Abstracts for the 25th Annual Loudoun County Regional Science and Engineering Fair

March 16, 2006 Heritage High School
Categories
The categories for the Loudoun County Regional Science and Engineering Fair
100  Behavioral & Social Science
200  Biochemistry
300  Botany
400  Chemistry
500  Computer Science
600  Earth Science
700  Engineering
800  Environmental Science
900  Mathematics
1000 Medicine & Health
1100 Microbiology
1200 Physics
1300 Space Science
1400 Zoology

Project Numbering
All projects are given a number. The first number indicates the student’s grade. The letter represents the school. The last numbers indicate the category and entry number. For example project 10V1103 is a tenth grader at Park View High School. This project is the third project in Microbiology.

School codes:
W- Briar Woods  C-Loudoun County  I-Harmony Intermediate
B-Broad Run    L-Loudoun Valley
D-Dominion     V-Park View
F- Freedom     P-Potomac Falls
H-Heritage     S-Stone Bridge
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<th>Student's Name</th>
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# 100 Behavioral and Social Science

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This project was a behavioral and social science experiment to test the effect of color on the sense of smell. The purpose was to find out if the targeted scents of lemon, apple, and pineapple are closely related to the colors in which they normally appear.

Subjects of various ages were presented with samples of lemonade, apple juice, and pineapple juice at thirty second intervals. Each type of liquid was dyed and presented in red, blue, and green. Each type of liquid was also presented in its unaltered color. The subjects tried to identify the scents. The independent variable was the color in which each liquid appeared, and the dependent variable was the scent that the subjects perceived.

During the study, more people correctly identified the lemonade, apple juice, and pineapple juice when the liquids appeared in the colors in which they are normally seen. This suggests that the perception of the targeted scents is indeed linked with color.

This experiment demonstrates that the human sense of smell is influenced by color. The hypothesis stated that if volunteers were given liquids appearing in colors with which they are not commonly associated, then they would identify the scents inaccurately. Also, scents of liquids appearing in normal colors would be identified correctly. This hypothesis was not entirely correct. Sometimes subjects identified the liquids correctly regardless of color. Other times subjects identified the scents correctly only if the liquids were presented in their commonly occurring colors.

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

2. Student independently performed all procedures as outlined in this abstract.  
\( \checkmark \) Yes  
\( \square \) No

3. This project was conducted at a Registered Research Institution.  
\( \square \) Yes  
\( \checkmark \) No

4. Is this project a continuation?  
\( \square \) Yes  
\( \checkmark \) No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  
\( \checkmark \) Yes  
\( \square \) No

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

Natalie J. Baird  
Finalist or Team Leader Signature  
02-21-06  
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 Adolescent Female Memory Aptitude of Audio and Visual Learning
Breann M. Baldwin
Heritage High School, Leesburg, VA

The purpose of this experiment was to find out if females, ages thirteen to sixteen, remember more through visual or audio learning. The experiment was carried out with the hypothesis that teenage females would remember more through visual learning. This experiment was performed to compare with other experiments of this topic and origin.

The experiment was conducted with thirty test subjects. Fifteen test subjects were chosen to listen to a book on tape and the other fifteen were chosen to read the same book. After this, the test subjects were given a piece of paper with questions from the story, that could be answered in both cases. These questions were checked and data was compiled on the accuracy of their answers.

A relationship was found as the testing was completed. The experiment seemed to show that the test subjects who read the story had a higher accuracy on the questions they answered afterward. The majority of the audio book listeners answered fewer questions correct.

From the collected data, a conclusion was developed. It was concluded that the majority of females, ages thirteen to sixteen, remember more through visual learning. The hypothesis was supported by the data. Many factors could have been a part of the conclusion. The results of this experiment might suggest that the right temporal lobe, the one that is involved with visual memory, is stronger in the adolescent female brain. If time applies, there will hopefully be more investigation and an extension to this project.

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

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Breann Baldwin
Finalist or Team Leader Signature
2/14/16
Date

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The Effects of Letter Stem Size on Second Grade Reading Ability
Alexandra Butt
Dominion High School, Sterling, Virginia

Students of the second grade reading level often struggle reading words of a more difficult reading level. The purpose of this research was to determine whether letter stem size in words of the third grade reading level had an effect on second grade reading ability. Students were asked to read a control paragraph (paragraph A) consisting of words on the second grade reading level. Students then read paragraph SL, the same as paragraph A, but containing seven substituted words with no stems (short letters such as a, c, m, etc.). Then students read paragraph TL, the same as paragraph A, but with seven substituted words containing two or more stems (tall letters such as t, l, k, etc.). Three trials were conducted and data was analyzed via statistical analysis using a t-test. The null hypothesis, stating there will be no difference in the error level of students reading words containing stems versus no stems, is accepted. Although statistically there was no significant difference, in every trial students had more difficulty pronouncing words without stems more than words with stems. A possible explanation for this is that stems in words can 'break up' words so students can see the words in sections. Conversely, words containing no stems may have parts that are easily overlooked causing students to incorrectly emphasize syllables. In the future, teachers and parents working with children learning to read should pay attention to stems in new, challenging words and should be more patient when dealing with no-stem words.

