass of the crystals and the independent variable was the temperature of the environment. The salt crystal solutions were put into three different environments which were each at a temperature 1.6, 18.3, and 35 degrees Celsius. The 18.3 and 35 temperature environments were not good for a crystals mass however the 1.6 degree temperature was much better.

In conclusion, the 1.6 degree temperature was much better for the mass of the salt crystals where as the 18.3 and 35 degree temperature were nearly equal in the ineffectiveness for the formation of the crystals. This is shown in the statement: at df=14, =0.5, x2= 7.815 for significance; the calculated x2 of 15.58 is greater than 7.815 and is significant. The null hypothesis is rejected and the research that crystals would have a larger mass when grown in a colder environment is supported.

If further research was to be conducted, then the person who was conducting the experiment would need to monitor the pressure of the environment so as to limit the possibility of error.

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Ryan Finnegan
Finalist or Team Leader Signature 7/20/08

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The Correlation of Carbon Dioxide and Hurricanes
Michael J. Fowler
Briar Woods High School, Ashburn, VA

The purpose of this project is to test whether the concentration of carbon dioxide in the atmosphere affects the severity of hurricanes. This will help weather forecasters better predict future hurricane seasons.

By the theory of global warming, as the concentration of carbon dioxide increases so will the temperature of the oceans. Consequently, a rise in sea surface temperatures will result in more severe hurricane seasons. This project uses data on carbon dioxide concentrations, Atlantic sea surface temperatures, and Atlantic hurricanes to test this theory. The three sets of data are broken down into one year averages from 1981 to 2004. Each set of data is compared to the other two in graphs. For each graph the Pearson r correlation coefficient is calculated to mathematically show whether a correlation exists among the three sets of data.

For the graph comparing carbon dioxide concentration to hurricane intensity a modest correlation is found. The graph comparing carbon dioxide concentration to sea surface temperature has a poor correlation. Finally, the graph comparing sea surface temperature to hurricane intensity has essentially no correlation. The results show a possible correlation between the concentration of carbon dioxide and the intensity of hurricanes, but not through the series of events stated above.

The results support the hypothesis that if the concentration of carbon dioxide increases, then the intensity of Atlantic hurricanes will increase. Further testing should be done to discover the true cause of the increase in hurricane activity, thereby saving lives with more accurate weather predictions.

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2. Student independently performed all procedures as outlined in this abstract. Yes No

3. Student worked or used equipment in a site other than school, field or home. Yes No

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Michaell Fowler, Michael

Finalist or Team Leader Signature 7/31/08

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The Effect of Lava Viscosity on Lava Flows Near Olympus Mons
Kristin E. Hopper
Academy of Science/ Potomac Falls High School, Sterling, Virginia

Mars has been the topic of research for scientists for years. By understanding more about Mars, it’s possible that we’ll learn more about Earth. I’m observing Olympus Mons’ lava flows to Mauna Loa’s and Mt. Vesuvius’ lava flows to estimate the viscosity of the lava flows on Olympus Mons. By comparing a Martian shield volcano to Earth shield and composite volcanoes, my project will be able to demonstrate how similar volcanoes on Mars are to volcanoes on Earth, and how these similarities can be used to estimate the viscosity of a feature and other calculations without having to be there in person.

My hypothesis is if the length and widths of lava flows near Olympus Mons are measured and compared to the lava flows of Mauna Loa and Mount Vesuvius on Earth, and they show comparisons to the lava flows of Mauna Loa, then the average viscosity of lava flows near Olympus Mons is a low lava viscosity. I will estimate whether Olympus Mons’ lava flows have a low or high viscosity by comparing the averaged length, width, and depth of the lava flows on these volcanoes. I have made the necessary measurements using satellite photos of the volcanoes and by using the ruler tool in Photoshop. Next I will see how effective this method of estimation of viscosity is by using a formula to calculate the viscosity of lava flows on Olympus Mons. The formula to calculate viscosity is from J. Zimbelman’s research. My advisor is Mr. Writer.

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   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

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Kristin Hopper 2/25/08
Finalist or Team Leader Signature Date

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How Weather Affects Satellite Signals
Kevin Lohr
Loudoun Valley High School, Purcellville, VA, United States

The purpose of this experiment was to determine the effect of weather on the transmission of satellite signals. The results of the experiment could be used to improve the transmission of these signals in the future. It would also be useful to determine what type and how much of a certain inclement weather would have a negative effect on signal strength.

To begin this experiment, one must start with a DirecTV satellite dish connected to a receiver. Choose three stations, preferably ones that do not receive signals from the same satellite. Take readings from each station under the signal strength menu four times a day: at 6:00 AM, 12 Noon, 4:30 PM, and 8:00 PM. Continue this regimen until the desired amount of data has been collected.

For most of the trial period, which lasted from summer until spring, the data was very consistent. The 6:00 AM readings and 8:00 PM readings were almost always the weakest, with a range of 68-85. However the 12 Noon and 4:30 PM readings were very strong, with a range of 79-92.

At the conclusion of data collection, several correlation tests were run to see what kinds of meteorology variables would affect signal strength the most. It was hypothesized beforehand that these variables: barometric pressure, relative humidity, temperature, and cloud coverage, would affect signal strength. In the end, most of the correlations were from -0.05 to 0.05, which is very close to 0, meaning there is no correlation. Over a period of heavy rainfall, signal strength was measured over 24 hours, and the correlation was -0.89. This shows that falling precipitation has the greatest effect on signal strength.

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   Potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue

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Kevin Lohr
2/12/08

Finalist or Team Leader Signature Date

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## Engineering:
### Materials & Bioengineering (800)

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</tbody>
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The Effect of Cork, Rubber Balls, and Sawdust in a Wooden Baseball Bat, on a Baseball's Distance

John Brookbank
Stone Bridge High School, Ashburn, VA

For years in Major League Baseball, professional players have been caught "corking" their bats to cause the baseball to travel a greater distance. MLB has been cracking down on this rule, but they need to understand which bat filler the players are using to maximize their hitting abilities. This experiment was designed to argue whether or not filling a wooden baseball bat has an effect on how far the baseball travels off of the bat.

In this experiment three wooden bats were filled with cork, rubber balls, or sawdust. These were the independent variables. One bat was solid and labeled the control. A batting mechanism was constructed to swing each of the bats, and the distance was recorded for 15 trials. The distance the ball traveled for each of the bats was the dependent variable.

As a result of the experiment, the sawdust caused the ball to travel an average distance of 232 cm. The hypothesis (the rubber balls would make the ball travel farther) was rejected because the rubber balls were predicted to cause the ball to travel farther, but they actually decreased the distance the ball traveled.

One question that should be asked, is how the way the bat filler is placed in the chamber of the bat? Whether or not the filler was crumbled could cause different results. There was also space between the rubber balls and the cork inside of the bats. This experiment puts a label on how the professional baseball players are able to cheat in the MLB.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   □ human subjects  
   □ vertebrate animals  
   Potentially hazardous biological agents:  
   □ microorganisms  
   □ rDNA  
   □ tissue

2. Student independently performed all procedures as outlined in this abstract.  
   ✓ Yes  
   □ No

3. Student worked or used equipment in a site other than school, field or home.  
   □ Yes  
   ✓ No

4. This project is a continuation of previous research.  
   □ Yes  
   ✓ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   □ Yes  
   ✓ No

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I/We also attest that the above properly reflects my/our own work.

John Brookbank  
Finalist or Team Leader Signature  
2/20/08  
Date

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Parachute Declination and Accuracy Determined By Shapes
Eric K. Dang
Park View High School, Sterling, Virginia

Parachutes have provided people with a way to fall thousands of feet without injury and by creating differently shaped parachutes, there could be another approach in falling from the sky.

This experiment deals with fourteen differently shaped and layered parachutes that are dropped and measured on how fast the parachute fell as well as where it fell. Each parachute was constructed on one of the seven different shapes and was given either one or two layers of nylon material. All parachutes were self-constructed from raw materials and were tested inside a building.

After testing was completed, the results came in as inconclusive. No trends between any parachutes were found to show that shapes or layers played a role. However, it was shown that the weight of the parachute, as well as the parachute passenger, could have possibly been a factor. Results for the two-layered parachutes could not have been attained as they became too heavy and collapsed quickly after opening.

The results neither supported, nor rejected the hypothesis. Weight of the parachute overcame the effect of shapes and created an experiment for a different purpose. Instead of testing a controlled experiment on the effects of shapes on a parachute, it tested an uncontrolled experiment on parachute weights. To help correct this, further testing on differently shaped parachutes with a heavier passenger bases would be necessary in order to help keep the parachute from falling faster than the passenger.

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2. Student independently performed all procedures as outlined in this abstract. Yes □ No □

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Eric Dang
Finalist or Team Leader Signature 2/13/08

802V10
Dang, Eric

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
How Lateral Soil Pressure Affects Retaining Walls
Marina O. Guirguis
Freedom High School, South Riding, Virginia

What can retaining walls do for you? Retaining walls help the community in various ways. Civil engineers use retaining walls in many different ways, including landscaping and holding back soils from falling over into highways. What could go wrong? If the earthly material behind that wall fell onto the highway with many cars driving through, that could be fatal to many lives. It is important to make sure the retaining walls are sturdy enough for the material it is holding back.

Retaining walls cannot be solely responsible for holding back too many heavy things. To make it easier for the retaining walls, it is important to put soils with the least amount of pressure behind the walls. In order to detect which soil is the most ideal, four soils were tested against a model retaining wall. The lateral soil pressure each soil applied to the model was measured in Newtons.

The two most ideal soils to put behind the model were top soil and foundry sands. Though foundry sands seem to be used frequently as a common backfill, top soil appeared to be more suitable of a soil. Gravel was not a favorable soil to put behind a retaining wall. The particles of the gravel are much larger than the particles of the foundry sands and top soil. The smaller particles fit into spaces without causing as much pressure. Therefore, the hypothesis was supported and top soil and foundry sands were the choicest soils to use behind a retaining wall.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

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Marina O. Guirguis
Finalist or Team Leader Signature 01/30/08

Date

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In the world of theatre, the desire to create illusions of reality is pressing. To simulate actuality while hiding behind the facade of the stage is a constant challenge. The purpose of this experiment was to test different types of machine produced, glycol based fog to determine which would produce a realistic ground-hugging fog. (Not unlike the clichéd fog of the eerie cemetery movie scene) By comparing two different types of fog: a hot fog directly from the machine, and a cold fog directed through a chiller, it was hypothesized that the cold fog would last longer before dissipating and that less fog would be required to fill a defined space.

After testing, the results showed that the cold fog did indeed remain longer in the predetermined space and that it required significantly less fog to fill said space. These findings can help anyone with a flair for dramatics; be it the professional theatre technician or the avid Halloween enthusiast.

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   □ tissue

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I/We also attest that the above properly reflects my/our own work.

Hess, Aaron

804W12

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Type of Drying on the Density of Drywall Compound
Patricia D. Hicks
Loudoun Valley High School, Purcellville, Virginia

This experiment was conducted to see if the way drywall compound dries affects its density. Drywall was measured into Tupperware containers and allowed to dry in one of three styles: normal room settings, heated and dried in an oven, or dried using a vacuum pump. The normal room setting trials were the control for this experiment. Each of the drywall blocks were then removed from the Tupperware and the mass was taken and the density was calculated using a small piece of the drywall. The small piece's volume was calculated using volume displacement and then the density was calculated. For the oven baked drywall, the average mass was 114.119 grams and the density was 2.022 g/mL. For the vacuum pump dried drywall compound both the average mass and the average density were lower than that of the oven baked trials. The setting or technique that is used to dry drywall compound does seem to affect the density of the compound although only slightly with these three techniques.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/WWe also attest that the above properly reflects my/our own work.

Patricia Hicks
02/12/2008

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805L12
Hicks, Patricia
The Relationship Between Bridge Designs and the Amount of Mass They Can Hold
Andrew Holcomb
Heritage High School, Leesburg, VA, United States

Bridges are complex structures that are used for means of transportation. The stronger the bridge, the safer it is. The purpose of this experiment was to test which type of bridge design would hold more mass, a beam design or an arch design.

Fifteen bridges of each design type were constructed of balsa wood for the experiment. The strength of each bridge design was tested by adding mass that was measured by a digital fish scale. The largest mass held by each bridge before snapping was recorded and compared.

On average, arch bridges held more mass than beam bridges. As more mass was exerted on the beam bridges, they tended to bend and buckle before snapping. However the arch bridges maintained their engineered shape until snapping.

The arch design is structurally stronger than the beam design. These findings matched the literature regarding historical use and design of bridges. Through this experiment one can learn how arch bridges dissipate the forces put on them.

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Andrew Holcomb
Finalist or Team Leader Signature
2/12/08

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806H10
Holcomb, Andrew
The Effect of Colored Film on Solar Panel Absorption Percentage

Bilal Husain
Park View High School, Sterling, VA

The purpose of this experiment is to try and maximize the electrical output of a photovoltaic solar panel through manipulation of the light striking it. This science project relates to alternative fuel sources. The field of photovoltaics is a fast growing industry which benefits the environment by eliminating the need to burn fossil fuels that emit greenhouse gasses into the atmosphere and environment, and is potentially beneficial to the average consumer’s wallet. Thousands can be saved a year if a cheaper way to gather more solar energy in solar panels is discovered.

In this experiment, the color of the film being applied to the solar panel is the independent variable and the output in milli-amperes is the dependant variable. The solar panel was coated with film and the number of milli-amperes being put out was recorded by a multimeter. This study indicated that white light cannot simply be filtered to exclude all other colors except those with high amounts of photons, because it would only detract from the overall amount of photons hitting the solar panel. This finding refuted the hypothesis.

Possible further research stemming from the findings of this project includes the possibility of utilizing film that will not simply filter out all of the colors except its own, but instead convert the low photon colors into the high photon colors. Further research into the efficiency of semiconductors that are cheaply available and can produce more energy for solar panels may expand upon these findings.

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   □ human subjects  
   □ vertebrate animals

Potentially hazardous biological agents:
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   □ rDNA  
   □ tissue

2. Student independently performed all procedures as outlined in this abstract. ✓Yes  □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes  ✓No

4. This project is a continuation of previous research.  □ Yes  ✓No

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807V09
Husain, Bilal

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The Relationship Between the Diameter of Nickel-Titanium Wires and Their Shape Memory
Sara Iqbal
Freedom High School

Braces—everyone seems to have them these days. Nickel-titanium (NiTi) wire is a type of wire that is used for braces. They are shape memory alloys (SMAs), which means they present the shape memory effect and are very flexible. Shape memory effect is the ability of SMAs to be deformed and then returned to their original state by heating them.

For this experiment, different diameters of NiTi were tested at a constant temperature, 93\(^\circ\) C. The five different diameters included: 0.01524 cm, 0.02032 cm, 0.0254 cm, 0.03048 cm, and 0.0381 cm. They were coiled around the index finger six times, and were put in the oven at 93\(^\circ\) C. The time it took for the wire to return to its original shape was recorded.

The mean of the smallest wire, 0.01524 cm, was significantly higher than the rest of the wires. It took the longest to return to its original shape. The 0.03048 cm wire was the wire that took the shortest to return to its original shape, thus having the best shape memory.

The hypothesis, "if the diameter of nickel-titanium wire is bigger, it will take longer for it to return to its original shape," is refuted. The smallest wire does retain the shape the best, though, because it takes longer for it to change its shape. Usually, wires with bigger diameters are used in orthodontics, and it is because they perform the best shape memory effect.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  

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   - [ ] vertebrate animals  

   Potentially hazardous biological agents:  
   - [ ] microorganisms  
   - [ ] rDNA  
   - [ ] tissue  

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   - [ ] Yes  
   - [ ] No  

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   - [ ] Yes  
   - [ ] No  

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L/We also attest that the above properly reflects my/our own work.

Sara Iqbal  
1/31/08  
Findlist or Team Leader Signature  
Date

808F10  
Iqbal, Sara

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Creation of Polymer Micro-origami for Drug Delivery Systems
Nilofar Latifi
Dominion High School, Sterling, VA

Over 46% of Americans use at least one of the 3.5 billion prescription drugs sold in the United States daily. Studies have shown that often the elderly and children experience a hard time swallowing medicines in form of large capsules or tablets. The intent of this research was to create nanocapsules that would make ingestion of drugs easier for these individuals.

It was thought that nanostructures could be formed through the simultaneous folding of a polymer known as polydimethylsiloxane (PDMS). Various shapes were cut out manually from thin PDMS films and tested primarily via the use of water droplets. Due to the hydrophilic and capillary actions that occurred after a water drop was placed in the center of the precip polymer, the thin film rose, folded, and ultimately formed various nanostructures with respect to the shape in which they were cut. Additionally, drugs such as Rocephin and Claritin D were added to water and tested on the nanostructure. Pyramids, boxes, and tubes were effectively created with the drugs encapsulated inside. The null hypothesis that micro-origami could not by employed in the creation of nanocapsules out of polydimethylsiloxane, was refuted.

Further research would entail the use of other polymers, various shapes, and smaller dimension in order to create structures. The encapsulation of other drugs could be explored as could the creation of nanostructures in hopes of targeting specific cells in the body. This research indicates that further exploration of the efficacy of nanostructures in drug delivery is merited.

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   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. Yes □ No
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Nilofar Latifi 2/19/08
Finalist or Team Leader Signature Date

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The Relative Strength of Ice and Pykrete
Richard Meyer
Hamony Intermediate School, Hamilton, VA

The purpose of the experiments was to determine the melting rate and strength of pykrete relative to ice. During World War II, pykrete was developed for the purpose of creating large floating pykrete ships that would be unsinkable. The properties tested included melting rate, compression strength, impact resistance, and shear strength. A hydraulic press was used to apply compression and shear loads to samples of ice and pykrete until the samples failed. A weight was dropped from varying heights to determine impact resistance. The melting rates were determined by floating samples of ice and pykrete into separate containers of water. In the compression tests, pykrete outperformed ice by a factor of five to one in pressure. One observation from the compression tests is that pykrete buckled whereas ice shattered. In the shear tests, pykrete outperformed ice by a factor 1.4 times in pressure. An observation from the compression and shear tests is that pykrete results were more consistent than the ice results. For the impact resistance tests, ice stood a max of 0.9 Joules, whereas pykrete remained intact except for relatively small cracks under impact energies over a range of 8.3 Joules. Pykrete outperformed ice especially in the impact resistance tests, which was the original purpose for its development.

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Richard Meyer
Finalist or Team Leader Signature 2/21/08

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810109
Meyer, Richard
The Efficacy of a Sixth Century Venetian Well in Removing Bacteria from Potomac River Water.
Mitchell D. Phelan
Stone Bridge High School, Ashburn, VA

In the sixth century, the citizens of Venice had some of the cleanest drinking water in the world. By use of a relatively simple sand filter, they were able to greatly reduce the quantity of bacteria in their drinking water, thus improving their quality of life. The purpose of this experiment was to determine the efficacy of the filter in purifying water. The independent variable in the experiment was the treatment of the water, filtered or not filtered. The dependent variable was the growth of bacteria after culturing the water for 22 hours.

A model of the Venetian well was constructed using a plastic bucket and PVC pipes. The bucket was then filled with sand and covered with a sheet of fenestrated plexi-glass. Water was collected from the Potomac River. The water was cultured before and after filtering.

The bacteria colonies from the unfiltered water had coalesced, so bacteria were measured in percent covering the plates. The mean averages were 62.7% for unfiltered water and 0.2% for filtered water. The hypothesis was supported because the t-test showed a significant difference between groups (P<0.01).

The filter was highly effective in removing bacteria from heavily contaminated water. This research could provide insight into the efficacy of the Medieval technology for historians. Future research could compare this filter to contemporaneous technology in other regions of the world.

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Mitchell Phelan
2/21/05

Phelan, Mitchell

811S10

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A Comparison of Freezing Pipes
Paul Rachner
Park View High School, Sterling, VA

This experiment involves testing how long it takes plastic, copper, and galvanized steel pipes to freeze and then burst. The hypothesis was that the galvanized steel pipe would take the longest to break. Each of the three pipes took a different amount of time and each broke in either the middle or ends. One of each of the three pipes were placed in the refrigerator at the same temperature and for the same amount of time. Every thirty minutes to an hour the refrigerator was checked for any leaks or breaks in the pipes. As soon as the pipes were checked, data was recorded by trial, time, and size of the broken area. Even though the galvanized steel pipe was the strongest out of the three, it still eventually busted. The statistics were significant and that it showed that the galvanized steel pipe was the most durable out of the three pipes. This project effects society by allowing people to know how to prevent their pipes from freezing and then breaking.

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2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
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I/we also attest that the above properly reflects my/our own work.

Finalist or Team Leader Signature: Paul Rachner
Date: 2/5/08

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The Efficacy of Appropriate Technology Filter Materials on Bacteria Colony Removal in Water

Dexter Strong
Stone Bridge High School Ashburn, VA

In many developing nations, there is often lack in clean drinking water for the population. The purpose of this experiment was to create a filter that could be used in a developing nation to minimize pathogenic bacteria in the drinking water. The criteria included ease of construction, operation, maintenance, and efficacy. Three different filters were designed: (1) charcoal, sand, pebbles, (2) pebbles, sand, charcoal, (3) sand, charcoal, pebbles. Goose Creek water was collected and cultured before and after filtering. The independent variable was the order of the material strata, and the dependent variable was the reduction of bacteria from the pre-filtered and post-filtered samples.

All three filters tested showed efficacy with a maximum decrease in mean bacterial colony count of forty one percent. Filter (1) had a mean decrease of forty five percent, filter (2) had a mean decrease of forty two percent, and filter (3) had a mean decrease of thirty two percent. There was a significant difference between the means of the unfiltered water and the filtered water. (P<0.01) Because of this the null hypothesis was unsupported. The original hypothesis stated that filter (1) would be the most effective. The statistical analysis did not support the hypothesis, as filter (3) was the most effective.

Future experiments could be based on how size or if different filter medium used, would remove larger numbers of bacteria. Also, how effective are the charcoal and pebbles in the filters and whether they are necessary at all. Lastly, how much sand is necessary to decrease the bacteria level to zero?

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Finalist or Team Leader Signature 2/21/68

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813S11
Strong, Thomas
Effect of Non-Newtonian Fluids on Ballistic Fabric
James E. Thomas
LCPS Academy of Science, Sterling, Virginia

The purpose of this experimentation is to enhance ballistic fabric with the concentration on bettering the stab resistance of the fabric. This will be done by using a non-Newtonian fluid known as polyethylene glycol, and two different sizes of silica particles. The silica particles were suspended in the polyethylene glycol. Then that mixture was combined with ethanol so that it could be absorbed by the ballistic Kevlar. Using a sharp nail the resistance to puncture of the enhanced Kevlar with either large or small particles was tested and compared to the resistance of the non-enhanced Kevlar. The data showed that the enhanced Kevlar offered a greater resistance to puncture to the non-enhanced Kevlar.

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James Thomas 2/20/08
Finalist or Team Leader Signature Date

Thomas, James

814D11

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Electrospinning Fibers for Fibroblast Growth

Kelly A. Vorndran
Academy of Science, Sterling, Virginia

This project is being done to determine the degree to which cells could be cultured on electrospun fibers for use in tissue engineering. In order to determine to what extent the electrospun fibers would be useful, mats are to be electrospun either from polycaprolactone or a chitosan and polyethylene oxide (PEO) mix. These different solutions were chosen in order to show the influence of different chemicals on the growth of a cell culture.