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

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Alexandra Butt 02/14/10
Finalist or Team Leader Signature Date

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The purpose of this experiment was to determine whether or not there is a correlation between student's musical involvement and their GPAs. To test this experiment, surveys were distributed to students in the 9th through 12th grades at Potomac Falls High School. The survey asked students to select a GPA range and whether they currently play a musical instrument, never played a musical instrument, or played a musical instrument at one time.

The results of this experiment were initially inconclusive. Although a greater percentage of students who currently play a musical instrument fell into the range of "A" than those who do not currently play a musical instrument, limited time and resources distorted the results of this project. Currently, more data is being collected to further evaluate the hypothesis.
Effect of Musical Genre on Short-Term Memory
Cobb II, Roger B.
Broad Run High School, Ashburn, Virginia

This project is to compare the effects of musical genre on an individual's capacity to remember random sequences of letters and numbers; short term-memory.

In the study participants will listen to a predetermined sample of each genre of music while attempting to memorize a test sheet that is unique to that genre. There will be a period between the listening and memorization and the recall of the sequences where the participant will have neither music playing nor test sheet to review. The music samples, timing and test sheets are the same for each participant as well as the volume of the sample.

Results that followed no identifiable pattern led to the suspicion that outside forces may be altering the results however this could not be determined. The results found that genre does in fact have an impact on one's short-term memory. “Punk” and “metal” proved to have the best results.

The results of the experiment led to the conclusion that music with steady tempo and rhythm and relatively no abrupt volume changes to be bets for one's short-term memory. Music with steady and continuous features is best for short-term retention but the volume does little to alter the retention as long as that volume is constant throughout.

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

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

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ Yes ☒ No

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[Signature]
Feb. 17, 2006

Finalist or Team Leader Signature
Date

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The Effect of Different Types of Music on Tonal Memory
Cummings, Melinda
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

Tonal memory is a great asset to those in search of a musical career. It enables one to correctly remember pitch and patterns of notes when experiencing distraction. In this project the effect of different types of music on tonal memory was tested by selecting twenty people, five each for rap, country, classical, and rock music, and having them participate in tests that would measure their tonal memory. During testing, small clips of songs were played on the piano, followed by a part of a song in a different key to test how well the participant would remember the first pitch that was played. Their results were then carefully recorded. The hypothesis that the greatest contributor to tonal memory would be classical, while the type of music that detracted the most from tonal memory would be rap, was supported. A t-test was performed (P=0.05, df=19, calculated value for classical versus rap being 0.001041) and the conclusion was that there was a significant difference between the contributions of classical and rap music to tonal memory. Classical had the highest level of accuracy in the notes sung, while rap had the lowest. Country and rock music ended up sharing similar results. The P-value for rock and country when compared was 0.538675, which did not show a great level of significance to the project or hypothesis when compared with the results of classical and rap. When all calculation was complete the hypothesis of different types of music affecting tonal memory was supported.

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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
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Melinda Cummings 2-15-06

Finalist or Team Leader Signature Date

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The Effect of Hypothalamus Size on Mammalian Reproductive Strategies
Nikita R. Green
Dominion High School, Sterling, Virginia

Many animals exhibit different mating preferences such as polygamy or monogamy. Polygamy is the act of having multiple mating partners while monogamy is having one mating partner with which to breed. The purpose of this research was to determine whether the hypothalamus size in the temporal region of the brain regulated mating preferences. Hypothalamus sizes and the ratios of hypothalamus size to brain size were taken of twenty-three mammals: thirteen polygamous mammals and ten monogamous mammals. Statistical analysis performed using a t-Test supported the null hypothesis which stated there would be no significant difference in hypothalamus size. The original supposition was that polygamous animals would have a relatively larger hypothalamus. However, the coyote is considered to be monogamous and it has a relatively small hypothalamus. Further research would entail looking at the levels of various sex hormones and determining the significance of the impact that they have on mating preference.