Electrospinning at 6 to 15 kilovolts and different solution concentrations has been performed to date. Only PEO has resulted in a suitable mat. Current work with a chitosan and PEO mixture is resolving concentration issues. Additionally, layering of multiple solutions will be attempted.

This could eventually result in the creation of an environment ideal for cell/organ proliferation. This mat environment would fulfill multiple growth requirements required for a cellular scaffold supporting cell/organ growth.

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   - vertebrate animals
   - potentially hazardous biological agents:
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     - rDNA
     - tissue

2. Student independently performed all procedures as outlined in this abstract.
   ✔ Yes  ☐ No

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Finalist or Team Leader Signature  2/20/08

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The Relationship Between Temperature and the Breaking Point of a Guitar String
Brendan Yarbrough
Briar Woods High School, Ashburn, VA

The purpose of this project was to test what raising and lowering the temperature of nylon guitar strings would do to the strength of nylon high E guitar strings. To test this without ruining an actual guitar a mock guitar neck had to be constructed. This was made of a short piece of wood, some eye hole screws, and normal slotted flat head screw driver screws. The eye hole screws were the tie points and the slotted screws acted as the nut and bridge of a guitar. The strings were then attached and tuned to E and tested at room temperature, 150°F, and 32°F.

When testing was finished, it was found that guitar strings really only work best at room temperature, which was the control. It is best to keep nylon guitar strings at a moderate temperature to help them keep their strength. Heat weakened the structure and cold may have made the strings brittle. Research could still be expanded. Extreme heat and cold were not tested in this experiment. Also strings could be tested to see how well they hold their tune in different temperatures. There may have been some sources of error. The screws seemed to dig into the strings and weaken them before testing. Also, the tuner used was a little finicky.

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Brendan Yarbrough
Finalist or Team Leader Signature
1-30-06

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# Engineering:
## Electrical & Mechanical (900)

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<td>Thomas, Garrett</td>
<td>Diameter Advantage?</td>
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The Effects of Polarization on the Efficiency of Photovoltaic Cells

Joshua Fass
Broad Run High School, Ashburn, VA

Renewable energy sources that are non-polluting have drawn much interest in a time of global warming and increasing environmental awareness. Solar energy is very abundant and would be one of the most attractive candidates except that collection is inefficient. Polarization may have significant effects on photovoltaic cells.

The output voltage of a photovoltaic cell was measured when exposed to a constant light source and then when the light entering was polarized by a polarization sheet. This was repeated thirty times and the control voltage was weighted by the light transmission factor of the sheet to yield its efficiency. The control efficiency was compared to the experimental efficiency.

The control efficiency was found to be 4.6% more than the experimental efficiency. This means that polarization had a detrimental effect on the efficiency of photovoltaic cells.

From this, it can be concluded that for optimal efficiency, the light entering photovoltaic cells should not be polarized. Solar power plants often use reflectors to concentrate light onto photovoltaic collectors. If these reflectors are dielectrics, then they will polarize the light and reduce efficiency. Also, the moon polarizes light as sunlight reflects off of it and may damage photovoltaic cells if the detrimental effects are cumulative.

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Joshua Fass
Finalist or Team Leader Signature
February 4, 2008
Date
The Effect of size of skateboarding wheel on performance
Chris Frisicaro
Heritage High School, Leesburg, VA

This experiment tries to answer the question, “Do different size wheels on a skateboard effect the speed at which it spins.” The purpose of this experiment is to compare wheel size in skateboards to help aspiring skateboarders choose optimal wheel size.

The actual experiment was conducted by dropping a skateboard with different sized wheels (48mm, 52mm, 56mm and 58mm) down a ramp and timing how long it took to travel 12 meters. A total of 3 trials were conducted on each size and a t-test was completed to determine whether the data was statically significant. The independent variable was the size of the wheels and the dependant variable was the time it took to travel.

Through this experiment it was found that smaller skateboarding wheels are faster than larger ones in gaining speed. The overall result was that the smaller the wheel the faster the skateboard can go. The original hypothesis was refuted and the null hypothesis, smaller skateboard wheels are faster than larger ones was accepted. This experiment could lead to other finding regarding skateboard wheels. If this experiment were continued, it may be interesting to look at larger wheel traction compared to smaller wheel traction. This experiment can help aid new skaters in finding their true wheels.

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   Potentially hazardous biological agents:
   □ microorganisms □ rDNA □ tissue
   □ Yes □ No

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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I/We also attest that the above properly reflects my/our own work.

Chris Frisicaro 2/20/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Maximizing the Revolutions-Per-Minute of Hydroelectric Turbines
Morgan D. Hesket
Loudoun Valley High School, Purcellville, Virginia, United States

The purpose of this experiment is to determine what combination of water turbine orientation and structure maximizes the number of revolutions-per-minute (RPM) the turbine achieves in a unidirectional water flow, therefore increasing the potential energy yield of the turbine. A turbine was built using a three-inch long piece of two-inch diameter PVC pipe, with four same-length arc sections of a one-inch diameter PVC pipe screwed to its surface, each 90° apart from the others. Styrofoam discs were placed inside the two-inch diameter PVC pipe at either end in order to balance the turbine during testing. Using the water jets of a hot tub, four different orientation and structure combinations were tested: a horizontal free-floating axis (fishing line), a horizontal stationary axis (wooden dowel), a vertical free-floating axis, and a vertical stationary axis. For each of these combinations, three trials were run in which the turbine was allowed to spin for one minute while the number of revolutions the turbine made was counted. The order of increasing efficiency for the orientation/structure combinations based on their average RPM is as follows: vertical free-floating (42.667 RPM), vertical stationary (45.667 RPM), horizontal free-floating (46.667 RPM), and horizontal stationary (68 RPM). By over 20 RPM, the best orientation/structure combination for water turbines in a unidirectional water flow appears to be a horizontal stationary axis turbine. T-tests for this data prove that a horizontal axis is statistically better than a vertical one, while a stationary turbine functions better than a free-floating one, verifying the above conclusion.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
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   Potentially hazardous biological agents:
   ☐ microorganisms  ☐ rDNA  ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes  ☐ No

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I also attest that the above properly reflects my/our own work.

Morgan Heskett  2/20/2008
Finalist or Team Leader Signature  Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The purpose of this experiment is to find out how much energy is used by a toaster while it is idle and when it is active. By measuring the voltage of a toaster while it is idle and when it is active and then comparing them you can find out which uses more energy. I did this by plugging a toaster into a Kill A Watt Electricity Usage Monitor and then measuring the voltage of it while not in use for 1 minute 10 times. I then actually used the toaster and measured the voltage of it while it was toasting for 1 minute 10 times. The results of my experiment were that the voltage of the idle toaster was consistently higher than the voltage of the active toaster. This means that the idle appliance does indeed use more energy than the active appliance. This is important information because people can use this knowledge to make the decision to unplug their appliances when they don't use them on a regular basis to conserve energy and save money on their electricity bills.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): [ ] human subjects
   [ ] vertebrate animals
   Potentially hazardous biological agents:
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   [ ] rDNA
   [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No
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Lucy Moorehead
Finalist or Team Leader Signature
01/31/09

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Got Water: The Relationship Between Heat Absorbent Materials Used in Solar Desalination and the
Amount of Purified Water Produced
Danielle E. Psimas
Harmony Intermediate School, Hamilton, VA

The purpose of the experiment was to determine what heat absorbent material would
produce the most purified water during solar desalination. This was accomplished by
constructing a solar desalination unit and testing different heat absorbent materials for a set
period of time.

Throughout the course of the experiment, different common materials were used to
absorb heat and increase the amount of water produced in solar desalination. The
independent variable was the heat absorbent material that was used. The dependent
variable was the amount of purified water that was produced. Several trials were
conducted during the experiment. One trial included brick, another trial included sand, and
the last trial included no heat absorbent material. This was the control group in the
experiment.

The experiment showed that brick was the most efficient material that was tested in the
experiment. Sand was the second most efficient. The use of no heat absorbent material
was the least efficient. The hypothesis that was made prior to the experiment was
supported. Brick is the most efficient common material that was tested. Further research
after the experiment yielded information about thermal conductivity rating and highly
efficient, less common materials that could be used.

The main conclusion drawn from this experiment is that brick is an efficient common
substance to use in solar desalination. Other conclusions include that solar desalination
would require a large surface area to become efficient and that solar desalination would be
inefficient in areas of the world that experienced cold weather.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL
that apply): ☐ human subjects ☐ vertebrate animals

Potentially hazardous biological agents:
☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

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Danielle Psimas
Finalist or Team Leader Signature 2.21.08

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regulations and that all appropriate reviews and approvals have been obtained including the
final clearance by the Intel ISEF Scientific Review Committee.
LED Luminosity (Powered by Solar Energy) vs. Incandescent Luminosity

Cory D. Reinecke
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA 20175, USA

This research project investigated the relative efficiency between Light Emitting Diodes (LEDs) powered by solar energy and a standard incandescent light bulb. Data was collected to compare the intensity of the emitted light versus power consumption between and array of LEDs and the incandescent bulb. In the experiment, a small solar panel was connected to a series of LEDs located inside of an enclosed box. A luminosity meter measured intensity of light generated by the LEDs while a volt-meter recorded voltage and current data. Data was collected at different times throughout a number of days to characterize the relationship between solar power generated and the light intensity produced by the LEDs. The hypothesis was that an array of LEDs powered by solar energy would produce a greater light intensity using less power and thereby be more energy efficient overall. Trials were conducted producing measurements of LED intensity versus voltage and current provided by solar panel as the panel was exposed to the sun in the morning, noon, and afternoon of each day. As shown by the experimental results, the original hypothesis that LEDs are more efficient in producing light over an incandescent light bulb was supported. The test showed that for bright sunny days, and the worst case afternoon readings the mean and standard deviation luminosity values were: mean = 341 Lux, and standard deviation, s = 69.1. These values were compared to the luminosity reading of a 25-Watt incandescent bulb, which had a measured value of luminosity of 224 Lux.

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   Potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue
2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No
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Cory Reinecke
2/14/08
Finalist or Team Leader Signature Date

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ROvER (Robotic Metal Detector)
Chris Seebeck
Potomac Falls High School, Potomac Falls, VA

Everyone wants to find something valuable but doesn't want to do all the searching. This project was to research and create a robot that can search for metal objects on the ground.

Tests and research were done on a simple robot. It was determined how to make the two independent systems work together from these tests. The best way to come about this was to solder a lead to an LED on the metal detector to connect to the motherboard. This acts as a powered sensor that sends a signal back to the motherboard when a metal object is detected.

The chassis was constructed out of metal using metal cutters and metal benders. The metal was then fiberglassed so there would not be any interference with the metal detector. The electronics were installed and mounted on the robot's frame. Once construction and installation was complete then programming the robot's behavior commenced. This was done with a simple programming language. Fiberglass needed to be layered for frame rigidity. Otherwise the fiberglass distorts from the lack of support. Also programming took a lot of time to get the robot to behave correctly.

The robot is able to navigate and locate metal objects. This would only be a prototype of an actual product. The potential uses of this robot are endless, military, civilian, and almost anything that metal detectors are used for. Plus due to its small size it can go places regular metal detectors cannot reach.

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   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. Yes □ No
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Chris Seebeck 2/15/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Big barrel, little barrel, supposedly it matters, but who can be sure. This experiment tests the effect of baseball bat diameter vs. the distance that the baseball travels when hit. This experiment was conducted with a swinging machine that hit the baseball with the same force each and every trial. The experiment was conducted at none other than a baseball field. The swinging machine consisted of a rotating swing arm supported by braces on the top and bottom of the frame. Tension was created by a garage door spring mounted behind the frame. A baseball tee set in front of the swing arm and the baseball bat was fastened into the swing arm using 2 U-bolts. The swing arm was pulled back to the same place every trial, and 15 baseballs were hit by each bat. After every 5 the field was cleared to ensure that the baseballs didn’t hit each other and affect the results. After experimentation was concluded results showed that the baseball bat with a greater diameter hit the baseball farther than the baseball bat with the lesser diameter. The t-test value for this experiment was 8.1963, and the degrees of freedom was 2.048, therefore the null hypothesis is rejected, and the data gained from this experiment is significant. The hypothesis of this experiment was supported, saying that the baseball bat with the greater diameter hit the ball farther. Other questions that have arisen from this experiment are why the ball was hit farther by the greater diameter bat, and whether or not it’s the same case with wooden baseball bats.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals

Potentially hazardous biological agents: □ microorganisms □ sDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

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Garrett Thomas 24-08

Finalist or Team Leader Signature Date

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<th>Last name, First Name</th>
<th>Title</th>
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<td>Gonda Jr, Timothy</td>
<td>The Effects of Blade Design on the Ability of a Wind Powered Generator to Power a Laptop Computer</td>
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<td>Williams, Jordan</td>
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Effect of Propeller Design on a Windmill
Jared W. Carter
Potomac Falls High School, Sterling, Virginia, United States of America

The purpose of this experiment was to determine whether or not propeller design can influence generator output on a windmill. The results of this experiment could open up many other experiments to determine which design is most efficient. The information received showed the fact that differently designed propellers change generator output.

The experiment was conducted using a miniature windmill. An electric fan was used to mimic wind in the experiment. The wind from the fan spun the propeller on the windmill. This hereby caused the motor which was connected to the propeller to spin. There were two electrical pickups on the motor which transferred the energy produced from the spinning propeller blade to the amp meter with a set of electrical wires. The amp meter read how many milliamps that the spinning propeller blade produced. The control yielded an average of 23.3 milliamps, while the lightweight orange propeller produced a shocking 162.5 milliamps.

This project proved the fact that slightly different propeller designs can produce up to seven times as much electricity. Hopefully the experiment will inspire others to find which propeller design yields the most electricity. This propeller design could be enough to replace the worldwide gas crisis. Propeller design has a noticeable effect on generator output on a windmill.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
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Jared Carter
Finalist or Team Leader Signature 16/08/08

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The Effects of Blade Design on the Ability of a Windpowered Generator to Power a Laptop Computer
Gonda, Timothy B
Broad Run High School, Ashburn, VA

The effects of blade design on the ability of a wind powered generator to adequately supply power to run a laptop computer, for a useful amount of time, was investigated by building a wind powered generator and collecting 2 samples for each blade design and wind speed.

Four blade designs were tested. They are as follows:
- 4 30 inch long blades 4s
- 8 30 inch long blades 8s
- 4 30 inch long symmetrical blades 4s 2
- 4 50 inch long blades 4L

Significant differences were found in the power output of 2 of the blade designs variants 4s2 and 4L, while the 3rd blade design variant 8s produced similar power output. Blade design must not have a significant impact on power output and the 4s design produced the highest mean power output.

Based on the test results, it is possible to power a laptop from a small wind turbine generator if the generator was built correctly. The 19 watts of power that is produced can be used to power a laptop computer for at least several hours per day.

Adding additional blades, or making blades longer did not increase power production and in fact it had the opposite effect.

The contributions of this project are that it was demonstrated that a laptop computer could be powered by a small homebuilt windmill generator device, that a simply constructed 4 blade design was the most efficient.

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   □ vertebrate animals
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   □ tissue

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Finalist or Team Leader Signature  Date

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The Relationship Between Long Boarding and Air Resistance  
Jordan Lutz  
Briar Woods High School, Ashburn, VA

Long boarders have always been striving to receive the maximum velocity while riding, and this project has shown just how to do that. The purpose of this project is to determine the way to stand on a board while long boarding that will receive the least amount of air resistance, thus making the rider travel fastest. By testing a variety of stances, and recording the time and distance the rider traveled, this project has determined which stance makes the rider travel fastest. By using the formula d/t=s (where d=distance, t=time, and s=speed), the stance that makes the rider travel the fastest was determined. The control of the experiment was standing up straight on the long board. The different stances—being the independent variables—that were tested were crouched in a ball, a well-liked stance used by long board racers that supposedly is very aerodynamic, and a motorcycle fairing like wooden wedge that was held in front of the rider. The wooden wedge is like a motorcycle fairing, except it tapers to the front, and it’s tall enough to cover the entire body of the rider. The results show that the wooden wedge gave the rider the max velocity, averaging at 7.28 ft/s. In the real world, people won’t long board with a giant wooden wedge in front of them, so the fastest stance besides the wooden wedge will be the one that makes the most sense to take. The next fastest stance is the control, averaging at 6.75 ft/s. This is the most practical way to stand and receive the maximum velocity. The wind greatly affected this project. At the time, the wind was blowing in the direction the rider was traveling; this corrupted the data. The hypothesis was completely rejected, by the reason for it is known. Testing on a day with no wind would better test the hypothesis, showing more practical data. Fixing the faulty take/off method would show more accurate results.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ✗ human subjects  
   □ vertebrate animals  
   Potentially hazardous biological agents:  
   □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. ✓ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes ✓ No

4. This project is a continuation of previous research. □ Yes ✓ No

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Lutz, Jordan

1003W09

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The Effects of Manipulating the Shape of the Penstock on Energy (Volts) Generated from Hydroelectric Power
Kyung-Ji A. Min
Freedom High School, South Riding, Virginia

The purpose of this experiment is to determine whether a hydroelectric powered dam can be manipulated to create more energy in a certain amount of time. In order to create this energy, water from a dam is carried through a tube called a penstock onto turbine blades. This turbine will spin and cause the generator to transform the spinning turbine into energy used in our schools, building, and homes. The hypothesis states that if the penstock is converted from a tube-shape into a cone-shape, then the water pressure will increase, therefore spinning the turbine faster and creating more energy.

To test the hypothesis, a model of a hydroelectric dam was made. Water was poured into the dam and went through the energy making process. While the independent variable is the cone-shaped penstock, the dependent variable is the amount of energy produced.

At the end of the experiment, the voltmeter showed that the hypothesis was proven correct and the null hypothesis was proven incorrect. The independent variable and control had a significant difference with the tube-shape creating a mean of 0.026 volts and the cone-shape creating a mean of 0.032 volts.

With oil and fuel running low in supply and renewable energy sources like hydroelectric power needed to replace them, the alternative energy sources need to be as efficient as possible. With the change in the shape of the penstock, this experiment proves that more voltage comes out of a cone-shaped penstock than a tube-shaped one in a hydroelectric powered dam.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  □ human subjects  □ vertebrate animals  □ Potentially hazardous biological agents:  □ microorganisms  □ rDNA  □ tissue

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Min, Kyung-Ji

1004F09

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The Relationship Between the Angle of a Solar Panel and the Amount of Energy Produced

Anthony J. Perez
Freedom High School, South Riding, VA

Solar energy capture could account for forty percent of the world's energy needs by the year 2025. However, even this could be increased by finding the best angle for energy absorption. By maximizing the amount of energy absorbed by solar panels, it would be possible to clean the environment, and create cheaper energy. This experiment was performed with those goals in mind, along with the knowledge that mankind may benefit greatly from a change in the gathering of energy.

The study started with the statement of the problem, along with the statement of the independent and dependent variables. The angle of the solar panel to the ground was the independent variable, while the dependent variable was the amount of indicated voltage that the panel was producing. During four predetermined times of day, measurements were taken to see how much indicated voltage was produced by the solar panel at varying angles. Although there were slight differences in the readings of each angle, none were considered to be statistically significant according to the t test results. The conclusion based on these results was that the hypothesis: if the sun's rays fall on a solar panel at a forty-five degree angle, then the energy produced will be used to its highest potential, was not supported. This means that although there are slight differences in readings of the angles tested, there was no angle that definitively maximized energy absorbed.

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______________________________
Finalist or Team Leader Signature

2-7-08

Date

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1005F10

Perez, Anthony
The Relationship of Increasing Horizontal-Axis Blade Length on the Potential Difference in Volts
Bobby Pourkazemi
Stone Bridge High School, Ashburn, VA

Wind turbines are one of the alternative energy sources currently being investigated for large-scale energy production. However, the need for renewable resources requires wind turbines to perform at their highest levels of efficiency. This experiment tested the effect of blade length on the voltage being produced. The independent variable was the length of the blade, and the dependent variable was the number of volts produced. The horizontal-axis wind turbine was placed at the mouth of a wind tunnel. Each set of blades was then individually tested, and the voltage was recorded using a multimeter. The control was the 17cm blade.

The mean for the 17cm, 20cm, 23cm, 26cm, and 29cm blades were 0.32, 0.3, 0.21, 0.17, and 0.12 volts respectively. The results of the test for all blades showed a significant difference between the experimental groups and to the control (17cm blade) P<0.05. Contrary to other experiments of the same kind, increasing the blade length decreased the power produced. This was probably because the blades added more mass.

The original hypothesis was rejected because the increase in blade length resulted in a decrease of voltage. This raises the question of, “What is the most efficacious ratio of mass to surface area.”

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Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

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[N signature]
Finalist or Team Leader Signature

2/21/08
Date

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The Development of Solar Tower Technology for Use in Third-World Countries
Ian S. Saeger
Dominion High School, Sterling, Virginia

Many methods have been formulated to produce clean energy for third-world countries and most have failed. Solar tower technology presents an opportunity for these countries to have economical, clean energy and would require minimal capital. The purpose of this research was to determine both the scalability of the solar tower concept, and the viability of a modified solar tower design. A solar tower of height thirteen feet was constructed of sheet metal. This tower eliminated the expense of the large glass collector that is normally used and heated the air within through conduction. The goal of constructing a solar tower with the potential to produce electricity was attained. Air was moved through the tower and the determination of potential was obtained through measurement of fan rpm. It was not possible to determine whether or not this movement was caused by heating of the air or by wind intake. Further research would entail correlating generator efficiency to fan design as well as exploring different materials for construction of the tower itself. Finally it would entail positioning the openings in the tower to maximize wind intake. The construction of this type of tower indicates the potential of providing economical, clean energy to disadvantaged countries.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Ian Saeger
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2/10/08

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1007D12
Saeger, Ian
The Relationship Between Temperature and the Rate of Reaction in a Hydrogen Fuel Cell
Meredith L. Scaggs
Stone Bridge High School, Ashburn, VA, 20147, USA

There is an increasing need to develop more efficient ways to harness the world’s renewable resources, as the supply of nonrenewable fossil fuels becomes more costly in price as well as to the environment. This project focuses on how temperature affects the reaction rate in hydrogen fuel cells.

The hydrogen fuel cell car was run at three different temperatures, 11°C, 24°C, and 43°C, the control temperature was 24°C. Each of the twenty trials was timed, measured in seconds, to determine how quickly the engine utilized 6 mL of hydrogen.

The results supported the hypothesis stating, “If an engine powered by a hydrogen fuel cell is run at different temperatures, 11°C, 24°C, and 43°C, then the engine run at 11°C C will be the most efficient.” It was determined to be the most efficient because it used 6 mL of hydrogen in the least amount of time. The results showed that the probability of error was less than 0.05, and there was a significant time difference between the two means of the experimental groups, 11°C and 43°C, and 11°C and 24°C. However, there was not a statistically significant difference between 43°C and 24°C.

The experimental results showed hydrogen fuel cell cars run more efficiently at lower temperatures than higher temperatures. This supports the experimental hypothesis, emphasizing the impact of temperature on efficiency of a fuel cell. The car ran faster at 11°C because the heat by-product created by the engine dissipates faster in colder temperatures. Future experiments could consider more extreme temperatures testing the car’s efficiency.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
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   ☑ No

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Meredith Scaggs  
2/21/08  
Finalist or Team Leader Signature  
Date

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The Efficiency of Ethanol vs. Gasoline in Internal Combustion Engines
John Thomas
Potomac Falls High School, Sterling, VA, USA

The purpose of the trails were to determine the relative fuel efficiency between gasoline, E85 ethanol and mixtures of the two in the forms of E10, E20 and E50. Data was collected and fuel efficiency determined by the amount of time a 15 ml trail of each fuel would power a small internal combustion engine. Over the course of 125 total trials, gasoline proved to be the most fuel efficient and, on average, powered the internal combustion engine for a duration of 81.06 seconds. E85 ethanol yielded the least fuel efficiency out of the independent variables. The engine averaged only 47.68 seconds of continuous combustion while fueled by the 85% corn based ethanol. The results obtained by E10, E20 and E50 continued to support the correlation between a increase in ethanol concentration and a decrease in fuel efficiency. E10 yielded an average of 75.53 seconds. Fifteen ml of E20 powered the internal combustion engine for a mean of 70.45 seconds. E50 fuel produced an average period of combustion that lasted only 62.38 seconds. The hypothesis that gasoline would prove to be the most fuel efficient of the fuels was supported. E85 was shown to power the engine for an average of only 36% of the time that the same amount of gasoline was able to produce continuous combustion.

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John Thomas
Finalist or Team Leader Signature

Date

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Retardation of Opaque Crud on Solar Powered Lights
Wenkel, Erik B.
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

Which substance, when applied to solar powered lights, would extend their life and performance the longest, was investigated by using several substances and testing their battery charging current output each week. This is to determine what substance would cause the greatest delay in formation of performance reducing opaque crud on the solar powered lights. The substances tested were Oil, Silicon, Rain-X, and PAM along with Nothing. The substances were applied once to the solar powered lights and they were left outside in a wood stand. The current output was tested every week using a digital multimeter. The hypothesis Rain-X would be the substance that would extend the performance of the lights the longest was not supported. Oil extended the performance the longest, and Nothing extended the performance the shortest. A t-test was run (P=0.05, df=20, and a calculated t value of 2.9188 for Oil, 2.2432 for Silicon, 1.8820 for Rain-X, and 2.2676 for PAM) and it was concluded that there was significant difference between the types of substances added to the solar powered lights and their current flow. It was concluded that doing Nothing would allow the solar powered lights to degrade the quickest, and adding Multipurpose Oil extends the performance of solar powered lights the longest. You might extend this project by extending the period of the observation to include all the seasons of one year. An application of this project is to apply Oil to the solar cells in solar farms to extend life without cleaning maintenance.

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Erik Wenkel 2/10/08
Finalist or Team Leader Signature Date

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Can the temperature of water affect how fast a boat goes?
Jordan B. Williams
Park View High School
Sterling, Virginia

The purpose of the experiment is to find out if the temperature of water can affect how fast a boat goes. The first procedure was to possess a wooden boat, remote-controlled boat, and a tube that is capable to be filled with water. Fill the tube with water of 20, 40, 60, 80, and 100 degrees Celsius, and timed how long it took for the boats to go across. Then took all the data collected to calculate the mean speed, the average speed of the boats. The fastest time clocked was in water of 100 degrees Celsius. The times of the boats descended when the water became colder, resulting in the slowest time being in water of 20 degrees Celsius. The biggest different in times was 60 to 80 degrees Celsius. From the data collected, the conclusion in that the boat will go faster in hot water than in cold water.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Jordan Williams
Finalist or Team Leader Signature
2/20/18
Date

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1011V10
Williams, Jordan
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# Environmental Management (1100)

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Oil Recovery via the Use of Novel Skimmer Surfaces
Lanuere Marisee Acosta
Dominion High School, Sterling VA

Many tankers transport oil across the world’s oceans and waterways daily. The possibility of an oil spill is large. As a result, spills can pollute entire ecosystems. Oil response organizations spend months cleaning up oil using a three-part system: controlling the spread of oil using booms, collecting the oil on the surface using skimmers, and absorbing left over oil with sorbents.

The purpose of this research was to determine whether the total surface area covered by an oil skimmer has an effect on the amount of oil collected. Three drums of varying surface area were created and attached to a skimmer. The following oils of different viscosities were remediated: 10W-30, 50 and vegetable.

Statistical analysis via a t-test was conducted and the null hypothesis, that there would be no difference in the amount of oil collected regardless of skimmer type, was supported. Collection with each drum was not significant enough to conclude that the shape of the drum had an effect. A possible explanation of these results would be the instability of the skimmer and drum. Though the level of insignificance was small, the flat-shaped drum collected the most oil. Further research would entail the construction of subsequent drums from different materials to see whether that plays a role in remediation efficiency.

Continued research on a larger scale could indicate that advances are needed for the development of more efficient oil skimming technology. Worldwide, this is important because habitat degradation via exposure to oil may be felt for many years.

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     - ☐ rDNA
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I/we also attest that the above properly reflects my/our own work.

Finalist or Team Leader Signature: [Signature]  Date: 1/19/07

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The Location and Incidence of Naturally Occurring Fluoride in Loudoun County Well Water
Sarah Andrew
Heritage High School, Leesburg, Virginia

The purpose of this experiment was to see if there was a significance considering the location and concentration of fluoride in the well water throughout Loudoun County, Virginia. Receiving adequate amounts of fluoride is an important aspect of one's health.
To perform this experiment, a total of 42 well water samples were collected from various towns throughout Loudoun County. The location of the well water was the independent variable, and the concentration of fluoride was the dependent variable. Prior to testing the fluoride concentration with fluoride test strips, hydrochloric acid was used to acidify the water enough so the strips could be used.
After the statistical analysis, it was determined that the null hypothesis was rejected, and the research that there are groups of wells containing fluoride in Loudoun County, Virginia was supported. The Pearson R Correlation was calculated as well. Although there was a low positive correlation, the findings of this experiment do not have statistical significance. Overall, the well water of Loudoun County is risk-free and is beneficial to one's health.
This experiment reiterates the importance of being aware of the concentration of fluoride in the well water one drinks. If one knows the level of fluoride concentration, medical issues such as fluorosis could easily be prevented. In terms of new experimental ideas, perhaps a study of the fluoride concentration could be performed at a larger scale, such as a study of the well water throughout all of Virginia.

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Sarah Andrew
Finalist or Team Leader Signature 2/19/08

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The Effect of Urban Development on the Expansion or Contraction of the Beaverdam Creek Reservoir's Floodplain
Holly Dominguez
Briar Woods High School, Ashburn, VA

The purpose of this experiment is to find out if the urban development has an effect on the floodplain of the Beaverdam Creek Reservoir. However, Mother Nature does also have an effect on the floodplain as well. This experiment was interrupted by a drought in the summer months of 2007. The drought lowered the water levels of the reservoir, as well as the creek that feeds the reservoir. So, this experiment may not agree with the hypothesis, but it does show how quickly the water levels can drop. Now that the water levels are low, the unpredictably of the floodplain is greater, because there is a higher risk of flash flooding. The independent variable is the amount of increased urban development, and dependent variable is the floodplain. The reservoir was surveyed, and it was found that the floodplain has shrunk significantly in the past year. The null hypothesis is as follows: the floodplain has not been effected by the amount of urban development. The null hypothesis was neither rejected nor accepted because the results of the experiment did not show any indication that urban development was the cause of the contracting of the reservoir. Urban development may effect the floodplain of the reservoir but in this experiment it shows no indication of this. Since the water levels are so low, it cannot be found if urban development has effected the floodplain at all, it may take several years for the water levels to return and several years to see if the urban development does effect the floodplain.

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Dominguez, Holly

1103W10

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The Relationship between Soil Type and Radon Levels
Kate E. Fowler
Briar Woods High School, Ashburn, VA

The purpose of this project was to determine whether there is a relationship between soil type and radon levels in Loudoun County homes. This could help builders and homeowners determine whether to install a radon ventilation system in homes.

The radon level in 50 Loudoun County homes was tested. The predominant type of soil and bedrock (sedimentary, metamorphic or igneous) around each house were determined using geological maps. The houses were categorized by soil type and the radon levels were averaged. The type of soil and bedrock were the independent variables and the radon level was the dependent variable.

The radon levels for each soil type were compared to the other two using a t test. The difference in radon levels between sedimentary and metamorphic houses was considered statistically significant and between sedimentary and igneous was not quite statistically significant. The average radon level for houses built in sedimentary soil was three times higher than other houses. In addition, 37 percent of all tested houses had radon levels above the EPA acceptable level of radon.

The results did not support the hypothesis that houses in igneous soil would have higher levels of radon. This project showed that houses built in sedimentary soil are more likely to have high levels of radon and need a radon ventilation system. Further research including the effects of blasting on the radon levels in surrounding houses could help homeowners determine the need to install a radon ventilation system, thereby saving lives by reducing radon exposure.

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Kate Fowler
Finalist or Team Leader Signature 2/20/08

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The Effect of Allaria petiolata on the Arbuscular Mycorrhizal Fungi (AMF) and Its Effect on the Growth of Native Plants
Johnny (Jun-Hong) Kim
Stone Bridge High School, Ashburn, VA

As exotic species invade American native plants' ecosystems, many ecologists carried out studies on the invasion with the majority of the studies concentrating on the aboveground interactions. In this research, the effect of the invasion by the exotic plant, garlic mustard (Allaria petiolata), on the soil community and the growth of native plants was observed especially focusing on the abundance of arbuscular mycorrhizal fungi (AMF).

Viola sp. plants were divided into two groups: the first group was planted in soil where no garlic mustard invasion occurred and the second group was planted in soil where garlic mustard was growing. The independent variables were the different soils, and the dependent variable was the height of the Viola sp. in centimeters after 40 days.

The hypothesis was supported as the origin of the soil did have a significant effect on the growth of Viola sp. The results showed that the mean height of plants in non-invasive soil steadily increased (from 5.8cm to 7.2 cm) while the mean height of plants in soil from a garlic mustard site dropped significantly (from 5.8cm to 4cm). The test showed a statistically significant difference between the two groups (P<0.01): Day 30 with P=0.0005 and Day 40 with P=2E-05.

The rootlets of the two groups of Viola sp. were observed and the abundance of AMF was distinct between the two groups. The rootlets in the soil where garlic mustard was not present had abundant internal AMF compared a lack of internal AMF in the rootlets from the soil with garlic mustard invasion. Thus, the abundance of AMF showed a positive connection with the growth of Viola sp.

Further research needs be done on the function of AMF and how the fungi support the intake of important nutrients by their hosts.

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Finalist or Team Leader Signature: [Signature]
Date: 02/21/09

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The Effect of City Plan on Airflow and Pollutant Disperal
Tasia Paraskevopoulos
Academy of Science, Sterling, VA

With the continual rise of urban industrial centers around the world, pollution accumulation poses a serious growing threat to the inhabitants of these cities. It was hypothesized that, with more aerodynamic building designs and city plans that are conducive to more healthful distribution of typically stagnating pollutants, the conditions in inner city areas could be vastly improved. The purpose of this study was to observe the effect of building architecture and arrangement on airflow in cities through the use of modeling. Buildings made of foam were placed inside a wind tunnel, and the airflow and pollution distribution were observed by introducing solid particulates into the working section while running the fan at various wind speeds. Variations in weather conditions, environmental surroundings, population, building materials, land elevation, and any other presences that may have affected the dependent variable were not considered. The results of the experiment indicate the degree to which airflow and pollution distribution were affected by differences in city planning.

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Tasia Paraskevopoulos, Tasia

Finalist or Team Leader Signature: Tasia Paraskevopoulos
Date: 02-20-08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Chitosan is the second most abundant polysaccharide in nature. Utilization of the remedial properties of chitosan can prevent bacteria from spreading and/or eliminate harmful substances in the environment. The intent of this research was to determine whether chitosan had any effect in preventing the spread of Escherichia coli in wastewater and on kidney stents as well as whether it had the ability to eliminate sulfur from anthracite coal-mining wastewater.

Three testing scenarios were created. In the first, two tanks containing Escherichia coli and PVC pipes were used to simulate actual wastewater treatment facility environments. After an initial period of 30 days, chitosan was added to one of the tanks. Secondly, kidney stents were pre-coated with a chitosan paste and submerged into a container containing an Escherichia coli solution. The container was then placed into the incubator. Lastly, sulfur was extracted out of both anthracite coal and anthracite coal soaked in a chitosan paste.

The null hypothesis, that chitosan would not be an efficient biological remediand, was rejected. Chitosan was able to reduce the amount and spread of bacteria found on the PVC pipes and kidney stents. The effect of chitosan on sulfur reduction was greatly significant. Sulfur was reduced by an average of 88.1 percent. Further research may help develop an improved chitosan paste which can completely prevent the spread of bacteria and certainly merits further investigation as a biological remediand.

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   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

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Signed: ____________________________ Date: 2/19/08

Finalist or Team Leader Signature

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Integrating GIS with Predator/Prey Population Modeling
Lewis Reining
Academy of Science, Sterling, Virginia, United States

As more species become listed as endangered, it is essential that improved methods are developed for examining the possibilities of effectively reintroducing these endangered species into alternate environments. In order to avoid creating an imbalance in animal populations, visualizations of possible scenarios can be produced through computer simulations which reveal the results of these changes. By combining a predator/prey population simulator with the Geographic Information System (GIS) database and augmenting its capability by implementing a prey intelligence algorithm, an improved method for modeling was created. This would allow environmental biologists to more accurately predict the effect of relocating species into specific communities. The predator/prey simulator evolved from a previous effort, and has been enhanced by the inclusion of map data acquired from GIS through field studies. This can be updated prior to any future exploration as an added feature. The prey intelligence algorithms were written as stimulus-response operations into Visual C++ code. These operations reflect the effect of topography and predator proximity on the prey. The simulator was tested successfully using the Canadian lynx and Snowshoe hare. The results when compared to known population studies accurately defined the outcome.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):    □ human subjects    □ vertebrate animals
    Potentially hazardous biological agents:
    □ microorganisms    □ rDNA    □ tissue

2. Student independently performed all procedures as outlined in this abstract.    □ Yes    □ No

3. Student worked or used equipment in a site other than school, field or home.    □ Yes    □ No

4. This project is a continuation of previous research.    □ Yes    □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):    □ Yes    □ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research.
I/We also attest that the above properly reflects my/our own work.

Lewis Reining
Finalist or Team Leader Signature  2/20/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
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The Effect of Biodegradables' Decomposing Rate on the pH of Soil
Helen Amos
Stone Bridge High School, Ashburn, VA

Environmental analysis can be used by farmers and gardeners to determine which biodegradables would quickly improve soil conditions for healthy plants.

The experiment tested how different biodegradable products affect the pH of soil and how quickly pH changed. Three different biodegradables were used as the independent variables. Equal weights of biodegradable materials were placed between equal weights of soil in three containers. A fourth container was used as the control and soil with no biodegradable materials was put in it. Distilled water was added to each container before they were closed. The pH of each experimental group was the dependent variable and was measured at the same time every day.

The result of this experiment was that the pH of the soil changed at different rates. Appearance of mold in the soil at different points in the experiment provided evidence that the decomposing biodegradables changed the availability of nutrients in the soil.

A conclusion was that organic material changes the pH of the soil to levels that are good for plant growth at different rates. The hypothesis was supported because the pH of the soil in the container with newspaper grew visible mold and changed the pH slower than the soil mixed with chicken bones or banana peels.

Further research can be done on bacteria or mold that contribute to soil health are impacted by pH. Other research can also be done on how minerals in different biodegradables affect the soil fertility or the growth of plants in the soil.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals □ potentially hazardous biological agents:
   □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
4. This project is a continuation of previous research. □ Yes □ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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Helen Amos 2/19/2008

Finalist or Team Leader Signature Date

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Analysis of Passive Microwave Remote Sensing Data Illuminating the Progressive Opening of the Northwest Passage Due to Increasing Sea Ice Melt
David P. Baxter
Loudoun Academy of Science, Sterling, Virginia

It was the intent of this study to collect and analyze passive microwave remote sensing data specific to the Northwest Passage. In order to examine the dynamic changes in ice cover of this waterway, the data was analyzed from November 1978 through the present. Archived passive microwave data from earth observational satellite's Scanning Multichannel Microwave Radiometer (SMMR) and the Special Sensor Microwave/Imager (SSMI) was converted to sea ice concentration values representing the percentage of ice within 25 by 25 square kilometer grid cells. The calculated values show the magnitude as well as extent of both ice covered and open sea water. It was determined that sea ice coverage through the entire passage has decreased exponentially. This gives supportive evidence of arctic climate change. It also predicts that the decrease in ice coverage may continue at increasing rates. As this decline in sea ice coverage progresses, the Northwest Passage will become increasingly accessible to shipping traffic.

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Potentially hazardous biological agents:
☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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4. This project is a continuation of previous research. ☐ Yes ☑ No

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David Baxter
Finalist or Team Leader Signature

February 2008
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Water Source on the Agricultural and Pollutant Levels
Alexis Burkett
Stone Bridge High School, Ashburn, VA

Pollutants related to agricultural run-off (animal waste, fertilizers) and lawn chemicals are common toxins found in water sheds. The main idea of this experiment was to see if the time and location of the water shed/source (stream, creek, reservoir) made a difference on pollutant concentrations such as nitrates, nitrites and ammonia (NO3, NO4, NH4).

The experiment examined the concentration (PPM) of pollutants (NO3, NO4, NH4), and pH levels to show how these chemicals varied over time (Oct 2007–Jan 2008) and how they were affected by sampling location. Bottled water was used as the control. The independent variable was the location of the water sources (Ashburn Farm Stream, Goose Creek, Beaverdam Creek Reservoir). The dependent variable was the pollutant concentration and pH measured using a high-end aquarium colorimetric assay. With the exception of pH, there were no statistical differences in any of the pollutants at any of the sampling locations. Likewise, the pollutant concentrations did not change much over time. Lack of rain during our on-going drought was the most likely reason for no differences between the water source locations. With no rain there is no way for agriculture/residential lawn chemicals to run-off into the different water sources and would therefore result in lower overall pollutant levels. Future experiments could be done in spring when rainfall is greater and farmers/homeowners are more likely to use chemicals. What would have happened if we had normal rainfall this year? Would the levels go up or still remain the same?

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects
   □ vertebrate animals

   Potentially hazardous biological agents:
   □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract. ✔ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes  ✔ No

4. This project is a continuation of previous research.  □ Yes  ✔ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  □ Yes  ✔ No

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Alexis Burkett
Finalist or Team Leader Signature:  2/20/08

Date

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Nitrogen Levels of Soil Near the Potomac River
Tommy C. Dacanay
Potomac Falls High School, Sterling, Virginia

This project's purpose is to determine differences in levels of nitrogen content in soils closer to or farther from a body of water, specifically the Potomac River.

Two groups of soil samples were collected, one at the shore of the river, 0 meters from the river water, and the other 25 meters from the river. A nitrate-nitrogen test kit was used to determine the nitrogen content of the soils. All tools used to test the soil samples were cleaned between each test to prevent mixing of the samples. The mean nitrate-nitrogen content of the soil samples collected at the shore of the river was found to be 17.3 lbs/acre (pounds per acre), while the mean nitrate-nitrogen content of the soil samples collected 25 meters from the river was found to be 116 lbs/acre.

Although previous research indicated nitrogen levels farther from a body of water should generally be lower, the mean nitrogen content at the shore of the river was less than the content 25 meters from the river. The soil nitrogen content of the samples taken 25 meters from the river were uniformly higher than the sample with the highest amount of nitrogen taken at the shore. Soil close to the river may have been directly affected by the river water, as the water may have washed the nitrogen out of the soil. Clarification may require greater numbers of sample groups taken both at the shore of the river, 25 meters from the river, and greater distances from the river.

This project may contribute to agriculture around rivers. The process of water "eroding" nitrogen from the soil was demonstrated, possibly aiding farmers in deciding where to plant their nitrogen-dependant crops.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  ☐ human subjects  ☐ vertebrate animals  ☐ Potentially hazardous biological agents:  ☐ microorganisms  ☐ rDNA  ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes  ☐ No

3. Student worked or used equipment in a site other than school, field or home.  ☐ Yes  ☑ No

4. This project is a continuation of previous research.  ☐ Yes  ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  ☐ Yes  ☑ No

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Tommy C. Dacanay  2/11/06
Finalist or Team Leader Signature  Date
The Relation Between Water Quality Compared To Population Density
By: Vincent DiRenzo
Broad Run High School, Ashburn, Virginia

In summary this project evaluated the water quality between rural and urban areas by testing pH level, hardness, alkalinity, nitrate and nitrite levels and observing conditions of color, turbidity and temperature. There were three stream locations studied, two in Middleburg, Virginia for the more rural areas and one in Ashburn, Virginia which has higher population density. Prior to the research it was predicted that Middleburg would have better water quality due to less population density which possibly means less pollution unless there are factors like runoff in the stream. My procedures were: first fill 500mL jar with water, then take the ph and other test strips and dip them in to the sample, after that hold the water up to the light and look for amount of sediment in jar and also the color of the water, finally record findings into the field notebook. All in all both the streams would be safe to drink based on safe pH levels, hardness, alkalinity, nitrate, nitrite, turbidity levels, and color as defined by clean water classification standards. Therefore my hypothesis was disproved that Middleburg’s water is of a higher quality than the water in Ashburn which shows that the population density had little to no effect on the water quality between these two locations.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   ☐ human subjects  ☐ pathogenic agents  ☐ recombinant DNA  
   ☐ non-human vertebrate animals  ☑ controlled substances  ☐ human/animal tissue

2. Student independently performed all procedures as outlined in this abstract.  ☑ Yes  ☐ No

3. This project was conducted at a Registered Research Institution.  ☐ Yes  ☑ No

4. Is this project a continuation?  ☐ Yes  ☑ No

I/we hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/we also attest that the above properly reflects my/our own work.

[Signature]
Finalist or Team Leader Signature

2/10/02
Date

1205B10
Direnzo, Vincent

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The Relationship Between Fertilizer and the Oxygen Level of Water Habitats
Jeff Hershey
Broad Run High School, Ashburn, VA

Many people and many jobs depend on the condition of major bodies of water, such as the Chesapeake Bay. If the Chesapeake Bay is polluted by things such as fertilizer, and the population of a large number of organisms is depleted, the nation’s economy and citizens will be affected greatly. The experiment was completed to determine which kind of fertilizer pollutes water habitats more and therefore shouldn’t be used.

In the completed experiment, jars were filled with 100 milliliters of a water source. Algae was added to the jars. Two different types of fertilizer, one chemical and one organic, were also added. The algae grew and when it died, the amount of oxygen it robbed was observed.

The experiment showed that there was no difference between how much oxygen the different fertilizers caused the algae to take away from the water sample. Therefore, it is concluded that it does not matter what kind of fertilizer is used, both fertilizers pollute the water by the same amount. Thus, bodies of water, such as the Chesapeake Bay, are polluted the same amount if fertilizer gets into the water, regardless of the kind of fertilizer.

Further testing on the subject addressed could be done to determine which kind of fertilizer runs off of crops and lawns and gets washed into major bodies of water more easily. This would allow people to fertilize their lawns with the least harmful type of fertilizer, cutting down on the pollution of major bodies of water.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals

   Potentially hazardous biological agents:
   ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☐ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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Jeff Hershey
Finalist or Team Leader Signature
3/1/09
Date

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1206B09
Hershey, Jeffrey
The purpose of this experiment was to show how different locations, i.e. cities, suburban, and rural areas, are affected by pollutants emitted off by objects such as cars, airplanes, and trains. This shows how people are directly hurting the environment and referencing a major issue, the environment’s well-being. During this experiment the independent variable was the different locations, while the dependent variable was the various CO2 levels. The control was the suburban locations.

Samples of the air from each area where read and analyzed using a scientific calculator and a carbon dioxide sensor. The results of this experiment show that areas with higher amounts of air pollutants for example cities, contain higher amounts of carbon dioxide than rural areas. The average amount of carbon dioxide per million in cities was, 845.593, in the suburbs the mean was 683.691 and in rural areas the mean was 558.681. Thus concluding that areas with a higher concentration of air pollutants have higher amounts of carbon dioxide than in places with lower concentrations. The results show how humans are directly effecting the environment by taking away necessary natural products such as trees and replacing them with harmful objects such as cars, which harm the environment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - human subjects
   - vertebrate animals
   - Potentially hazardous biological agents:
     - microorganisms
     - rDNA
     - tissue
   - Yes
   - No

2. Student independently performed all procedures as outlined in this abstract.  
   - Yes
   - No

3. Student worked or used equipment in a site other than school, field or home.  
   - Yes
   - No

4. This project is a continuation of previous research.  
   - Yes
   - No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   - Yes
   - No

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Allison Hope  
Finalist or Team Leader Signature  
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Atmospheric haze is a vital indication of our atmosphere’s health and is detected in the atmosphere by using a VHS sun photometer. The quantity used to express the results of haze measurements is Aerosol Optical Thickness (AOT). By using the VHS sun photometer this experiment will prove that as the amount of days without precipitation increases, the amount of haze or AOT in the atmosphere will increase also.

The control will be the measurement of AOT in the atmosphere on a sunny day. This measurement will be compared to the measurement of AOT on both a day without precipitation and a day with. When the measurements were taken, the AOT measurement that was taken on a day without precipitation increased slightly from the amount of AOT on a sunny day. However, the AOT measurement taken on a day with precipitation decreased greatly from the amount of AOT on a sunny day.

The data of this experiment did not support the hypothesis during the statistics and therefore the hypothesis was refuted. The reason the amount of AOT increased as the days without precipitation increased is because the rain clears the atmosphere of most of the AOT. If the amount of AOT decreases greatly with precipitation, would climates with extreme amounts of precipitation even have atmospheric haze? Or would there be very great amounts of atmospheric haze in the desert?

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - [ ] human subjects
   - [ ] vertebrate animals
   - [ ] potentially hazardous biological agents:
     - [ ] microorganisms
     - [ ] rDNA
     - [ ] tissue

2. Student independently performed all procedures as outlined in this abstract.  
   - Yes [ ] No [ ]

3. Student worked or used equipment in a site other than school, field or home. 
   - Yes [ ] No [ ]

4. This project is a continuation of previous research.  
   - Yes [ ] No [ ]

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   - Yes [ ] No [ ]

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King, Melissa  
Finalist or Team Leader Signature: Melissa King  
Date: 2/3/08

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The Relationship Between Different Oil Spill Cleanup Methods and the Amount of Residual Oil
Elaine Kwak
Freedom High School, South Riding, VA

During the last decade, over a billion gallons of oil have been spilled worldwide, causing significant damage to the environment. There are several methods that are used to clean up after these harmful oil spills. This experiment tests the effectiveness of two main cleanup methods: mechanically, using booms and skimmers, and chemically using dispersants. Toothpicks and cotton balls were used to simulate booms and skimmers, respectively. Detergent was used to simulate dispersants. Three containers filled with water and motor oil simulated an oil spill. The mass of the spill was measured before cleanup and after cleanup to evaluate the effectiveness of the two methods. Statistics showed that at the 95% confidence level, the data collected did not provide sufficient evidence to show that the simulated dispersants were more effective in cleaning up the oil than the simulated booms and skimmers. The difference before and after the cleanup with dispersants was very small, and the mass actually increased because of the added mass of the dishwashing detergent. The mass of the contaminated water treated mechanically decreased significantly, partly because water was absorbed along with the oil by the cotton balls. Measuring the mass, therefore, isn’t a reliable indicator of the effectiveness of the cleanup method. Distillation may be a more suitable method to measure the effectiveness of the cleanup because the water would evaporate, leaving only the oil. Areas for further experimentation would include testing the effectiveness of bioremediation compared to mechanical cleanup methods.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals
   Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
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Elaine Kwak
Finalist or Team Leader Signature
2/21/08

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The Relationship Between the 2007 Drought in Virginia and the Water Quality of Goose Creek in Loudoun County, Virginia
Jessica Kyle
Briar Woods High School, Ashburn, VA

A continuation of previous research, this project focused on the effect of drought on water quality, namely Goose Creek in Loudoun County, Virginia. At the time of the experiment, Northern Virginia had experienced drought conditions for the majority of the year and was under severe water restrictions.

This experiment was conducted by obtaining water quality data from Goose Creek and comparing the results against online data provided by the U.S. Geological Survey (USGS) for the winter of 2000-2001, a period of time when Loudoun County was not in a drought. Using a Vernier LabPro connected to a TI graphing calculator and the appropriate sensors, temperature, pH, dissolved oxygen, and turbidity data was collected from two locations along Goose Creek once a week for three weeks. Water samples were also collected at each location for further testing at Briar Woods High School. Using LaMotte water quality products, the samples were tested for nitrate and phosphate. Following the three week testing period, the research data was compared to data recorded by the USGS.

Unfortunately, after statistically analyzing the experiment's data, the results proved to be statistically insignificant due to the small number of trials in the experiment. Also, the USGS did not record data for turbidity or phosphate during the winter of 2000-2001. Nor did it provide enough nitrate data from that time period for statistical analysis to be completed. Both of these conditions added to the statistical insignificance of the research. Therefore, due to experiment's insignificance, the research hypothesis was refuted.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects  □ vertebrate animals  □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. Student worked or used equipment in a site other than school, field or home.  Yes  No

4. This project is a continuation of previous research.  Yes  No

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Jessica Kyle  January 27, 2008
Finalist or Team Leader Signature  Date

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1210W12
Kyle, Jessica
Effects of Precipitation on pH, Nitrate, Nitrite, General and Carbonate Hardness in Ponds
Loan H. Nguyen
Park View High School, Sterling, Virginia

This study aims to see if precipitation has an affect on the pH, nitrite, nitrate, carbonate and general hardness in ponds. The pH, nitrite, nitrate, carbonate and general hardness affect the biotic and abiotic features of a pond. So, by knowing that levels change after a period of precipitation aids in the protection of a ponds plants and organisms.

In this study, water was tested for pH, nitrite, nitrate, carbonate and general hardness in three locations. The independent variable in this experiment is the day the water is tested, whether it has precipitation or is dry. The dependent variables are the levels of pH, nitrite, nitrate, carbonate and general hardness.

The results of this experiment refute the original hypothesis. It shows that when there was no precipitation the level of pH were lower or more acidic then when precipitation had occurred. The level of carbonate hardness changed to a higher level when there was rain and the levels of general hardness also increased with precipitation. The nitrite and nitrate levels in this experiment could not be tested because there was none in ponds or it was too little to detect with the test strips.

Further research needed is why the results came out the way they did. The research shows that the findings should be reversed however and the results show that that is false. In conclusion, this experiment showed that the levels of pH, carbonate and general hardness did change when precipitation occurred.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents:
   ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☑ Yes ☐ No

4. This project is a continuation of previous research. ☑ Yes ☐ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work.

Loan Nguyen 2/19
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Unpaved driving terrain can be easily eroded. To test a material’s ability to protect vulnerable terrain from damage caused by vehicles, the control was tested (no protective material used). Then the first material was laid across vulnerable terrain and tested as the control was: a bicycle was driven across the material; the depth of damage caused by the bicycle was recorded; then a tractor was driven across the material and the damage from that vehicle was recorded. This procedure was repeated for each material being tested. The hypothesis (if a thin sheet of steel is laid out on top of wet terrain, when driven across, then the sheet will distribute the weight of the vehicle more evenly, diminishing damage to the terrain) was not supported by the results of this experiment. The material whose results were most significantly different from the control’s results for the tractor was the heavy-duty truck bedding. A t-test was run (P=0.05, df=4, and a calculated t-value of 38.9), and it was concluded there was a significant difference between the bedding’s results and the control’s. The material whose results were most significantly different from the control’s results for the bicycle was the 1cm-thick plywood. A t-test was run (P=0.05, df=4, and a calculated t-value of 20.83), and it was concluded there was a significant difference between the plywood’s results and the control’s. However, the material’s rigidity and weight make it improbable for transport on a bicycle.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No
4. This project is a continuation of previous research. □ Yes □ No
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[Signature]

1212C10

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The relationship between the rising carbon dioxide level and the rising atmospheric temperature on polar ice cap melting was examined by running an experiment using air sealed jars, baking soda and vinegar (as the carbon dioxide), and ice cubes. The objective of the experiment is to show how the steady increase of carbon dioxide from greenhouse gasses has and will significantly increase the Earth’s temperature from 1900 to 2100. The idea is that if the experimenter increases the amount of carbon dioxide in the jar, then the temperature in the jar will increase and the ice cube will melt faster. The experimenter will gradually increase the amount of baking soda according to previous couple year’s carbon dioxide concentration in the atmosphere. In turn the internal temperature will rise showing that there is a correlation between carbon dioxide and rising temperature. To show this there will be six air sealed jars under a heat controlled lamp. Each jar will have a different amount of baking soda and vinegar in it representing a previous year. The temperature will be taken for all of the jars. Then an ice cube will be placed into the jar with the carbon dioxide and the melting of the ice cube will be timed. The experiment was performed and the hypothesis was supported. A t-test was run as well (calculated t value of 1.4351 for increased carbon dioxide level raises temperature without ice) and confirmed this correlation. Of course Jar 6, the jar representing the year 2100, had the highest temperature and the shortest melting time. As shown in many situations there is a connection between the rising carbon dioxide levels and the rising temperature which in turn is causing the polar ice caps to melt at a rapid speed.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ eDNA □ tissue □ Yes □ No

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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Finalist or Team Leader Signature 2/13/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship of Sand Addition to Potting Soil and the Growth of Grass

Maria Rillo
Freedom High School, South Riding, VA

This project tests the effects of sand addition to soil over time. Natural environments' soil composition is not controlled, compared to houseplants. The experiment has three independent variables that increase in amount of sand addition. No sand addition is the control. For four weeks, each of the ninety Festuca arundinacea plants used were measured once each week. The hypothesis states that if the amount of sand increases, then the height of the grass will decrease. This is because water, needed for growth, flows to the bottom much faster if the soil contained sand than with no sand due to the bigger pores. The hypothesis was based on the amount of water each plant was able to obtain.

At the conclusion of the experiment, the hypothesis proved to be wrong. The independent variable with the most sand grew faster than the other variables in the primary stages of growth. Root growth favored the larger pores than the compact potting soil alone. In the fourth week, the variable with less sand caught up to the leading variable of four centimeters. The control was left behind with some of its trials saturated in water due to the less mass without sand. The statistics show that there is a wide range of data that shows significance would have been a small distinction and may contain a broad range of possible errors. Sand addition to potting soil is insignificant to grass growth. This experiment is ideal for plant growth in environments of differing soil compositions.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue
2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No
3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No
4. This project is a continuation of previous research. ☐ Yes ☑ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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I/We also attest that the above properly reflects my/our own work.

Maria Rillo
Finalist or Team Leader Signature

2/21/08
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Heavy Metals in water on Nasturtium Officinale
Heather M. Rodgers
Loudoun Valley High School, Purcellville, Virginia

As water mixes with heavy metals such as Pb, Cu, and Fe, toxic water is formed, polluting the environment. Traditional means of removal is costly. The purification of toxic water will be tested using the common plant, Nasturtium Officinale. The plants came from Endless Summer Harvest in Purcellville, Virginia. One plant was placed in a mason jar filled with 100mL of either Pb(NO3)2, Cu(NO3)2, Fe(NO3)3, or deionized water. The plants were then placed in a growth chamber where they received a constant temperature of 70° F and 12 hours of sunlight for six days. After six days 0.14g of the plant’s roots and leaves were removed, dried, crushed, and then placed in a test tube with 1mL of 1M HCl and 4mL of deionized water. The solution was mixed and then the actual plant was filtered out and then placed in a Spec 20. The recorded percent transmitted was then compared to a preconfigured table to see how much of the metal the plant had absorbed. The average amount of Pb absorbed was between 0.025M and 0.0125M while the average amount of Cu absorbed was between 0.025M and 0.0125M, and an insignificant amount of Fe was absorbed. Nasturtium Officinale was found to remove Pb and Cu from water while Fe was not removed. These results could be used to clean up the environment in a cost-effective way.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents:
   ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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Heather Rodgers 2/20/08
Finalist or Team Leader Signature Date

1215L12
Rodgers, Heather

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effects of Differing pH and Water Pollution on Duckweed (Lemna Minor)

Tony Schulien
Potomac Falls High School, 46400 Algonkian Parkway, Potomac Falls, VA 20165

This research and experiment relates to the study of environmental sciences. It deals with the relationship of living things and how changes in their environment by things such as water pollution and acid rain affect them.

In this experiment I had duckweed plants which I paced 1g of in one Dixie cup. There were 90 Dixie cups with 30 pH5, 30 pH7, and 30pH 9. I then recorded the growth in grams of each cup of duckweed each day for one week. The dependent variable was the growth of the duckweed, and the independent variable was the pH level of the water.

In this experiment it was found that Duckweed would grow best in a pH around 7, or a neutral pH, it was also found that acid rain is harmful to plants such as duckweed when it gets into lakes, ponds, or streams.

The results to this experiment supported the hypothesis, and it was able to be concluded that acid rain is dangerous to aquatic plants in lakes, ponds, and streams. When acid rain gets into these bodies of water, it modifies the pH, and that can be harmful to the plants that live in them.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals

Potentially hazardous biological agents:

□ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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Anthony Schulien
Finalist or Team Leader Signature
February 6, 2008 Date
The Relationship Between the Abiotic and Biotic Factors of a Creek
Farah Shah
Park View High School, Sterling, Virginia

A purpose of this experiment was to conclude whether the abiotic factors of a creek were affected by its biotic factors. The hypothesis was that abiotic factors of a creek would be positively affected its biotic factors of a creek. A portion of the creek with scarce biotic factors was the control, and a portion of the creek with many biotic factors was the experimental variable. Plants and animals were the biotic factors, which were the independent variables. Abiotic factors, such as oxygen and salinity levels, were the dependent variables. Throughout twenty days, the experimenter recorded biotic factors around each creek and tested a sample of water from each portion of the creek for abiotic values. The results supported and refuted the hypothesis. Statistics from the control creek showed that its abiotic factors were not affected by its biotic factors. However, statistics from the experimental creek showed that its biotic factors did affect its abiotic factors. After further investigation, a discovery was made that the portion of the creek used as the control had a drainage pipe running sewage into it. The sewage increased abiotic values of the control creek, making them similar to the experimental creek’s values. However, the control creek was not sufficient for living things. Further research, such as testing the negative and positive affects of runoff on creeks, can continue this experiment for society.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   □ human subjects
   □ vertebrate animals
   □ Potentially hazardous biological agents:
     □ microorganisms
     □ rDNA
     □ tissue
2. Student independently performed all procedures as outlined in this abstract.  ✔ Yes □ No
3. Student worked or used equipment in a site other than school, field or home.  □ Yes  ✔ No
4. This project is a continuation of previous research.  □ Yes  ✔ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself):  □ Yes  ✔ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work.

Shah, Farah

02-20-08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
How Hybrid Cars Affect Pollution
Parman Soleymani
Potomac Falls, Sterling, Virginia

The purpose for this experiment was to find out if hybrid vehicles reduced the amount of pollution given off into the air from car exhausts. This was done by gathering 20 hybrid vehicles, and 20 standard gasoline vehicles. Both of the groups were the same brand of vehicles, which in this case were Toyotas. The vehicles were tested by using a car emissions calculator which determined the amount of pollution given off from each individual vehicle. Once the testing was done, the results were compared with one another. The hybrid vehicles deposited nearly half as much pollutants into the air as standard gasoline vehicles. The results showed that the hybrid vehicles are, indeed, better for the environment because they give off less pollution.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): [ ] human subjects [ ] vertebrate animals

Potentially hazardous biological agents:
[ ] microorganisms [ ] rDNA [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [ ] No

4. This project is a continuation of previous research. [ ] Yes [ ] No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): [ ] Yes [ ] No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work.
Parman Soleymani 12/21/07
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Acid Rain on Building Materials

Jennifer Taylor
Broad Run High School, Ashburn, VA

So many buildings and monuments are destroyed due to acid rain. The purpose of this experiment was to show which building materials acid rain affects the most, so that buildings can be built to be better protected from the effects of acid rain.

For this experiment, artificial acid rain was created with diluted sulfuric acid and distilled water. It was tested against plain distilled water as a control. The building materials tested were: bricks, marble, steel, and wood. Each material was sprayed three times twice a day (8:00 am and 8:00 pm) for six weeks. The independent variable was the type of building materials selected. The dependent variable was how much the mass of the materials changed.

The difference in the mean change of all the marble tiles between the distilled water and the artificial acid rain was the highest. Steel also showed a significant change in mass. Brick did not change as much and wood mass changed the least.

It was concluded that acid rain affects marble the most. For this reason the hypothesis that the marble tiles would change the most was supported.

How can we stop acid rain from damaging buildings and other structures? What substances are the best for protecting materials that react to acid rain such as marble? Further research and projects can answer these questions from the results of this experiment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   □ human subjects
   □ vertebrate animals
   □ Potentially hazardous biological agents:
   □ microorganisms
   □ rDNA
   □ tissue

2. Student independently performed all procedures as outlined in this abstract.  ✔ Yes   □ No

3. Student worked or used equipment in a site other than school, field or home.  □ Yes   ✔ No

4. This project is a continuation of previous research.  □ Yes   ✔ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  □ Yes   ✔ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work.

Jennifer Taylor

2/4/08

Principal or Team Leader Signature  Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Modified Salt-Gradient Solar Ponds as a Practical Energy Source

Rachel Todd
Park View High School, Sterling, VA

The purpose of the experiment was to determine if models of salt-gradient solar ponds could give off their own heat and raise the temperature of water in a dish.

Methodology involved filling two 75.71 liter aquariums with 45.9 liters of water and 2.84 liters of salt. 30 drops of red dye were added to the solutions. Each tank had 7.57 liters of water pumped under each red layer and then 30 drops of blue dye added to each solution. The temperatures were recorded for twenty days. In Phase 2, dishes containing water were floated on the surface of the tanks. The temperatures of the dishes’ water were recorded at ten minute intervals. The independent variable was the time intervals between measurements and the dependent variable was the temperature of the models.

Temperatures in each layer remained comparable varying only about a degree. A plausible reason may be due to the models not having a large enough volume to recreate a salt-gradient solar pond.

The hypothesis was refuted because the models didn’t produce enough heat to raise the water’s temperature in the dishes. Therefore existing salt-gradient solar ponds should used for business purposes, instead of models for practical uses.

Recent information shows salt-gradient solar ponds take years to create gradients after the bottom temperature has been stable, at around 62 degrees Celsius. The experiment could be improved by using tanks with larger volumes and surface areas, stronger heat sources, and more accurate equipment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects      Potentially hazardous biological agents:
               □ vertebrate animals  □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes  □ No

4. This project is a continuation of previous research. □ Yes  □ No

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Rachel Todd 2/19/08
Finalist or Team Leader Signature  Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Salt is a hygroscopic compound that attracts water and can cause concrete to become more saturated with water than it would otherwise. This experiment, through the exposure of concrete to ocean salt concentrated water investigated the effects of sodium chloride on the strength of concrete. A level of 2.5 refractometer unit of salinity was added to each of the fifteen concretes that would be under the influence of sodium, whereas fifteen replicates of the control were exposed to fresh water only. During the run of the experiment, degradational composition of the concrete was evaluated every 2-3 of days, and observations were made as pores emerged and visible corrosion was observed. At the end of the experiment, final examinations were made, where control groups and salt influenced concrete were analyzed. The groups that had been exposed to salt presented more physical deterioration than the ones that were simply exposed to fresh water, which showed little to no external change. This result supports the hypothesis, which stated that sodium environmental conditions did play a role in debilitating concrete. Consequently, there existed a significant environmental difference between the two groups, causing distinct outcomes to both. The results can be directly related to the ultimate purpose of this experiment, which intended to verify how it could be related to urban construction and engineering, where selection of proper material is essential as to where it is going to be employed.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - [ ] human subjects  
   - [ ] vertebrate animals  
   - Potentially hazardous biological agents:  
     - [ ] microorganisms  
     - [ ] rDNA  
     - [ ] tissue

2. Student independently performed all procedures as outlined in this abstract.  
   - Yes  
   - No

3. Student worked or used equipment in a site other than school, field or home.  
   - Yes  
   - No

4. This project is a continuation of previous research.  
   - Yes  
   - No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   - Yes  
   - No

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I/We also attest that the above properly reflects my/our own work.

Andrea Wen  
02/21/08

Finalist or Team Leader Signature  
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effects of Light Pollution on Migratory Bird Flight Routes in Virginia
Emily L. Wilson
Dominion High School, Sterling, VA

With the expansion of urban development, communities have increased their implementation of nighttime lighting sources. This has had a dramatic effect on animal populations which rely on the darkness to mate, capture food and migrate. Birds have been hit particularly hard by light pollution in the atmosphere which is inhibiting their migration routes as a result of their inability to see guiding stars.

The purpose of this research was to determine the current amount of light pollution in specific counties in Virginia that corresponded with migratory flight routes of native birds. Six counties were selected based on the presence of migratory flight routes during the fall migration. Five areas were chosen within each selected county and the stars in and around the constellation Cassiopeia were counted in each area. The number of visible stars were used to determine light pollution levels according to the Bortle Class Scale. The null hypothesis, that there would be no effect on bird migration due to light pollution, was rejected. Statistical analysis via a t-test indicated a significant difference in the light pollution between each county. Urban counties experienced a much greater incidence of potentially migratory interfering light pollution than did rural counties. Birds that migrate through counties containing large urban areas could eventually cease to migrate or not survive migration. The ever-increasing amount of light pollution in the counties of Virginia alone can be diminished with lighting restrictions and statewide understanding of the consequences.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents:
   ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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Emily Wilson
Finalist or Team Leader Signature
02/20/08

1222D12
Wilson, Emily

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
This experiment was done to see the affect that different kinds of water (creek and distilled) have on different kinds of soil (worked farmland with and without BMPs, developed land with and without BMPs, and undeveloped land) and how the soil affects the water. This experiment was done by testing the soils individually for pH, nitrogen, phosphorus, and potassium. The water was tested for pH, chloride, and bacteria content. The water was poured through each of the soils and the tests were done again. The new results for each test were compared to the old results to see affects the soil and water had on each other. The hypothesis that the creek water would affect the soil the most was supported. The soil that had creek water pass through it had much more potassium than the soil that had distilled water pass through. The hypothesis that if the water was poured through the the worked farmland with BMPs soil sample, it would change the least and if it was poured through the developed land without BMPs it would change the most was not supported. It was not supported because the the water that went through the worked farmland with BMPs had more chloride than the water that went through the developed land without BMPs. The soil did not change much when the water passed through and the water did not change much when it was poured through the soil. There was more bacteria in the water that went through the soil. T-tests were done on the pH data. The test on the soil before and after the creek water (P=1.00, df=4 and t=0.00) was not significant. The test on the soil before and after the distilled water (P=0.704, df=4 and t=0.4082) was also not significant. The t-test of the distilled water before and after being poured through the soil (P=0.0046, df=4 and t=5.7155) was statistically significant. This shows that the soil was able to change the pH of the distilled water, however the same test was not conclusive when done with the creek water. To see the actual affects of BMPs on the soil and water quality, more extensive tests over a longer period of time need to be performed.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

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Michael Wyngarden  2/12/08

Finalist or Team Leader Signature  Date

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## Mathematical Sciences (1300)

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The Relationship Between Tornadoes and Moon Phases
Caitlin Banks
Park View High School, Sterling, VA

What is the relationship between tornadoes and moon phases? When compared from the data at seventeen different angles, there was no known connection between the two variables. In the experiment, the data for every tornado that occurred in twelve areas of the country was recorded, and the moon phase of the specific date was recorded with it on a chart. With a hypothesis stating that as the moon phases changed throughout the month, the amount of tornadoes in given areas would change, the hypothesis was refuted.

There is also no known correlation between the magnitude of the tornadoes that took place and the moon phases that occurred. Some of the phases of the moon are shorter than others. The moon only stays in these phases for about one day in every month, while the other phases last for almost a week each. In each of the areas, the only association between tornadoes and moon phases is that during the longer moon phases, more tornadoes occur, and, during the shorter moon phases, fewer tornadoes occur. This means that there is still not a supported hypothesis about how to better predict tornadoes using information from the moon. Maybe if there were more rates of comparison included in the experiment or if the areas were opened up to more than one country, then there could be a possibility of a better idea to further experiment.

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   - [ ] human subjects
   - [ ] vertebrate animals
   - [ ] Potentially hazardous biological agents: 
     - [ ] microorganisms
     - [ ] rDNA
     - [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [ ] No

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Caitlin L. Banks 2/14/08
Finalist or Team Leader Signature Date

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People have always wondered if there is one thing that can sum up everything in the universe in some way. In theory, there is a number that can relate to natural formations from galaxy formations to rose petal alignment, to man-made objects from ancient buildings to credit cards, all can be related to Phi, a mathematical constant.

This experiment should add to the theory of Phi correlation by comparing Phi to the ratios of human finger bones.

The procedure was simple, the bones were measured with a metric caliper and by dividing the larger bones to the smaller ones, I got a ratio and I then correlated these ratios the Phi.

The purpose of this experiment is to support the theory the Phi correlates to human finger bones. The experiment showed a strong correlation to Phi, but there was too much room for error to confirm these results.

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Tyler Chilton
Finalist or Team Leader Signature
2/14/09
Date

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Pigskin Pick'em: The Relationship Between the Combine and Future NFL Success
Brian E. Oden
Loudoun Valley High School, Purcellville, VA, USA

The NFL Combine consists of a series of physical tests which are designed to analyze the potential capabilities of a particular athlete. Test results from the bench press, vertical jump, broad jump, three cone drill, twenty yard shuttle, 60 yard shuttle, 40 yard dash, medical evaluation as well as the wonderlic IQ test are combined to make a predictive player profile that attempts to predict the athlete’s future success in the NFL and their respective rank among their peers.

For years this process has both created unwarranted publicity for potential prospects and confirmed the abilities of superior athletes but is it a reliable method of prediction? This experiment will attempt to analyze the predictive value of the controversial combine in the hopes of learning the approximate effectiveness of the NFL’s primary tool of evaluation. Past observations have indicated that many NFL stars have underperformed at the combine while many over-hyped athletes have performed well and become busts.

Through careful analysis of individual performances and their corresponding number of pro bowl appearances, proof was found that supports the conclusion that due to inconsistencies in evaluation and uncontrollable variables (Hard work and dedication), the NFL combine cannot be considered a valid method of evaluation. With the help of an excel spreadsheet, the combine results and careers of athletes drafted from 1999 to 2005 were analyzed to reveal the secrets of the assumed correlation between combine success and career productivity. Results of the analysis revealed little to no correlation between superior combine performances and career success.

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Finalist or Team Leader Signature: ________________ Date: 2/19/08

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1303L12
Oden, Brian
The Relationship Between Different Types of Media and Their Accuracy in Predicting the Weather
Jennifer A. Soroka
Broad Run High School, 2167 Ashburn Road, Ashburn VA

The weather is an uncontrollable aspect of every day life. However, by knowing which sources of media are the most accurate in predicting the weather, we can all make more educated decisions in how to go about our lives. The purpose of this experiment is to discover which media type produces the most accurate weather forecasts. The independent variable is the type of media from which one obtains weather predictions, and the dependent variable is the accuracy of the weather predictions. Over a thirty-day window of time, one will be taking the weather predictions from three different sources of media—internet, television, and newspaper, as well as the actual weather occurrence. This will include taking high and low temperatures. At the end of the 30-day period of observation, one will create charts that graph the delta between the predictions of each media source and the actual temperatures for that day. The smaller the variant between the actual and predicted temperatures indicates greater accuracy. By analyzing the data, one will discover which media source is the most accurate.

As a result of this experiment, it was discovered that weather predictions from the television (Channel 4 news at 6) were more accurate in predicting the weather than the internet (intellicast.com) and the local newspaper (Washington Post). This rejected the hypothesis that the internet would be the most accurate source of media in predicting the weather. Another question that might arise from this study would be: “What is the best method to interpret your observations in order to produce the most accurate results?”

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Jennifer A. Soroka 2-3-08
Finalist or Team Leader Signature Date

1304B10
Soroka, Jennifer

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Estimation is an important life skill developed during childhood. Due to lack of complex mathematic skills in first graders, they are ideal subjects for research into the development of estimation skills. The purpose of this research was to determine if the estimation skills of students who speak English as their native language differ from those who learn it secondary to another language. A class of 14 students was tested with complex math estimation problems and asked to guess the correct answer. The null hypothesis, that there was no correlation between estimation skills in students speaking English as their first language or their second language, was rejected. Native English speakers answered 62% of the questions accurately while those who spoke English as a second language answered 44% correctly. When asked to estimate an actual number, the native English speakers answered within a +/- 5 range on either side of the desired numerical answer 24% of the time. Non-native English speakers answered correctly 17% of the time. A combined math class of both native English speakers and English as a second language students might not be the most efficient learning environment. Non-native English speakers may be left behind in early formative years of math education. Subsequent years of math education could be affected were these skills not more closely monitored. Mathematics is used everyday. It is imperative to start all students with the development of initially strong skills and make sure that no student gets left behind due to lack of understanding.

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[Signature]
Finalist or Team Leader Signature
February 16th, 2008
Date

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Soil Type Effects on Chicken Bone Decomposition
Kelly Anderson
Potomac Falls High School, 46400 Algonkian Parkway, Potomac Falls, VA 20165

More people are getting interested in ‘going green’, and saving the Earth. This is a great thing to worry about, and one way to help out is to save space in landfills we use. More landfills have been made, and closed off, and it’s very unhealthy for our planet. By doing this experiment, it is hoped that a way could be found to make the decomposition of bones left over from restaurants and dinners faster; in turn, saving room in the landfills.

The independent variable in this experiment is the type of soil the bones are buried in. The dependent variable is the rate of decomposition. One bone was considered one trial. Four cycles were tested, for a total of thirty trials per soil type. Once the entire experiment was completed, the Average Rate of Decomposition for each bone was calculated, along with the Final Average Percent Total Loss of each soil type.

After calculating the Final Average Percent Total Loss, the results were compared and the conclusion was that bones not buried lost the most total weight over a two week period. The buried bones lost much less. For the bones buried in soil, those buried in the Potting Soil lost the most, while the Silt Bones lost the least. These results supported neither the hypothesis nor the null hypothesis.

Based upon these results, two conclusions can be made. First is that all of the bones taking up space in our landfills could be taken to a separate landfill with no other waste in it, where they would be buried in Potting Soil. Second is that these bones could be evenly spread across the surface of landfills. This, however, may be unclean. The results rejected the hypothesis, however, still allowed for the objective of this experiment to be obtained – helping to find a better and faster way to dispose of our waste.

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I We also attest that the above properly reflects my/our own work.

Kelly Anderson 02/20/05
Finalist or Team Leader Signature Date

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Here Comes Treble: A Study of Sound
Paul Burgess
Briar Woods High School, Ashburn, VA

Studies dating back to at least the 1960s and as recent as 2002 indicate that the normal range of hearing for "a healthy, middle-aged male" is between 20 Hz and 20,000 Hz. Infant observations have shown that a human's hearing and response capabilities should be more or less fully developed by the age of two, but there is no solid study readily available that lists the rate of deterioration of hearing, and how much age or gender factor in.

In the experiment, the hope was to establish the existence of a correlation between age and gender, and frequencies a person can hear. Testing divided the subjects into blocks by age, and then further by gender. They all listened to the same set of frequencies and marked whether they can perceive the sound.

T-tests performed dismissed the age vs. frequency data as there was too high of a chance that the results occurred by chance. The null hypothesis that gender has nothing to do with hearing range seems to have been rejected by the data tables and graphs. These results suggest that there is indeed some sort of correlation between gender and frequencies perceived. Interestingly, it also shows that females of any age group will, on average, be more likely to hear higher frequencies and less likely to hear lower frequencies. Despite a poor t-test score, in the context of the experiment, it still seems that age affects frequencies heard. If that portion of the experiment were remodeled, more substantive data could be drawn.

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[Signature]
Finalist or Team Leader Signature

1402W12
Burgess, Paul

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HPV Vaccine Compliance: Is Knowledge the Missing Link?
Chopivsky, Lesya
Loudoun County High School, 415 Dry Mill Rd., Leesburg, Va, USA

The knowledge level of females ages 13-26 regarding Human Papillomavirus (HPV) and HPV vaccine (Gardasil) was tested by two surveys. The first survey was given to 67 high school and young adult females to establish baseline knowledge and opinions about receiving Gardasil. Five days after taking the survey, a randomly selected experimental group was asked to read a brief educational tool (independent variable). The hypothesis was that this educational tool would increase participants' scores and their willingness to receive Gardasil. Two weeks after the first survey was taken, a second survey was completed by all subjects to compare their scores and willingness to receive Gardasil (dependent variable). The average score of the control group’s first and second survey was 36% and 39%, respectively. The average score of the experimental group’s first survey was 36%, the same score as the control group, and their average second survey score was 65%, a nearly doubled improvement. T-test showed statistical significance at p<0.01. 20% of participants had an increased positive attitude towards receiving the vaccine. 68% of experimental group participants believed they had become more educated about HPV and the vaccine. Importantly, all participants who read the educational tool and considered themselves educated had an increased positive opinion about receiving Gardasil. Those who felt educated only after the first survey may have realized how little subject knowledge they had after taking the survey. Information about symptoms and effects of HPV contained in the survey document may have persuaded control group subjects to be more willing to receive the vaccine. Participants who had an increased negative opinion may have felt educated enough after the study to make an informed decision. The results of this study strongly support the hypothesis that an educational tool will increase HPV knowledge in young women. The hypothesis that an educational tool will motivate young women to receive the HPV vaccine also was supported, although not as strongly.

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Lesya Chopivsky  2/13/08
Finalist or Team Leader Signature  Date

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Expression of Mendel’s Laws in Drosophila melanogaster

Diana C. Cuevas
Broad Run High School, Ashburn, Virginia

Mendel’s genetic studies postulated three laws that consistently occur in all organisms, proving that genetic characteristics are passed on from parent to offspring. In this experiment, two types of Drosophila melanogaster (fruit fly) were the subjects: wild types (red eye color) were crossed with white types (white eye color) for the first generation (F1). My hypothesis was that if two fruit flies were mated, their offspring would inherit and exhibit characteristics of the parents.

All the flies were cultured in media easily obtained from household supplies. These media included vinegar, plantain, water, and non-flavored jell. The tubes were then covered with cotton and placed in a box where they were maintained at a constant temperature. The results of the experiment supported the hypothesis. The dominant and recessive traits were observed during the study. Mating of female white types and male wild types produced offspring with their characteristics 50% of the time, and then in the second generation (F2) these resulted in red eyes in females 25% of the time, white female eyes, red male eyes, and white males eyes, proving Mendel’s three laws. The dominance in the alleles (red color) and the recessiveness (white eyes), the segregation of the genetic information (alleles) and the independent assortment, were from the F2 individuals, all the four traits can be expressed.

For further research, it would be interesting to investigate development of more than one genetic characteristic. Would it change?

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Diana C. Cuevas 02/12/08
Finalist or Team Leader Signature Date

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The efficacy of Copper Sulfate on Bacillus megaterium

Remy D. Gascoigne
Loudoun Valley High School, Purcellville, Virginia, U.S.A

The purpose of this experiment was to test the efficacy of copper sulfate on different types of bacteria. This experiment was conducted by cultivating Bacillus megaterium on Tryptic Soy agar. There were 5 different concentrations of copper sulfate used with 5 trials for each concentration. There were also 5 petri dishes without and copper sulfate in the agar to act as the control for compassion. Data was collected by calculating the percent of the surface area covered in bacteria colonies. The results are as followed: the lowest percent surface area covered in bacteria was 18.592% and the highest was 35.407% for the controls with only two out of the 25 dishes containing copper had percentages of 3.377% and 4.621%. Further experimentation on the efficacy of copper on strains of bacteria such as Staphylococcus as this project could suggest copper as a very useful as a nanoparticle embedded into a hospital doorknob or other commonly used objects within hospitals. The copper could possibly and effectively prevent the spread of such harmful diseases without harming humans in a cost-efficient manner.

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Remy Gascoigne
Finalist or Team Leader Signature
Feb 20

Date

1405L12

Gascoigne, Remy

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Diacetyl (Popcorn Lung Chemical) in Intestinal Flora: A Medical Study
Erica J. Gouse
Dominion High School, Sterling, Virginia

Americans consume 17 billion quarts of popcorn each year. The average American will eat 60-70 quarts of popcorn in their lifetime. The United States is responsible for nearly all of the world’s popcorn production, with 25 states growing the crop. Popcorn companies use a butter-flavored chemical called diacetyl. Exposure to this has reportedly caused the lung disease bronchiolitis obliterans (“popcorn lung”) in factory workers for nearly two decades, as well as in consumers. The purpose of this research was to determine whether diacetyl negatively affected intestinal bacteria in addition to reported lung tissue. Escherichia coli and Lactobacillus casei were subjected to butter from four different types of microwave popcorn. Diacetyl alone was also added to additional bacteria plates. Bacterial growth was monitored and observed. Each plate tested with butter and diacetyl was ranked via qualitative analysis on the basis of microbial death. Escherichia coli subjected to Act II, Jolly Time, and Orville Redenbacher exhibited moderate death while Pop Secret plates showed considerable death. Plates with Escherichia coli subjected to diacetyl exhibited an extreme rate of mortality. Interestingly, there was no great mortality in Lactobacillus casei. Hence, the null hypothesis, that diacetyl would have no effect on the growth of intestinal flora, was refuted in the case of Escherichia coli and supported in the case of Lactobacillus casei. Further research of the possible harmful effects of diacetyl on the body is merited. Death of intestinal flora could possibly shut down the entire digestive system.

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1406D12
Gouse, Erica

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Finalist or Team Leader Signature: ___________________________ Date: 2/20/08

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Cimetidine is known as one of the pharmaceutical endocrine disruptors, which are chemicals that interfere with the humans’ hormone system. In order to further analyze the effect of the medicine on the hormone system, the experiment used small, freshwater-living flatworms called planarias with remarkable regeneration qualities.

Independent variable was the amount of cimetidine added to the planaria’s habitat, and dependent variable was the change in the length of the planarias. The hypothesis predicted that increase in the amount of cimetidine would also accelerate the growth of planarias.

During the experiment, planarias were bisected in half as accurately as possible and were given a small dosage of powdered cimetidine in designated levels for two weeks. Every other day, the length of each planaria was measured and recorded on the data table.

The statistical analysis of the collected data showed two different results. The planarias with the two lowest amounts of cimetidine showed p-values of 0.095289 and 0.439148. Thus, the data accepted the null hypothesis and concluded that there was no significant correlation between the amount of cimetidine and the growth of planarias. However, planarias with 0.01875g and 0.025g of cimetidine showed statistical significance with the p-values of 0.001586 and 0.015390. Additionally, the experiment found that the survival rate for bisected planarias decreased as the amount of cimetidine in the water increased. This result shows that even the miniscule amount of pharmaceutical products, which also can be the possible endocrine disruptors, can significantly affect the environment and its living species.

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4. This project is a continuation of previous research. ☐ Yes ☑ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☑ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work.

Sonnya K. Im
08/15/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between the Vitamin C Levels of the Tablet and Raw Fruits

Kristin Ko
Freedom High School, South Riding, VA

The purpose of this experiment was to see which food source (vitamin C tablet, orange, grapefruit, lemon, apple, or grape) best provides the adequate amount of vitamin C for daily human diet. The hypothesis was "If various vitamin C sources are tested by using titration, then the vitamin C tablet will have the highest mean value of total volume to titrate (to indicate vitamin C level) than that of other food sources." In order to test this hypothesis, different vitamin C food sources were tested using titration. The indicator solution (1% starch solution plus iodine solution) was made and was added to the burette to measure the vitamin C level in each food source by changing its color. The more iodine solution used to titrate, the higher the vitamin C level. The independent variables for this experiment were the different types of vitamin C substance (tablet, orange, grapefruit, lemon, apple, or grape). The dependent variable was the level of vitamin C for each substance. The results were calculated using titration and then mathematical calculation. The calculation indicates how much each food sources is needed to be consumed to get the same amount of vitamin C in the tablet. The results stated that the tablet had the highest level of vitamin C, followed by orange, lemon, grapefruit, grape, and apple. The reason why the tablet had the highest vitamin C level is that it only concentrates on vitamin C, where the fruits have additional substances, such as water, other minerals, and sugars. Although tablets provide the adequate amount of vitamin C, raw fruits can also provide vitamin C and other minerals that are needed in the human body. To consume the needed vitamin C per day, a tablet is preferred.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   ☐ human subjects  ☐ vertebrate animals  ☐ Potentially hazardous biological agents:
   ☐ microorganisms  ☐ rDNA  ☐ tissue

2. Student independently performed all procedures as outlined in this abstract.  ☑ Yes  ☐ No

3. Student worked or used equipment in a site other than school, field or home.  ☐ Yes  ☑ No

4. This project is a continuation of previous research.  ☑ Yes  ☐ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  ☐ Yes  ☑ No

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Kristin Ko
Finalist or Team Leader Signature  2/18/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effects of Sugar and Caffeine on Blood Sugar Levels
Newton, Andrew
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The effects of caffeine and sugar on blood sugar levels was investigated by using caffeine free Strawberry Fanta and Sugar Free Red Bull as independent variables. This would determine what substance raises your blood sugar levels more, sugar or caffeine. This was tested by use of human subjects. They would fast for an hour and then have their blood sugar measurement taken. Next they would ingest either the drink with high caffeine or the drink with high sugar. They would wait and hour for the substance to sink in and then have their blood sugar measurement taken again. This way I could tell which substance effects blood sugar levels more. The hypothesis that caffeine would affect blood sugar levels more than sugar was not supported. A T-test was run ( P=0.05, df=8 and a calculated T value of 15) and it showed that at degree of freedom on P=0.05 that my T value of 15 was much greater than 2.056. This rejected my null hypothesis that caffeine affected blood sugar levels more. This concluded that sugar affects blood sugar much more under my test conditions. After thinking about these results I understood why the results were the way they were. Caffeine raises blood glucose levels by releasing stored glucose in the liver. The only way to store glucose is to eat sugary foods. I had the test subjects fasting for an hour before. This does not allow them to store any glucose. If there is no glucose stored in the liver than caffeine has no way to raise blood sugar. The few times that caffeine did raise the blood sugar was probably because the subjects had a lot of sugary foods before they fasted and they still had some stored in their liver. The caffeine released this raising blood sugar levels. My experiment concluded that sugar raises blood sugar levels more than caffeine.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): [X] human subjects
   [ ] vertebrate animals
   [ ] potentially hazardous biological agents:
   [ ] microorganisms
   [ ] rDNA
   [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

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[Signature]
Finalist or Team Leader Signature

[Date]
Date

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Evaluating the Accuracy of Protein Level Claims in Dietary Supplements
Stephanie K. O'Neil
Loudoun County High School, 415 Dry Mill Road, Leesburg, VA, 20175, USA

The amount of protein in protein-based dietary supplements was tested using the Coomassie Brilliant Blue Test. The assumption was that because the FDA does not regulate dietary supplements, the manufacturers of them might be inclined to overstate the level of protein on the supplement facts label. Four different brands of protein-based dietary supplements were tested using the Coomassie Brilliant Blue Test and a spectrophotometer which calculates the absorbance of protein once the Blue Test was added. The protein was diluted 50,000 times before being put in the spectrophotometer and the absorbance read. The absorbance was converted to grams using a BSA Standard curve graph. Once all the results were in grams, the comparison between the amount of protein as stated on the label of the supplement and the result from the experiment could be done. The results were unrealistic and most likely inaccurate. The experimental results showed that the actual amount of protein in the supplements were more than double the amount listed on the label, except for one supplement where the experimental amount was less than the stated amount on the label. These results were most likely caused by an error in measurement committed in the very beginning of the experiment. Since the solution that was tested was diluted such a great amount, if one little mistake was made in measuring before it was diluted, that mistake made a huge difference in the end. More testing could be done with more accurate measurements to ensure valid results.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ microorganisms ☐ rDNA ☐ tissue
   Potentially hazardous biological agents:
2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No
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4. This project is a continuation of previous research. ☐ Yes ☑ No
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_I/We also attest that the above properly reflects my/our own work._

Stephanie O'Neil
Finalist or Team Leader Signature
2/12/08

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The DDR Revolution
Golzar Omidyar
Heritage High School, 520 Evergreen Mill Road, Leesburg, VA 20175

The purpose of this experiment is to see if DDR (Dance Dance Revolution) is more effective at burning calories than jogging.

The subjects each jogged for two minutes at a constant speed of 5 kph, as measured by a speedometer. After a break, the subjects then played DDR for two minutes at the 'standard' level. The calories lost in each test were measured using a calorimeter worn by the subject during the trial.

The results showed that jogging is in fact more effective than DDR in burning calories and therefore a healthier way of exercising. These results did not support the original hypothesis, that DDR is more effective in burning calories than jogging.

For further research, it would be best to have many more test subjects so that the conclusions can be better supported. Also, playing DDR at a different level would affect how many calories are burned and would give a better indication of whether DDR or jogging is truly more effective.

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   ☐ microorganisms
   ☐ rDNA
   ☐ tissue

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Signature  Date

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The Importance of Drosophila Immune System On Vaccine Creation
Jossaura M. Otero
Dominion High School, Sterling, VA

Drosophila melanogaster is an insect that is used often in research because of its easy maintenance and quick reproductive rate. The purpose of this research was to determine if the immune system of Drosophila melanogaster could assist in the creation of vaccines. The fruit flies were exposed to Streptococcus salivarius for a period of 14 days. The number of flies that died were noted. They were then exposed to an additional of bacteria for 7 days as well as penicillin. The mortality of the flies were noted. Control flies experienced no exposure to the bacteria and their mortality was noted as well. The null hypothesis stating that enhanced immune response cannot be initiated in Drosophila melanogaster via repeated exposure to microbe was negated. There was a difference between the deaths of flies in the group exposed to the bacteria and the group exposed to both bacteria and Penicillin. Therefore, the immune system is affected by the double exposure to the bacteria. A possible explanation for this outcome is that the immune systems of flies can remember exposure to the microbe. Also the exposure to an antibiotic increases the chances of survival. Further research would entail comparison of the effects of two or more bacterial types and antibiotic on the immune system of Drosophila.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
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Jossaura Otero 02/18/08

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The Effect of Barometric Pressure Change on Sinus Pain

Kally Recinos
Heritage High School
520 Evergreen Mill Road, Leesburg VA

The purpose of this experiment was to study the changes in the barometric pressure and how it effects sinus pain.

Eight subjects including males and females of different ages were asked to record the date and time of sinus headaches. With this information it was possible to look up weather data corresponding to the date and time of the headache to see if the barometric pressure was changing. All the headaches recorded were compiled and placed into three categories: pressure rising pressure falling and pressure remaining steady.

The data collected in this experiment did show that barometric had an effect on headaches, because there were more headaches reported when the barometric pressure changed than with no change in pressure. Most of the subjects recorded headaches when the pressure was rising not when it was falling. The t-test calculations showed that the data collected was not significant, and the null hypothesis was accepted.

One factor to look at in this experiment is the low number of subjects that participated in this research. Improvements to this experiment would be to collect more data from more subjects over a longer period of time. Additional questions that can be investigated would be if age has an effect on the number of headaches recorded when barometric pressure is changing. Another variable to look at would be if location would change the number of headaches recorded.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☒ human subjects

Potentially hazardous biological agents:
☐ microorganisms
☐ rDNA
☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☒ No

4. This project is a continuation of previous research. ☐ Yes ☒ No

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[Signature] 2/13/10
Finalist or Team Leader Signature Date

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The Relationship Between Resting Heart Rate and Physical Fitness Designation.
Katie E. Sutton
Harmony Intermediate School, Hamilton, Virginia

Are physical fitness tests a reliable measurement of fitness? Resting pulse rate is generally considered to be one reliable indicator of fitness. The purpose of this study was to compare mean resting pulse rates among 15-year-old females who had achieved Presidential physical fitness designation to those who had not achieved the Presidential designation. The hypothesis was that fifteen year old females who have achieved presidential level will have lower resting heart rates than females who had not achieved Presidential level.

This experiment tested two groups: Presidential designated females and non-Presidential females. Twenty-five Presidential subjects' pulses were measured at rest serially and averaged and twenty-five non-Presidential females were also measured at rest, serially, and averaged. Presidential mean pulse rates ranged from 45-60 beats per minute, while non-presidential pulse rates ranged from 60-80 beats per minute. Presidential designated females had lower resting heart rates. These results support the original hypothesis.

This study provides evidence supporting Presidential physical fitness testing as a valid measurement of fitness. Additional evidence to support the continued use of physical fitness testing in schools could be gathered by examining other objective indicators of fitness such as post exercise recovery rates, peak exercise heart rates, and Body Mass Index.

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Yvonne Sutton 2-2-08
Finalist or Team Leader Signature Date

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The Effect of Shampoo on the Tensile Strength of Hair
Lindsay C. Terrio
Park View High School, Sterling, Virginia

The purpose of this science experiment was to see which shampoo would correct the tensile strength of hair. In the study, interesting tools were used, such as a spring scale in grams. Three shampoos were used as well, such as Herbal Essence’s “Break’s Over”, Redken Extreme, and Pantene Pro-V Time Renewal. As well as having these essential tools, the experiment took a total of five weeks to complete for the most accurate results. The experiment was successful in seeing which shampoo brought strength to the damaged hair. Each procedure was done accurately in the experiment. For the first four weeks, the hair that was used was placed in its mixture (water and shampoo solution where 20 hairs were placed in and stirred for one minute) once a week. In the 5th week each strand of hair was pulled to its breaking point by the spring scale precisely (60 strands total). The major result that was found was Herbal Essence’s “Break’s Over” was the shampoo that gave its hair pile the most strength. In the hypothesis Redken Extreme was thought to be the shampoo that would correct the strength in the damaged hair. If further work were made into this experiment, it would be interesting to see how other shampoo brands would work on hair. Also it would be interesting to see how the shampoo worked on other hair types as well. Concluding to this entire study, the experiment was successful. Each part of the experiment led to accurate results.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ Potentially hazardous biological agents:
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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No
3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No
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Lindsey Terrio 2/11/08
Finalist or Team Leader Signature Date

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Sensing Your Health: Optimum Sensor Placement in Clothing
Pushpit Thohan
Heritage High School, Leesburg, Virginia, USA

As technology becomes increasingly advanced in the twentieth century, so should its applications. Highly advanced sensors now have the capability of sensing many vital health statistics. As sensors become exponentially useful, a new way of incorporating sensors into a subject’s life is needed. This study investigates various locations in clothing to determine which location gives data most accurately. It is first necessary to find the actual surface temperature of the body at an experimental point. By recording the experimental values of the temperature captured by the clothing embedded sensor, it is possible to determine which location gives the most accurate reading. The points tested include: behind the neck, under the armpit, inside the waistband, and on a sleeve of a short sleeve T-shirt. The experimental values found at each point were recorded every minute for ninety minutes. A period of ninety minutes was chosen for testing because it ensures that the subject partakes in sufficient activities that vary movement. This ensured that no certain testing point received additional stability for testing.

This experiment found conclusive evidence that the location of the sensor in clothing does in fact largely impact the accuracy of the measurements. The results prove that the most accurate location to place a surface temperature sensor is within the waistband. However, this study does not aim to establish a general location for sensor placement, but instead highlights the importance of choosing the right location to place a sensor based on what it is measuring.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☐ Potentially hazardous biological agents: ☐ microorganisms ☐ rDNA ☐ tissue
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3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No
4. This project is a continuation of previous research. ☐ Yes ☑ No
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Finalist or Team Leader Signature 2/4/08
Date

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The purpose of this study was to determine the effect of the food glycemic index on blood glucose levels ultimately affecting hunger. The glycemic index ranks foods on how they affect blood glucose levels. It was expected that high glycemic index foods would raise the subject’s blood glucose levels higher before lunch than low glycemic index foods. The hypothesis was tested by measuring blood glucose levels 3 times a day for 24 days after the subject ate high glycemic index food and low glycemic index food (12 days for each diet). The level of hunger was measured on a scale of 1 to 5 after the last measurement of blood glucose level. The experiment supported the hypothesis that the mean blood glucose levels measured 3 times during a span of 4h and 30min after eating high glycemic index foods was higher than the mean blood glucose levels after eating low glycemic index foods (131.64 mg/dl as compared to 117.08 mg/dl). This difference was significant at the 0.05 level, with t-test result of 2.136.

The data for hunger was analyzed using the chi-square test with a result of chi=2.136 which was significant at the 0.05 level. As predicted, the hunger was higher at lunchtime after the subject had a high glycemic index snack than on the days that the subject had a low glycemic index snack.

The conducted study supported the idea that food glycemic index could be used as guidance for eating. Low glycemic index foods kept an active teenager feeling less hungry through out school day while high glycemic index foods not only elevated blood glucose levels to unnatural high levels (230 mg/dl) but also left a person with a stronger feeling of hunger and more likely to overeat at the next meal.

This experiment is a case study since it was performed on only one person. For more general results, this experimental design should be applied to testing groups of people.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): 
   - [x] human subjects
   - [ ] vertebrate animals

2. Student independently performed all procedures as outlined in this abstract. 
   - [x] Yes
   - [ ] No

3. Student worked or used equipment in a site other than school, field or home. 
   - [x] Yes
   - [x] No

4. This project is a continuation of previous research. 
   - [x] Yes
   - [x] No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): 
   - [x] Yes
   - [x] No

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Anna Tyrlik

Finalist or Team Leader Signature 2/21/08

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# Microbiology (1500)

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Freeze-Thaw Cycles and Winter Survival in Microbes
Jenna L. Ashworth
Dominion High School, Sterling, VA

On mountains and ski resorts, artificial snow-making machines are used to produce snow for the mountain during periods without snow. This snow is made using a cold weather bacterium, Pseudomonas syringae, as nucleation centers for crystal formation, and can only be found in glaciers and arctic lakes in cold climates such as Antarctica and Greenland. The intent of this research was to determine whether bacteria from within soil from warmer climates could survive the freezing process and hence be used in snow-making. Thirty soil samples were taken from Illinois and Virginia and submitted to eight-hour freeze-thaw cycles (two hours freezing, two hours thawing) and then stored in -20 degree Celsius freezer overnight. The samples were then plated and bacterial colonies were counted after a 24-hour growth period to assess survival. The null hypothesis stating that there would be no difference between the growth of bacteria with and without freeze-thaw cycles was supported. Despite the bacteria in the soil being submitted to temperatures below -20 degrees Celsius and incubated at 27 degrees Celsius, they survived and thrived after 24 hours. This indicates that perhaps bacteria found in habitats that are not extreme may be used for nucleation in snow making. Hence, snow production at local ski resorts would not have to be as costly and it would potentially be less harmful to the environment because the snow production would no longer introduce a foreign bacteria to the environment.

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   Potentially hazardous biological agents:
   □ microorganisms  □ rDNA  □ tissue
   □ Yes  □ No

2. Student independently performed all procedures as outlined in this abstract. □ Yes  □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes  □ No

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Jenna Ashworth  2-19-08
Finalist or Team Leader Signature  Date

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1501D12
Ashworth, Jenna
Effects of Water Temperature on Potentially Deadly Microorganisms
Eric M. Bolden
Loudoun Valley High School, Middleburg, Virginia

Infection of the central nervous system by the species Naegleria fowleri is rare; but, when such cases do occur, it will nearly always result in the death of the infected. It's important to find what factors could affect the likelihood of infection. In this case, varying water temperatures at which the species tends to thrive in are examined to determine the lowest activity levels of the specimen in respect to water temperature. It was hypothesized that the cooler water, the less active the specimens will be. Within the laboratory, the Amoeba proteus species is used in place of the Naegleria fowleri for safety precautions. After organizing 24 vials measuring at 2 drams 17mm x 60mm into four groups of six, samples of the Amoeba proteus specimens, as well as, a food source (another specimen Chilomona) are equally placed into a distilled water medium within each vial. Together, the two specimens are placed on a hot plate increasing the water temperature to 24, 26, 28, and 30°C respectively to each of the four groups. Percentage values are calculated by the division of the number of specimens undergoing binary fission by the total number of specimens visible after examining a given point under a light microscope. Activity levels, in comparison to those at the lab's room temperature of 22°C, increased by 10%, 15%, 26%, and in several cases exceeding inhabitable temperatures for the specimens. The Amoeba proteus species does reach a peak in activity level before exceeding temperatures considered non-habitable to the specimen. These temperatures are ideal in order to decrease the likelihood of infection. The results show the the hypothesis was true, but that there were also more reliable solutions. Activity levels were lower at cooler temperatures, but the ideal temperatures for the safety of swimmers are temperatures that exceed what is habitable to the specimen. Having a range of temperatures allow swimmers to see what is considered safe to swim, as well as, where infection is least likely to occur.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. Yes □ No

3. Student worked or used equipment in a site other than school, field or home. Yes □ No

4. This project is a continuation of previous research. □ Yes ✔ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes ✔ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work.

Signature: ____________________________ Date: 2/19/08

Finalist or Team Leader Signature

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The purpose of the experiment is to evaluate the effects of dog saliva on commonly found bacteria. To safely perform the experiment several safety precautions are taken, such as gloves, and perhaps a lab coat. Once this is completed collect the bacteria from an everyday surface and apply it to each of the ten agar plates, place it in the oven and allow it to grow for several days. Then measure the average circumference of each of the bacteria colonies. At that time, apply the dog saliva in the sterile tubes to five of the agar plates. Preferably the ones that have the most bacteria growing. Place these agar plates back into the oven, and measure the circumference once again in the morning. During the same period of time, apply the saliva that was not in the sterile tubes to the bacteria in the last five agar plates. At this time place the nutrient agar plates into the oven so that they can react overnight. The next morning measure the average circumference of each bacteria colony. Record all of the data into a record book and formulate graphs. Finally after all these requirements have been completed clean out the agar plates using bleach. Place all ten agar plates and their lids into the sink. Pour the bleach sufficiently onto the agar plates and let sit for twenty minutes. As soon as this is completed take out the agar plates and place them into a trash bag and seal it.

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   Potentially hazardous biological agents:
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Allison Clark 2/2/08
Finalist or Team Leader Signature Date

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Bacterial Susceptibility
Christopher T. Connelly
Potomac Falls High School, Sterling, Virginia

The purpose of the experiment was to test susceptibility to antibiotics of Gram-positive and Gram-negative bacteria and their susceptibility to antibiotics. The hypothesis was, “If the bacteria are exposed to the antimicrobials, then more Gram-positive bacteria than Gram-negative bacteria will be destroyed because Gram-negative bacteria are generally more resistant to antimicrobials.” The null hypothesis was that the change in the Gram status of bacteria will not affect the outcome of the experiment.

Eighty hole-punched filter paper discs were marked with a symbol representing each antimicrobial. Plates containing the Gram-positive bacteria (Streptococcus lactis) and Gram-negative bacteria (Escherichia coli) were labeled. The bacteria were spread on the agar plates. Using forceps, each disk was dipped in its corresponding antimicrobial and the excess scraped off, then placed in the agar plates. Ten plates contained Gram-positive bacteria, and ten contained Gram-negative bacteria. Each plate contained four disks: one disk impregnated with the antibiotic Ampicillin, one with Clorox Clean-Up with Bleach household cleaner, one with Clorox Disinfecting Kitchen Cleaner, and one with no solution. The plates were placed in an incubator at 37° Celsius for 96 hours. After 96 hours, the plates were removed from the incubator, and the zones of inhibition were measured in millimeters. The outcome proved that the Gram-negative bacteria were more resistant to all antimicrobials. Ampicillin was most effective against both bacteria.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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4. This project is a continuation of previous research. ☐ Yes ☑ No

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Christopher Connelly 2/12/08
Finalist or Team Leader Signature Date

1504P09
Connelly, Christopher

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The Production of Cellulase Enzymes
Victoria L. Crone
Loudoun Valley High School, Purcellville, VA

Cellulase enzymes are important in the production of ethanol as an alternative fuel source. Ethanol has been an important topic for scientists in order to reduce the United States dependence on foreign oil. There are three different ways to produce ethanol fuel from cellulose. One of the most common is enzyme hydrolysis; however, the production of the enzymes needed to break down cellulose is not cost efficient. The objective of this experiment is to better understand how cellulase enzymes are obtained and to find out what is the best environment for obtaining these enzymes.

A common source for cellulase enzymes is from fermenting fungi, such as Aspergillus niger. An agar was created using the “optimized culture medium” with a few adjustments from Immanuel’s lab “The Production and Partial Purification of Cellulase by Aspergillus niger and A. fumigatus Fermented in Coir waste and Sawdust.” A. niger was inoculated and kept at three different temperatures to grow, 40 degrees Celsius, 32 degrees Celsius, and the control at 25 degrees Celsius. The control group was expected to have the most enzymes. The Dinitrosalicylic Acid Method was performed on each fungus culture to determine the amount of cellulase enzymes emitted from the fungus.

The procedure for this experiment was very complicated and time consuming. Many problems were encountered and were overcome. By doing this experiment we can see the difficulties in obtaining cellulase enzymes, therefore making the production of ethanol fuel very costly and not efficient on a commercial level.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): 
   [ ] human subjects
   [ ] vertebrate animals
   [X] Potentially hazardous biological agents:
     [X] microorganisms
     [ ] rDNA
     [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [✓] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [✓] No

4. This project is a continuation of previous research. [ ] Yes [✓] No

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[Signature] 2/20/2008
Finalist or Team Leader Signature Date

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The Relationship Between Common Household Herbs and their Inhibition on Escherichia coli Growth as Measured in Halo Effect (diameter in cm)
Jacklyn A. Daly
Freedom High School, South Riding, VA

Bacteria resistant to antibiotics have become a growing issue and more research on alternative cures for bacterial infections is needed. The idea of using herbs to treat and/or inhibit bacterial infections is one of the alternative cures that deserves further consideration. In this experiment, Escherichia coli was selected because it is a bacteria that is resistant to some antibiotics. The herbs selected for the experiment were thyme, sage, and garlic. In this experiment, Petri dishes were prepared with nutrient agar and inoculated with E. coli, using an aseptic lawn technique. The herbs were mashed with ethanol, using a mortar and pestle, to produce sterile herb tinctures. The six herb tinctures produced were garlic, sage, thyme, garlic-sage, sage-thyme, and garlic-thyme. A sterile blotter dipped in the herb tincture was placed on the inoculated agar. The Petri dishes were incubated at 37 degrees Celsius for 24 hours. The halo effect around each blotter was measured (diameter in cm). After statistical analysis, the tinctures containing garlic inhibited the growth of E. coli significantly more than any other herb or herb mixture tincture. The experiment supports that garlic can inhibit the growth of E. coli and herbs may be a valid alternative prevention or cure for antibiotic resistant bacteria. Although the experimental hypothesis, that the garlic-thyme mixture would inhibit the growth of E. coli more than any other herb or herb mixture, was not supported, the experiment supported that herbs such as garlic can inhibit the growth of E. coli in much of the same ways as the antibiotic control (Clprofloxin).

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Jacklyn Daly 2/7/08
Finalist or Team Leader Signature Date

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The Effects of Cleaning Agents on Household Bacteria
Joseph Gabro
Broad Run High School, Ashburn, Virginia

This project was performed because of curiosity of the growth of bacterial colonies. Many people know that bacteria is all around us, but people do not know which type of cleaning agent will get the job done. People often wonder which products work best to fight off household bacteria, but no one experiments on it. This experiment was conducted to share which cleaning agent works best against killing the most bacteria.

Clorox Bleach, Pine-Sol, and Scrubbing Bubbles were tested against bacterium. The hypothesis stated that Clorox Bleach would perform best at killing the most bacterium. The experiment was done by swiping bacterial colonies off a dirty sink, and placed on a sheep blood agar plate. This plate was then placed into an incubator, which after 24-48 hours would culture the bacterial colonies. After running through this procedure, it was showed that Pine-Sol worked best against bacteria, which ultimately did not support the hypothesis. Although Pine-Sol killed the most bacterium in this experiment, it wasn't effective compared to Clorox Bleach after using a t-test to prove that their p-values were too similar to one another.

It was concluded that Pine-Sol would be the best cleaning agent to use against fighting off household bacteria. Clorox Bleach would also be a great product to use, as well.

Further research might include a possibility of creating a product that kills 100% of bacteria. Also, if a product was created to kill as much bacterium as possible, would it include isopropanol, the main ingredient that Pine-Sol uses? These questions and comments could lead to future research and references.

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I/We also attest that the above properly reflects my/our own work.

Gabro, Joseph
1507B09

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The Relationship between Tea Tree Oil and the Most Effective Antibacterial Dishwashing Soap
Gaurav Gupta
Briar Woods High School, Ashburn, VA

This experiment tested three brands of dishwashing soap to improve the antibacterial properties of the best of the three. Part 1 of the experiment identified the most effective dishwashing soap and part 2 identified if tea-tree oil improved the most effective dishwashing soap. Bacteria were treated with Ajax, Palmolive, distilled water (control) and Dawn; and then incubated. After incubation, Ajax had a mean zone of inhibition of 23 mm, Dawn 6.7 mm, Distilled Water 0 mm, and Palmolive 22.1 mm; proving Ajax the most effective. In part 2, bacteria were treated with solutions of Ajax and Ajax + Tea Tree Oil. Ajax had the largest mean zone. The mean of the number of colonies of the Ajax + Tea Tree Oil was lower than the Ajax alone. The calculated t-value for Ajax was 5.8574 and for the Ajax + Tea Tree Oil 6.8052; 1.8514 in intended test. The table value of level of significance for the given degree of freedom was 2.048 and so the null hypothesis is rejected for all cases involving Ajax + Tea Tree Oil, in the colony method and accepted in the intended method as both tests contradicted each other.

A source of error in this experiment is an insufficient amount of bacterial growth in the second part of the experiment, and so, a method of counting the number of colonies was applied. Soon the intended test was applied. Other brands of dishwashing soaps and solutions claimed to be antiseptic can be used to expand this experiment.

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☐ vertebrate animals  

Potentially hazardous biological agents:
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☐ rDNA  
☐ tissue

2. Student independently performed all procedures as outlined in this abstract.  
☐ Yes  
☐ No

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☐ Yes  
☐ No

4. This project is a continuation of previous research.  
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☐ No

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☐ No

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Finalist or Team Leader Signature  
2/9/08  
Date

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The Relationship of Hair Type and Environment Exposure With the Amount of Bacteria in Hair

Jenilee B. Holgado
Freedom High School, South Riding, Virginia

Have you ever thought to yourself how much bacteria has grown on that single strand of hair? No one ever wants to think about it, but several dozen colonies of bacteria can grow in a short period of time. This experiment was to show the effect of environment on different types of hair.

The hypothesis of this experiment was that straight hair from an indoor environment would have fewer bacterial colonies than curly hair from an outdoor environment.

Several sample were collected for each hair type. The control was hair that was washed and then immediately platted and sealed. The indoor samples were washed and left indoors for 24 hours. The outdoor samples were washed and left outdoors for 24 hours. The indoor and outdoor samples were then platted and sealed. All three groups were left to culture for four days. After four days, the colonies were counted and recorded.

At a 95% confidence level, there was a higher amount of bacteria from curly hair than from straight and wavy hair. Straight hair tends to be less coiled which makes it harder for bacteria to collect and develop in. Wavy hair tends to collect more bacteria than straight hair. Curly hair is tightly coiled, which allows bacteria to collect the fastest and easiest.

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4. This project is a continuation of previous research. □ Yes □ No

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Finalist or Team Leader Signature: ___________ Date: 2/28/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The purpose of this project was to determine the effects of Homo sapien saliva on the growth of Escherichia coli bacteria. It was found that, although inconsistently throughout the trials, Homo sapien saliva does decrease the growth of Escherichia coli bacteria.

Nutrient agar plates were poured and inoculated with Escherichia coli bacteria. The Petri dishes were then set in an incubator for two days. When removed, filter disks were soaked in Homo sapien saliva and then placed in the center of each Petri dish. After leaving the dishes in the incubator for five days, a change in the growth of the Escherichia coli was observed. On average, the diameter of the zone of inhibition was measured to be approximately 0.97 centimeters.

After analyzing the data, it can be concluded that Homo sapien saliva limits the the growth and spread of Escherichia coli bacteria. These results can be used in further research of creating more efficient antibiotics to fight against Escherichia coli.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☒ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents: ☒ microorganisms ☐ rDNA ☐ tissue
2. Student independently performed all procedures as outlined in this abstract. ☐ Yes ☒ No
3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☒ No
4. This project is a continuation of previous research. ☐ Yes ☒ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☒ No

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Christina Lee

Finalist or Team Leader Signature Date

1510P10
Lee, Christina

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of water boiled with Psidium guajava on Escherichia coli
Megan Limson
Freedom High School, South Riding, VA

Many plants, like the guava or Psidium Guajava, have developed antibacterial properties because they are unable to move and escape from their predators. This fact has been utilized by many scientists in order to create medicine to fight deadly bacteria. However, many ancient techniques are still quite effective. The practice of boiling water with guava leaves is an old technique used to cure stomach illnesses and cleanse wounds. It is believed that the water took the properties of the guava leaves and killed bacteria. This experiment shall test this old technique.

The bacterium used to test this is Escherichia coli, a well known stomach bacteria. Antimicrobial discs were dipped into water boiled with Psidium guajava, hand sanitizer, and plain water. The last group of discs was left blank. They were placed in the middle of the growing Escherichia coli to see if it would inhibit the growth of the bacteria around it. The results proved that this method worked. The discs with Psidium guajava successfully inhibited the bacteria around it. Its results were close to that of the hand sanitizer. This supported my hypothesis in that it effectively inhibited the bacteria. This occurred because properties were passed into the water during the boiling process, just like how tea leaves pass flavor into the water.

This research can be furthered by comparing whether or not using fresh or dry guava leaves make a difference. It could also be tested on a different type of bacteria.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
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   ☐ vertebrate animals  

   Potentially hazardous biological agents:  
   ☒ microorganisms  
   ☐ rDNA  
   ☐ tissue

2. Student independently performed all procedures as outlined in this abstract.  
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   ☐ No

3. Student worked or used equipment in a site other than school, field or home.  
   ☐ Yes  
   ☒ No

4. This project is a continuation of previous research.  
   ☐ Yes  
   ☒ No

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   ☐ No

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Megan Limson  
2-4-08

Finalist or Team Leader Signature  
Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
"Life" is always abundant in kitchens. This "life", however, may not just be you and me. The study that was conducted included the use of different disinfectants on this kitchen bacterial growth.

In the experiment, lunchmeat (turkey) was spread over several cutting boards and cleaned with a different disinfectant each time. A sterile swab was then used to place samples of bacteria on the agar petri dishes. The cultures were incubated at 37 degrees C and showed whether the disinfectant did its job or allowed the bacteria to grow freely without much notice to the cleanser.

After the entire experiment, one disinfectant showed extremely favorable results. OxiClean had the clearest agar petri dishes and had the least amount of bacterial colonies. Although this did not support the experimental hypothesis, it was nice to find that there was in fact a disinfectant that can keep your kitchen clean. Clorox, the hypothesis prediction, was so close to water in its ineffectiveness that the t-test indicated that it was not a significant difference.

The conclusion to the experiment was that OxiClean had the best results. The hypothesis was not supported and neither was the null hypothesis. The purpose to this study was to see which disinfectant should be preferred by consumers.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): [ ] human subjects [ ] vertebrate animals [ ] Potentially hazardous biological agents: [x] microorganisms [ ] rDNA [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [x] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [x] No

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Sarah A. Paolozzi 7 Feb 2008

Finalist or Team Leader Signature Date

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Studies have documented that there is a connection between the use of antibiotics and growing bacterial resistance to the antibiotics. As a result, many people are asking the question, "Are prescription antibiotics the only option for effective treatment?"

An experiment was conducted using the four all-natural products: garlic, tea tree oil, clove oil, and dandelion root extract, along with the antibiotic Erythromycin on the bacteria, Bacillus cereus. All products tested were the independent variables in this experiment while the bacteria's reaction to these substances was the dependent variable. The bacteria were applied using a four-quadrant streaking method on a five percent sheep's blood nutrient agar. All five products were added to monitor their efficacy rates on the bacteria. After a three day observation period and several trials using each substance, the garlic killed or greatly reduced the bacteria where applied. Tea tree oil and clove oil acted as inhibitor of bacterial growth. Dandelion root extract showed no actual results even though the bacteria was killed. It should be noted however that the petri dishes used for testing Erythromycin had no visible colonies present prior to application.

Based on the results, this experiment was vary beneficial to anyone interested in alternative medical treatments; it shows that the antibiotics are not the only option to inhibit bacterial growth. The hypothesis that certain all-natural products inhibit or kill bacterial growth can be very useful. More studies should be conducted to determine their full potential and medicinal value.

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Jessica Reulein
Finalist or Team Leader Signature 2/21/08

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The Effect Of Disinfecting Wipes On The Growth Of Bacteria
Maureen A. Rice
Potomac Falls High School, Sterling, Virginia

The purpose of this experiment was to determine if the use of disinfecting wipes on surfaces changed the amount of bacteria that grew on the object, to show if the disinfecting wipe reduced the amount of microbial growth.

The surfaces that were chosen to be sampled for bacterial growth were a door push handle, vending machine buttons, and a computer keyboard and mouse. 120 samples were taken from these surfaces. 10 samples were taken from the first site before the use of the disinfecting wipe then 10 more samples were taken after the surface was wiped with a disinfecting wipe. The surfaces were swabbed with Q-tips then the Q-tips were each swabbed in a separate 35mm petri dish. The petri dishes were then put into an incubator and left for two days. After the two days the microbial growth was recorded.

The data from this experiment supported my alternate hypothesis in that the surfaces treated with a disinfecting wipe showed lower levels of microbial growth than the surfaces left untreated before sampling. The data showed that the computer keyboard and mouse had a higher level of microbial growth before the disinfecting wipe was used than the other two sites and also had the highest level of bacterial growth after the use of the disinfecting wipe. The door push handles had the least amount of microbial growth both before and after the use of the disinfecting wipe.

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   [ ] vertebrate animals

2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

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Maureen Rice
Finalist or Team Leader Signature

11/14/07
Date

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The Effect of Used Lip Gloss Versus Unused Lip Gloss on Bacterial Growth
Coral J. Ryan
Stone Bridge High School, Ashburn, VA

It is well known that bacteria is found everywhere in our world. The purpose of this experiment was to determine whether chemical preservatives in lip gloss can effectively kill bacteria that can contaminate lip gloss. To test this, two tubes of lip gloss were gathered, one containing used lip gloss, the other containing unused lip gloss. Samples were taken from each of the tubes and placed within Petri dishes. They were then left at room temperature for one week to allow bacterial growth to accumulate around the samples.

Once the time had passed and the samples were observed, it was found that the samples of used lip gloss had more bacterial growth than the samples of unused lip gloss. However, statistical analysis of the data collected showed that the difference between the two types of samples was insignificant. Therefore, the original hypothesis of "if used lip gloss and unused lip gloss are left to accumulate bacteria, then the used lip gloss will accumulate more bacteria than the unused lip gloss" was not supported by the results of this experiment. The results instead showed that the chemical preservatives that are put into lip gloss do work effectively in greatly decreasing the amount of bacteria within the lip gloss. Things that should be examined for the future include the amount of time it takes for a significant difference to develop between the two types of samples and if preservatives in other types of makeup work as effectively.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals ☒ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☒ No

4. This project is a continuation of previous research. ☐ Yes ☒ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☐ Yes ☒ No

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Finalist or Team Leader Signature: ____________________________ Date: 02/23/108

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between Time and the Growth of Bacteria in an Overused Water Filter
Carolyn Tousley
Stone Bridge High School, Ashburn, VA

This experiment involved testing a refrigerator’s water filter for bacteria. The filter was in use for two years after the ‘change filter’ light illuminated. The hypothesis was: If the refrigerator water filter is used well past its filter capacity, then bacteria will grow inside the filter, and will be released into the dispensed water.

The control variable was the home’s tap water, and the experimental variable was the dispensed filtered water. The experiment involved performing three different tests over a period of six weeks: pH, chlorine, and Heterotrophic Plate Count (HPC) using the SimPlate ® Method, which measures the most probable number of bacteria colonies (MPN).

The pH stayed normal (7.0) for both control and experimental samples. The filter removed some, but not all, chlorine. The HPC bacteria counts (control and experiment) did not follow a predictable pattern. The tap (control) water source was changed mid-experiment from a contaminated laundry room faucet to a clean basement faucet. After changing the source of the tap water to the basement faucet, the tap (control) samples had almost no bacteria in them (HPC MPN from 1.8 to 19). The experimental samples had high levels of bacteria (HPC MPN from 43 to 740).

It was concluded that in-refrigerator water filtration systems should be changed according to manufacturer’s directions.

Further experimentation could explore what type(s) of bacteria would grow in an expired refrigerator filter.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals
   Potentially hazardous biological agents:
   ☒ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☒ Yes ☐ No

4. This project is a continuation of previous research. ☐ Yes ☒ No

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I/We also attest that the above properly reflects my/our own work.

Carolyn Tousley
2/20/08

1516809
Tousley, Carolyn
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<td>Young, Skye</td>
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</table>
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The Relationship Between Wheel Diameter and the Speed of a Skateboard

Curtis Calder
Briar Woods High School, Ashburn, Virginia

The purpose of this project is to determine whether the wheel diameter affects the speed of the skateboard. The independent variable was the diameter of the wheel, and the dependent variable was the speed that the skateboard traveled. This project tests this on a skateboard, but this idea can be used on a variety of things besides skateboards. Each wheel size was run through a set of 15 trials in which the skateboard was released down a ramp and then traveled 194 inches. The starting point on the ramp and the ending point on the runway in the trials remained the same throughout. The stopwatch was started when the skateboard began down the ramp and was stopped as soon as the nose of the board crossed the end point. The hypothesis was that the larger wheels would make the skateboard travel the fastest, but it was the smaller wheels that constantly ended up with the lowest times. The smallest set of wheels completed each trial in an average of 3.122 seconds; the medium (control) set of wheels completed each trial in an average of 3.224 seconds; and the largest set of wheels were the slowest at an average of 3.308 seconds. The null hypothesis was rejected by the smaller set of wheels, but the larger set of wheels had insignificant data. The variance of the data for the largest set of wheels was 0.0019131, and the variance of the data for the smallest set of wheels was 0.001446. The calculated t-test for the smaller wheels was 7.3722, and was 5.6149 for the larger wheels. Since the smaller wheels mean was lower than the controls, the t-test had to be higher than the degrees of freedom at 42 and 0.5 which it was. The results were significant. For the larger set of wheels the mean was higher than the control, yet the t-test value was also higher than the degrees of freedom, meaning the results were insignificant. This project could be expanded by extending the length of the trials and using larger differences in wheel size. The source of error in the experiment could be each wheel was of a different model/make, but it was of the same material.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  □ human subjects  Potentially hazardous biological agents: □ microorganisms  □ rDNA  □ tissue  □ vertebrate animals  Yes  □ No  □ Yes  □ No

2. Student independently performed all procedures as outlined in this abstract.  Yes  □ No

3. Student worked or used equipment in a site other than school, field or home.  Yes  □ No

4. This project is a continuation of previous research.  □ Yes  □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  □ Yes  □ No

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[Signature]  2/14/08

Finalist or Team Leader Signature  Date

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The Effect of Temperature on Magnetic Strength
Zachary Cekala
Broad Run High School, Ashburn, VA

Magnetism is a broad and vast field of study and long has the human race attempted to maximize the efficiency of magnets and their magnetic strength. In order to this, different temperatures can be exposed to magnets to increase or decrease their effectiveness.

By suspending magnets above paperclips and recording the amount picked up, magnetic strength can be found. The independent variable is the different temperatures the magnet is exposed to prior to suspending it above the paperclips. The dependent variable is the magnetic strength displayed, measured in paperclips.

As shown in this experiment, magnets are stronger in colder environments than room temperature environments. The results supported my hypothesis and further support the idea that a colder magnet is a better magnet. Now, colder environments can be produced in the making of magnets to create better magnets, with the maximum magnetic strength.

What other factors can intensify the efficiency of magnets? Perhaps the size or shape of a magnet plays a role in such a question. Maybe coating a magnet with certain materials, such as glue or paint, will affect its magnetic strength.

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Finalist or Team Leader Signature: Zachary Cekala
Date: 2/11/08

1602B10
Cekala, Zachary

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Relationship Between the Velocity of .22 Caliber Ammunition and Accuracy
Robby Cockerham
Freedom High School, South Riding, VA

The mechanics and physics of firearms are something to be seriously contemplated when one is choosing the correct type of ammunition to use for their personal weapon. This study confronted the choices and furthered findings of other studies in attempting to find the most accurate type of .22 Caliber Ammunition.

In this experiment, Subsonic, High, and Hyper velocity ammunition were tested and the results were compared with the control, Standard Velocity. The findings were based on the average distance from the bull's eye with 50 trials for each ammunition type fired at 50 yards away. The rifle was secured to allow for no deviation in aiming and the trials were conducted in an indoor range that eliminated natural variables, including wind.

The results of the study, found by utilizing a t-test, were fairly insignificant excepting the results of the Subsonic ammunition. Subsonic ammunition was found to be significantly more accurate than the remaining types of ammunition, including the control, Standard velocity.

In conclusion, this study was successful and the results coincided with results found in previous studies that stated that Subsonic velocity ammunition is more accurate due to it not breaking the sound barrier during travel, which causes a slight deviation for non-Subsonic ammunition. Although the experimental hypothesis of this experiment was not supported, it was without surprise nor confusion.

This experiment raises questions such as how the results might change at a longer or shorter distance as well as if the same study with a different caliber weapon and ammunition would provide different results.

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Finalist or Team Leader Signature: Robby Cockerham Date: 2-5-08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Effect of Variance in Light Speed on the Distance of Stars
Fackler, Joseph M.
Broad Run High School, Ashburn VA

This project involves computing the theoretical decay of light speed and its impact on the distance of stars from the earth. The speed of light was declared in 1983 with measurements by atomic clocks. But the clocks themselves use light speed, so the speed of light, when used to define itself, will always be constant. Also, other alleged constants where a change had occurred were allowed to change, and prior to the 1983 declaration had produced truly constant constants when used with the changing speed of light. Allowing the speed of light to resume its previous relation to these other constants provides a changing speed of light.

This experiment simply places the earliest data for the relating constant against its contemporary light speed, then allows light speed to vary with the relating constant to find the new light speeds and the distance to the stars that results. The independent variable is the speed of light, and the dependent variable is the distance to the selected star. The differences in light speeds and distances were not large, however that may be because the data is from the past 70 years, when measurement systems were reasonably accurate. There was also a decreasing trend in the speed of light approaching the present. The experiment was conclusive on two counts, first, that the speed of light could scientifically vary, and second, that over a greater amount of time, this would result in a large difference in the speed of light.

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2. Student independently performed all procedures as outlined in this abstract. [ ] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [ ] No

4. This project is a continuation of previous research. □ Yes [ ] No

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Joseph Fackler 2/14/08
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
The Structure of an Instrument and its Emitted Sounds
Steph Fedor
Loudoun Valley High School
Purcellville, VA, USA

The purpose of this experiment was to determine whether the structure or material of a flute affected the sound emitted. It is a common myth that flutes made of a denser material play harsher than that of a less dense material. To test this, eight different flutes were gathered and played by two players. The sounds were recorded for frequency analysis. The analysis of the frequency, the dependent variable, would be affected by the structure and material of the flute, the independent variable. When the results were collected, it was apparent that there was no huge difference in the data. Disproving the original hypothesis, it was found that the configuration of a flute is not related to the tone produced. However, when the tone of the eight different flutes was being recorded, the distance of the player from the microphone was overlooked, which may have caused some incorrect data. Also, in a further study, a test on the exact material of which the chosen flutes are made up of would be helpful in determining possible uniqueness of the sound difference between materials. However, the results of this experiment provide evidence that structure does not affect tonal qualities.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes ☑ No

4. This project is a continuation of previous research. □ Yes ☑ No

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Stephanie M. Fedor
Finalist or Team Leader Signature 4/15/08

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1605L10
Fedor, Stephanie
The Effect of Acoustic Resonance on Physical Objects
Sean Maroni
Stone Bridge High School, Ashburn VA

The purpose of this experiment was to use the natural phenomenon of resonance to affect the stature integrity of a glass. Acoustic resonance is the tendency for an object to vibrate at a specific speed, or frequency. If an object's resonant frequency is applied from an outside source, the object will vibrate. To create this effect, the specific frequency of a wine glass vibration was pinpointed using frequency identification software. Then, a sine wave was generated at the specific frequency. Then, the sound was played to the wine glass at 100db. This caused the system to vibrate. Glass wine glasses were used as the control, and crystal glasses were used as the experimental group. And the dependent variable of vibration intensity was affected by the frequency of the tone.

It was found that the crystal wine glasses produced a 106.060% increase in vibrations over the glass wine glasses. The control group showed an average resonance frequency of 1116hz, while the experimental group averaged 785hz. On a 0-5 scale measuring vibration intensity, glass wine glasses averaged 2.2. The crystal glasses averaged 4.5. The chi squared showed a significant difference in the two groups (P<0.01).

As shown by the vibration levels in the crystal wine glasses, it can be concluded that acoustic resonance can dramatically affect an object. Moving beyond, this knowledge of acoustic resonance could be applied to predict the patterns of resonance occurring in other energy forms, such as modeling laser cavity resonance.

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Finalist or Team Leader Signature Date

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The Effect of Angle of Incidence on Reflected Laser Power
Daniel O'Keefe
Briar Woods High School, Ashburn, VA

The study of optics and lasers is key to this experiment. Lasers have been around since the 1950's, when Theodore Maiman, Charles H. Townes, Nikolai Basov, Aleksandr Prochorov, Gordon Gould, and Arthur Schawlow all tried to be the first to invent the laser.

The experiment was to determine if the laser power reflected by a mirror would decrease, as it's angle of incidence (AOI) increases. The Null Hypothesis is that the power stays constant, as the AOI increases. The independent variable is the AOI and the dependent variable is the reflected laser power. First, the control (straight in front of the laser) was measured, and then the goniometer was moved up to 10° and the sensor head moved to catch the laser. This 10° reflected power is the comparison standard for reflecting energy for subsequent readings. This procedure was repeated, moving the mirror in 10° increments and measuring the reflected power, until reaching and 80° AOI. The entire procedure was repeated 15 times at each setting in order to determine statistical validity.

Statistically significant data indicated that the reflected power decreased with increasing AOI and supported the hypothesis. It is necessary to consider this loss of energy in designing optical systems.

Further research would include the relationship of different laser wavelengths, as the mirror efficiently is not likely to be similar at all wavelengths.

The null hypothesis was that the reflection efficiency of the mirror would decrease as the angle increases.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals □ microorganisms □ rDNA □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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Finalist or Team Leader Signature: Daniel O'Keefe
Date: 1/20/08

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Measuring Acceleration in Force Applied to Football Helmets
Adam T. Odegaard
Loudoun Valley High School, Purcellville, Virginia, USA

One of the largest problems in the sports industry is injuries to the head. In the sport of football, there is an average of two deaths recorded every year from a severe blow to the head, despite the safety increases in protective gear. Concussions are a very common in football, occurring when a significant blow is delivered to the head. The majority of football concussions are not life threatening, but they can cause significant damage nonetheless.

The best way to ensure player safety is to create a safer helmet designed with the purpose of decreasing all head injuries that occur in the contact sport of football. The purpose of this experiment is to discover which form of padding material turns out to be the most effective in protecting the brain against severe blows. Technology has been used to monitor the force of the delivered hit and determine the severity of the possible concussion, but to date no company has published work on the experimental testing of new padding.

The predicted outcome of the testing is that the water and air will significantly reduce the force of the blow and thus protect the brain better. The sand is likely to simply transfer the force, and the gelatin is likely to mold to the shape of the head but do not much in the way of protecting against the hit. Foam is the control because it is undoubtedly the most commonly used material in football helmets today. Whichever proves to be the most durable and safest while at the same time being the lightest will be considered the best for manufacturing in youth and adult football helmets.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   - [ ] human subjects
   - [ ] vertebrate animals
   - [ ] potentially hazardous biological agents:
     - [ ] microorganisms
     - [ ] rDNA
     - [ ] tissue

2. Student independently performed all procedures as outlined in this abstract.
   - [x] Yes
   - [ ] No

3. Student worked or used equipment in a site other than school, field or home.
   - [ ] Yes
   - [x] No

4. This project is a continuation of previous research.
   - [ ] Yes
   - [x] No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):
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   - [x] No

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[Signature]
Date: 2/19/08

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Obtaining the maximum height a certain model rocket can go by finding its optimum mass.

Jessie Picone  
Heritage High School, Leesburg, VA

The purpose of this experiment was to test the effects of weight variance on a model rockets performance. Fifteen launches were fired, of those fifteen the weight was increased up to 20%. Rocket altitude was used as a measure of performance and was based on measurements of the elevation angle using a sextant and distance to the launch pad. These results were compared against a control launch where no payload was included and was used to determine the weight for optimum rocket performance. The independent variable was the total mass of the rocket. The dependent variable was the rocket’s apogee. The results showed that 4% of the rockets mass made the rocket fly the highest. If this experiment was going to be done again there should be some changes made. Statistics showed that the rocket with no mass increase would have been the second best option. The height of the rocket declined more as the mass increased. More rockets should be bought to prevent items from going wrong, its always good to have back ups. Also more trials should have been done, and it should have been more precise. The increase of the payload should be done by smaller increments. Instead of 4%, 12%, 16%, and 20% increased, the increments should have been reduced to 3.5%, 4%, 4.5%, and 5%. These would have focused even more on the optimum payload. 5%.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - human subjects  
   - vertebrate animals  

   Potentially hazardous biological agents:
   - microorganisms  
   - rDNA  
   - tissue

2. Student independently performed all procedures as outlined in this abstract.  
   ✔ Yes  
   No

3. Student worked or used equipment in a site other than school, field or home.  
   ✔ Yes  
   ✔ No

4. This project is a continuation of previous research.  
   ✔ Yes  
   ✔ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself):  
   ✔ Yes  
   ✔ No

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Jessie Picone  
Date: 2-19-08

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1609H09
Picone, Jessica
The Effect of Different Kinds of Water on the Reaction and Repulsion of an Applied Magnetic Field

Daniel Rush
Freedom High School, South Riding, VA

This study relates to the area of Magnetics. Diamagnetism is an interesting field of study. Scientists have been experimenting with this type of magnetism in order to develop new ways of transportation through a process known as diamagnetic levitation. Diamagnetic levitation uses a repulsion that is created by certain materials when a magnetic field is applied. Even though this type of magnetism is the least observed, it could be very useful in the future.

In this experiment, different types of water were examined to see if one produced a greater reaction to an applied magnetic field. The amount of repulsion was measured. The three types of water included: tap, filtered, and spring water. Each type of water was placed in a beaker with isopropyl alcohol and oil drops. When the water reacted to a magnet placed against the beaker, the reactivity was shown through the movement of the suspended oil drops.

Overall, the tap water produced the greatest reaction to an applied magnetic field. As a result, the hypothesis, which stated that the spring water would show the greatest reaction, was not supported. The results were statistically significant and different. The discovery of the tap water’s greater repulsion could be used successfully in diamagnetic levitation.

Some questions have arisen from this experiment. For example, would the addition of different solutions to the beaker affect the amount of repulsion? Also, could a much stronger magnet affect the reactions as well? These questions bring up points that could provide interesting research.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   - [ ] human subjects
   - [ ] vertebrate animals
   - Potentially hazardous biological agents:
     - [ ] microorganisms
     - [ ] rDNA
     - [ ] tissue
   - Yes  [ ] No

2. Student independently performed all procedures as outlined in this abstract.  [ ] Yes  [ ] No

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[Signature]
Finalist or Team Leader Signature  2/01/08

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The Role of Pigment/Pattern in UV-A & UV-B Radiation Absorption in Animals: A Health Study
Auesta Safi
 Dominion High School, Sterling VA

Radiation exposure, either from the sun or from nuclear accidents, can be deadly to animals. Increased exposure leads to increased absorption and absorption leads to harmful mutations in the genotypes of animals. The purpose of this research was to determine whether the pigmentation of a particular animal made it more prone to radiation absorption from the environment. Thirty-nine animals of various species and pigmentation were tested for radiation absorption. There was a difference in ultraviolet absorption between the control group, which was white, and those organisms that were green/yellow, black, brown, and the combination of green/red/blue. Those with darker colors absorbed more UV radiation. Interestingly, there was a significant difference in the amount of UV radiation absorbed between green colored organisms and green/yellow, brown and the green/red/blue combination. The green pigmented organisms absorbed less ultraviolet radiation than those that were green/yellow, brown, or a green/red/blue combination. The animals with the green/red/blue pigmentation combination absorbed more than the animals with black pigmentation. Hence, the null hypothesis stating that there would be no significant difference between the radiation absorption in animals with brighter pigmentation was both supported and refuted. Further research would entail the capture of organisms near nuclear sites such as Chernobyl or Three Mile Island to determine whether bright pigmentation, which is evolutionarily important in sexual selection during mating, is actually a health detriment.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  □ human subjects  □ vertebrate animals  □ microorganisms  □ rDNA  □ tissue

2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No

3. Student worked or used equipment in a site other than school, field or home. □ Yes □ No

4. This project is a continuation of previous research. □ Yes □ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

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[Signature]
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1611D12
Safi, Auesta

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This project was to test the relationship between laser light and heat waves. The main goal was to shine a laser through a column of air and see if the laser would bend. There was another set of tests which involved changing the angle of the laser and shining it through the gas lens at a given temperature differential and see how it would change. A formula that explains why the laser bended the way it did was Snell's law. This formula, \( n_1 \sin \theta_1 = n_2 \sin \theta_2 \), shows what happens as a light passes through different media. The heated column of air formed a gas lens in the shape of a cone, where the top was the shortest in diameter and the bottom is the longest.

In the experiment it was concluded that the laser would bend if it goes through a column of hot air, also that at the different angles it will bend drastically whilst going through the gascous lens. The results successfully supported the hypothesis. A unique use of the gas lens would be that it could not melt like a glass. It could also be used to: transmit power, vaporize objects, and focus energy on deuterium and tritium for hydrogen fusion. There could have been a greater impact on results if the temperature was a few thousand degrees higher and if there was a stronger laser.

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2. Student independently performed all procedures as outlined in this abstract. Yes No

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John Starke
Finalist or Team Leader Signature

Date

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Measuring the Depth of Impact Using Various Projectile Shapes
Kyle A. Sullivan
Loudoun Valley High School, Purcellville, Virginia, USA

When a free falling object comes flying straight down at high speeds, how far will it lodge itself into the earth? Is there a certain type of head that can help that object penetrate further underground than another? How?

These are questions that can all be answered in a simple experiment. But why do we care, honestly? Well the military wants to know, in order to make more effective weapons that are related to bunker busters, which are bombs that are designed to penetrate deep underground before detonating. Many other groups may also want to know for their own benefit.

There are three common shapes at which the head of an object can be designed; a pencil point shape, a dolphin nose shape, and a blunt, flat side. Out of all these options, I believe that if we use a pencil shaped head on a free falling object, than it will penetrate deeper into the earth than any of the other heads could. All shapes must have the same net weight and be dropped under the same circumstances in order for the experiment to be effective and accurate.

Using various materials ranging from wood to a ruler to concrete, this experiment was made possible and had effective results to find which shape head was most effective in lodging an object underground at its deepest possible point from a height of 10 ft 8 in.

In conclusion, the pencil point projectile was able to penetrate deepest (average 4.1 in), followed by the dolphin nosed projectile (average 3.7 in), and lastly by the blunt projectile (average 1.5 in).

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   - [ ] vertebrate animals  
   - [ ] Potentially hazardous biological agents:  
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Kyle Sullivan  
Finalist or Team Leader Signature  
2/19/08  
Date

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Art and Angles
Skye Young
Heritage High School, Leesburg, VA, United States

The purpose of this experiment was to investigate the effect of mirrors on visibility to reduce expenses in small museum security by using four "security guards" to find how many mirrors would be needed to see all the art pieces in an art museum.

This experiment was performed by choosing a real museum floor plan and creating a scale model of it. As each trial was conducted, a mirror, the independent variable, was added to increase visibility of the art pieces, starting without any mirrors. Then a laser was used to locate the pieces and test the actual visibility. The art pieces seen—the dependent variable—was then concluded and recorded into a chart. The chart was then converted into a bar graph and statistics were calculated to further investigate the results.

As each mirror was added, visibility of total pieces in the museum increased steadily until all pieces could be seen. There were a total of 93 art pieces in the museum and with only ten mirrors, they could all be seen with a minimum of four guards.

Conclusions made consist of the supported hypothesis that by increasing the amount of mirrors seen by each guard, visibility will also be increased. Also achieved, was by using mirrors instead of more guards or expensive technology, small museums could reduce their spending cost on effective security.

There could have been a more extensive analysis, though certain time constraints needed to be recognized. One could have expanded this experiment by delving into a more in-depth calculation on the specific angles of the mirrors and rays of light reflected and refracted on them. This could have made the research much more thorough and realistically applied.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Skye Young
2/19/08
Finalist or Team Leader Signature Date

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<th>Last name, First Name</th>
<th>Title</th>
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<td>Ukleja, Samuel</td>
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The Effect of Worms on the Growth of Plants
Kristen Booth
Park View High School, Sterling VA

This experiment was conducted to determine whether or not the presence of worms has an effect on the growth of plants. To do this, there were 30 sweet pea plants placed in two storage bins, 15 in each, one with worms and one without. The plants were grown, watered, and observed over a 14 day time period, with an observation of the height every other day. In the end, it was found that the presence of worms did not positively or negatively effect the plants when in the soil. However, on the contrary, the absence of worms did not negative effect either. So, if you had a profession in the field of gardening, you could use these results to produce and culture plants more effectively.

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2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

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Kristen Booth 2/10/05
Finalist or Team Leader Signature Date

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The Effect of Carbonation in Water on the Height of Tyee Spinach Plants
Susan V. Clarke
Stone Bridge High School, Ashburn, VA

Carbon dioxide, or lack thereof, can affect a plant dramatically. Increased amounts of carbon dioxide in water could increase, decrease, or have no effect on the growth of a plant. The purpose of this experiment is to find out about increased carbonation in water given to plants.

The experiment tested carbonation in water, as the independent variable, given to plants and how it affected the growth of plants, which was the dependent variable. Fifteen Tyee Spinach (Spinacia oleracea) plants were given water that contained pure water and carbonation that was added in, and fifteen Tyee Spinach plants were given distilled water (to be used as a control) for three weeks. Each week, a measurement of each plant was taken to see how tall, in centimeters, they had grown.

At the end of the three-week period, the results were the heights of the plants were statistically equivalent. The null hypothesis was accepted. The conclusion was increased carbonation in water given to Tyee Spinach plants does not increase the growth or development of the plants. The research hypothesis was refuted. The objective of the experiment was to discover if the carbonation would change the height of the plants, which was attained.

Does carbonation in water affect other types of plants differently? Also, do other types of water, such as tap water, affect plants differently? More experiments could be done to answer these questions and eventually learn the truth about water types and their effects on plants.

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2. Student independently performed all procedures as outlined in this abstract. □ Yes □ No
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Susan Clarke
Finalist or Team Leader Signature
2/18/08

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The Effect of Microwaved Water on the Growth Rate of Plants
Zach Clemens
Broad Run High School, Ashburn, Virginia

The purpose of this experiment was to determine weather or not microwaved water has a negative effect on the normal growth of plants. This was determined by taking six identical plant seeds and planting them in the same type and amount of soil. Two of the plants were watered with regular water, two plants were watered with water that had been microwaved for three minutes, and two plants were watered with water that had been microwaved for five minutes (the water was allowed to cool before being put on the plants). The plants were watered every other day for 28 days, and measurements were taken on each plant every seven days. At the end of the experiment, the plants that were watered with regular water grew the most, the plants that were watered with the five minute water grew the least, and the plants that were watered with the three minute water were in the middle. The water that had been microwaved for five minutes caused the plants to grow at about two-thirds the rate of the plants that were watered with regular water. After completion of the experiment, it was determined that microwaved water does in fact have a negative effect on the growth rate of plants.

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Zach Clemens 2/16/08

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The Effects of Deicing Salt Brires Calcium Chloride, Sodium Chloride, and Magnesium Chloride on Kentucky Bluegrass (Poa pratensis) Germination and Growth.
Cody M. Donald
Stone Bridge High School, Ashburn, Virginia

Millions of tons of salt are used for deicing American highways, streets and sidewalks each year. This experiment explores the effects of these salt solutions on Kentucky bluegrass (Poa pratensis) seeds, the grass most commonly found along the highways, streets, and sidewalks in Northern Virginia.

During this study, Calcium Chloride (CaCl), Magnesium Chloride (MgCl), Sodium Chloride (NaCl) and distilled water (control), were applied to fifteen separate pots containing the grass seed over sixteen days. The concentration of the salt solutions was a constant 200 millimoles per liter. The height, number of germinations, and color of the plants was measured throughout the experiment.

Plants treated with MgCl grew the least produced the least growth in terms of height. Plants treated with CaCl resulted in the least number of seed germinations. MgCl treated specimens differed in color from all the other substances tested determined as determined by overall plant color based on Royal Horticulture Society charts.

The experimental hypothesis that CaCl would be the most detrimental to overall plant health was refuted. However, CaCl did have the most adverse effect on actual seed germinations possibly due to interference with the cell’s ability to self-replicate caused by the change of Calcium content of the cell fluids or decreased osmotic pressure of the cell.

The results of the experiment indicate that regardless of the solution, the deicing chemicals tested all have a detrimental effect on the environment in terms of plant ecology. People using these chemicals for the application of removing ice may be damaging any vegetation surrounding the treatment area and therefore it is recommended that people use them as sparingly as possible.

This experiment could be further extended by the use of other commercial deicing agents such as Urea, Potassium Chloride, and Calcium Magnesium Acetate.

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2. Student independently performed all procedures as outlined in this abstract.  [ ] Yes  [ ] No

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[Signature]
[Date]

Donald, Cody

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The Effect of Nitrogen Concentration of Dog Urine on Grass

Yania Garcia-Mendoza
Heritage High School, 520 Evergreen Mill Road, Leesburg, VA 20175

This project is the result of an initial idea to test which type of grass, Kentucky Blue grass (Poa pratensis) or Bermuda Grass (Cynodon dactylon), would be more resistant to dog urine. The project used ammonia for testing because research showed that the amount of nitrogen present in dog urine was the cause of grass damage. The hypothesis that was finally developed was that Bermuda Grass would be more resistant to the nitrogen in dog urine.

The dependent variable was the growth in height of Kentucky Blue grass versus Bermuda grass, when 3 mL of ammonia and water were added to each sample, each day for a two week period. Control groups for each plant had only 3 mL of water added to the plants daily. Daily observations were recorded and statistics were applied to the results to determine the statistical importance of the height difference (in cm) after two weeks.

After testing both Kentucky Blue grass and Bermuda grass, the results of the project concluded that Kentucky Blue grass was more resistant to the nitrogen than Bermuda grass. Statistically speaking, t tests applied to the results indicated that the difference in height was significant.

For further experimentation, more plants for each group could further support the conclusion. Other confounding variables could include environmental conditions, particularly the temperature and sunlight (as each species has different optimal conditions).

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   [X] rDNA
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The Relationship Between the Source of Nitrogen and Orchard grass Yield
Laura Hovatter
Freedom High School, South Riding, VA

Can a natural source of nitrogen out perform commercial fertilizer for growing hay? Specifically, will nitrogen fixation, a process by which legume plants, like alfalfa, makes nitrogen available to other grasses, result in better growth and greater yield than can be obtained by applying granular urea?

To answer this question, two fields of orchardgrass were monitored during the summer growing season. One field contained a mix of orchardgrass and alfalfa to which no urea was applied and the other was pure orchardgrass to which urea was applied three times. The growth rates of each field were observed and recorded weekly and the yield of hay produced was calculated after harvest.

The average growth rate of the two fields was not significantly different. Unfortunately, these field trials were conducted during an unusually dry summer which reduced growth and lowered yields particularly for the mixed field. The pure field produced almost twice the volume of hay.

In this study commercial urea appears to out perform the naturally fixed nitrogen in kilograms per hectare. Thus the hypothesis was not supported. The lack of rainfall adversely impacted the fixation process and therefore the results were not as expected.

The effect of the summer drought cannot be ignored. A more definitive answer as to which source of nitrogen is more productive could be obtained if the amount and timing of rainfall could be controlled such as in a greenhouse. Other factors to be considered are average temperatures experienced, and other commercial nitrogen sources.

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Laura Hovatter 1/31/08
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How does music affect the growth and health of plants?
Anneke Klintworth
Potomac Falls High School, 46400 Algonkian Pwy., Potomac Falls, VA, 20165

This project involved an experiment on the effects of music on plants’ growth and health. The initial idea was to determine which kind of music has the most beneficial effects on a plant.

Four different kinds of music—an Audio book, German rock music, Classical music and Meditation music—were used in this experiment. One kind of music was played to a set of four plants in the same pot for eight hours per day, 40 days in a row. The plants were located in separate rooms, each near a window. One plant was separated from any sound as a control plant. The plants’ heights were measured each day.

The results show that the German rock plant grew the most on average, followed by the Audio book, the Classical music, the Meditation music and the one without sound. But observations about the plants’ health show that both the German rock plants and the Meditation music plant look unhealthier than the other plants.

These results show, first, that any kind of music benefits a plant more than isolation from sound. Furthermore, the best kinds of music for plants (of those used in this experiment) are the Audio book and the Classical music.

Further research could be done to determine if actually talking to plants would be even more beneficial than an Audio book. It would also be interesting to observe what effects different kinds of Classical music have on plants.

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- [ ] vertebrate animals
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- [X] No

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- [X] No

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Anneke Klintworth  
02/12/08
Finalist or Team Leader Signature  
Date

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The Impact of Different Nutrients, Commercial and Organic, on Plants
Lynne Lynch
Harmony Intermediate School, Hamilton, VA

The agriculture industry relies on commercial fertilizers for quickened plant growth and an
appetizing appearance. Why not use everyday materials such as leftover coffee grounds
and vegetable waste to produce the same results as commercial fertilizer? The purpose of
this experiment is to test commercial and organic fertilizers in an attempt to find which is
more effective on plant growth.

This experiment required the use of commercial and organic fertilizers on plants. Five
different fertilizers were collected: vegetable waste, fruit peelings, coffee grounds,
shellfish shells, and Miracle-Gro. Miracle-Gro, the commercial fertilizer, was the control
group. Thirty-five plants were divided into five groups. Each group was assigned one of
the five fertilizers. The experiment was divided into seven trials, each including one plant
from each fertilizer group. Each fertilizer was evaluated using a pH and nutrients test kit.
The size and color of every plant was evaluated and recorded weekly after germination.
The experiment resulted in one organic fertilizer, vegetable waste, being the most effective,
and commercial fertilizer being the least. Vegetable waste and commercial fertilizer both
had the same amount of Nitrogen, Phosphorus, and Potash. Vegetable waste had a higher
acidity level. The results supported the hypothesis: organic fertilizers are more effective
than commercial fertilizers.

Further studies could find which organic fertilizers work best on different types of plants.
The time and amount of trials could be increased. Which fertilizers work better later in a
plant's life cycle?

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   □ vertebrate animals
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   ✔ Yes □ No

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Lynne M. Lynch  2/21/08
Finalist or Team Leader Signature  Date

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regulations and that all appropriate reviews and approvals have been obtained including the
final clearance by the Intel ISEF Scientific Review Committee.
The Effects of Cigarette Smoke on the Growth of Brassica rapa, Fast Plants
Rivera, Elise
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The effects of cigarette smoke on the growth of Brassica rapa, Fast Plants, was investigated by exposing, the Fast Plants: Standard; F1 Non Purple Stem, Hairless; and F1 Non Purple Stem, Yellow-Green Leaf to cigarette smoke to find their average plant growth for thirty days straight, while having the same three species not exposed to cigarette smoke, but everything else still the same. This was done to see how pollutants such as cigarette smoke affect plants and their growth. For thirty days, three of the species of Fast Plants, each in their own environment (clear, plastic container) were exposed to cigarette smoke for 24 hours, while those same types of species in three other pots were not exposed to cigarette smoke. Crickets provided the plants with carbon dioxide, the Fast Plants were watered twice a day, and growing lights were used as the plants' source of light. Everyday a new cigarette would be lit for three of the pots, for the experimental group, with their own species, and in all six pots, the average growth of each species was recorded. The hypothesis for this experiment was that the Fast Plants that were exposed to the cigarette smoke, would not grow as much as the plants that were not exposed to cigarette smoke was supported. From the three t-tests that were run, (P=0.05, df=58,a calculated t value of 5.7 for Standard Fast Plants, a t value of 5.6 for F1 Non Purple Stem, Hairless, Fast Plants and a t value of 7.7 for the F1 Non Purple Stem, Yellow-Green Leaf) it was concluded that the Fast Plants not exposed to cigarette smoke grew more than the ones exposed to cigarette smoke. The data and measurement charts clearly show that the Fast Plants not exposed to cigarette smoke were around two times the growth of the ones exposed to cigarette smoke. It was concluded that at the end of the t-tests that for all the species of Fast Plants, that because the null hypothesis was accepted at the 0.05 level of significance, the research hypothesis that non-stressed (not exposed to cigarette smoke) plants would have a greater mean height than stressed (exposed to cigarette smoke) plants was supported.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
   [ ] human subjects
   [ ] vertebrate animals
   [ ] potentially hazardous biological agents:
   [ ] microorganisms
   [ ] rDNA
   [ ] tissue

2. Student independently performed all procedures as outlined in this abstract. [x] Yes [ ] No

3. Student worked or used equipment in a site other than school, field or home. [ ] Yes [x] No

4. This project is a continuation of previous research. [ ] Yes [x] No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): [ ] Yes [x] No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/We also attest that the above properly reflects my/our own work.

Elise Rivera
February 13, 2008
Finalist or Team Leader Signature Date

This embossed seal attests that this project is in compliance with all federal and state laws and regulations and that all appropriate reviews and approvals have been obtained including the final clearance by the Intel ISEF Scientific Review Committee.
Effect of Plant Growth Solutions on Epipremnum aureum
Darleen T. Tran
Freedom High School, South Riding, Virginia

The purpose of this experiment is to test the plant growth solutions on the length of roots of Epipremnum aureum plants. The data did not support the research hypothesis that the Epipremnum aureum plants grown in Shultz plant food would have a different mean root length than plants grown in water and Miracle-Gro plant food.

The plants grown in water exhibited a great mean root length (1.14 cm) than plants grown in Shultz plant food (1 cm) and plants grown in Miracle-Gro plant food (.7 cm). There was a slight significance with water and Miracle-Gro plant food versus water and Shultz plant food. The mean root length of plants grown in water is not significantly different from the mean root length of plants grown in Shultz plant food and plants grown in Miracle-Gro plant food.

The effect of plant growth solutions on the length of root growth on Epipremnum aureum plants was investigated by comparing the plants grown in water, Shultz plant food, and Miracle-Gro plant food for 21 days with a control (plants grown in water). There were many conditions that could improve the experiment such as the type of plant used, number of days the plants were grown in, and the type of solutions.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): ☐ human subjects ☐ vertebrate animals

Potential hazardous biological agents:
☐ microorganisms ☐ rDNA ☐ tissue

2. Student independently performed all procedures as outlined in this abstract. ☑ Yes ☐ No

3. Student worked or used equipment in a site other than school, field or home. ☐ Yes ☑ No

4. This project is a continuation of previous research. ☐ Yes ☑ No

5. My display board includes non-published photographs/visual depictions of humans (other than myself): ☑ Yes ☐ No

I/we hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I/we also attest that the above properly reflects my/our own work.

Darleen Tran 2/7/08
Finalist or Team Leader Signature Date

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1710F10
Tran, Darleen
Can Recycled Newspaper Be Used To Fertilize Plants?
Sam M. Ukleja
Potomac Falls High School, Sterling, Virginia

This experiment relates to the study of botany. Have you ever tried to grow grass, but the fertilizer you are using just won’t do the trick? This experiment was performed to determine if recycled newspaper could be used to effectively fertilize plants. The dependent variable in this experiment is the growth of the plants after being fertilized with the shredded newspaper. The independent variable in this experiment are the amount of newspaper and the amount of soil. The student will be mixing different amounts of newspaper with different amounts of soil to see which mixture will provide the best results. Some constants in this experiment include the amount of water, the amount of grass seed, the type of newspaper, and the amount of sunlight. There will be a total of 75 cups filled with soil, newspaper, and grass seed to be grown. Each of the five different mixtures (control, 120 mL soil : 120 mL newspaper, 180 mL soil : 60 mL newspaper, 200 mL soil : 40 mL newspaper, and 220 mL soil : 20 mL newspaper) will occupy 15 cups each. The control group will be isolated by having only soil. The results found that the newspaper had no measurable effect on the growth of the grass. In the 120 mL soil : 120 mL newspaper group, the newspaper only obstructed the growth of the grass. The hypothesis, which was stated that if one fertilizes a plant with recycled newspaper, then the plant will grow faster/fuller, was not supported by the data. Further research can be performed to see how the newspaper reacts with different plants, instead of just grass.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply): □ human subjects □ vertebrate animals Potentially hazardous biological agents: □ microorganisms □ rDNA □ tissue
2. Student independently performed all procedures as outlined in this abstract. Yes □ No
3. Student worked or used equipment in a site other than school, field or home. Yes □ No
4. This project is a continuation of previous research. Yes □ No
5. My display board includes non-published photographs/visual depictions of humans (other than myself): □ Yes □ No

I/We hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year’s research. I/We also attest that the above properly reflects my/our own work.

[Signature]
Finalist or Team Leader Signature

[Signature]
Date

1711P10
Ukleja, Samuel

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