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   □ 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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ Yes □ No

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Nikita R. Green
Signature
2/13/06
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 Stroop Effect: Age and Cognitive Ability
Jessica Hanson
Park View High School, Sterling Va, USA

If a color-word is written in a dissimilarly colored ink, does it take longer to recognize the ink color? If so, why, how long would the delay be and does age affect performance? These are the components of the Stroop Test and the experiment. The experiment was designed with the purpose to link age and cognitive ability.

Subjects from three age groups (under 10, 10-35 and 35 and over) are first shown color-words written in corresponding ink colors (control), then non color-related words written in multiple ink colors and finally color-words written in non-congruent ink colors and asked to read the color they see aloud opposed to what they read for each test. All tests were written on white paper and were taken in a quiet environment. The changes in words and ink color are the independent variables. The subjects' times will be recorded in seconds for each test, which is the independent variable.

Although the hypothesis suggested subjects under age 10 would perform best, results do not support this. Overall, age is not a major factor of cognitive ability although subjects aged 35 and older did take a longer time in completing the tests.

The experiment agreed with previous Stroop tests and refutes the original hypothesis although possibly proved the decline in mental functioning in adults aged 35 and older.

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

3. This project was conducted at a Registered Research Institution.  
   - [ ] Yes  
   - [x] No

4. Is this project a continuation?  
   - [ ] Yes  
   - [x] No

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   - [x] Yes  
   - [ ] No

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Jessica Hanson  
2-22-06

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.
Are You a Master of Disguise?
Reland L. Happel
Heritage High School, Leesburg, Virginia USA

Pictures can often be grouped based on their prominent features. The purpose of this study was to determine which parts of the face (or facial features) most affect a person's ability to categorize that face.

Pictures of celebrities were obtained and converted to gray-scale. The original pictures were used as the control stimuli. Treatment images were created by occluding the eyes, nose, mouth, or combinations of these features. Subjects were then tested on their ability to correctly classify control and treatment stimuli as actors or singers. The subjects' accuracy and response time were recorded as a function of which the facial features were occluded in the image.

Each treatment group in which only one feature was occluded resulted in a performance that was not significantly different than the control stimuli. However, the treatment groups with more than one feature occluded had both higher reaction times and lower accuracy rates than the control stimuli.

The researcher rejected the hypothesis that occluding the eyes in an image of the face would most affect a person's ability to group that face. However, the researcher was able to suggest that the number of features occluded is more important to the ability to group faces than the specific features that are occluded.

A further study could be run in the quantity of facial features that should be occluded to properly disguise oneself, or the impacts of lighting and inverted faces on recognition. The study of facial recognition is a field of countless opportunities.

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   ☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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

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[Signature]
Finalist or Team Leader Signature 2/23/06

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Snapshots vs. The Brain
Justin Holmbeck
Heritage High School, Leesburg VA, USA

Humans and satellites perceive images in many ways, using recognition and estimation to identify objects. Elements such as shape, shadow, color, and association aid in image identification. Studying how humans process images may improve satellite surveillance. This experiment tested 67 students to determine the relationship between increasing the resolution to a student’s ability to identify an object. Five copies of a picture of a tree were developed using 5 pixel levels (50, 25, 15, 10, 5, and 0) ranging from poor quality to crystal clear resolution. The subjects were asked to identify the photograph for each resolution. The independent variable was the picture quality, controlled by varying the resolution. The dependent variable was the amount of successful identifications of the tree for each resolution. The null hypothesis was that each of the 5 resolutions would have an even number of people identifying it as was. A chi-square analysis with a t of 196.214 at a p = 0.001 rejected the null hypothesis. The accepted hypothesis was that as the resolution of a given image is increased, then the ability to identify that image is increased. Interestingly, the intermediate pixel level was found to be the earliest photograph where people could identify the tree, showing a possible prime resolution for correlation. Further studies could investigate when people recognize images and if color or black and white pictures impact the ability to recognize an image. This information can be applied to satellite reconnaissance and help understand visual vantage point.

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

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3. This project was conducted at a Registered Research Institution. [ ] Yes  [X] No

4. Is this project a continuation?  [ ] Yes  [X] No

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[Signature]  2/23/06

Finalist or Team Leader Signature  Date

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The Effects of Daily Exercise on Ninth Grade Females' Learning Abilities
Rochelle N. Latka
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The hypothesis that physical exercise affects learning ability in a positive way was tested by having two groups of nine people that do regular exercise and those that don't, take a serious of quizzes over a ten week time span. Each week a test was administered to the eighteen individuals and those people were required to study and take it in a restricted time. Each group's quizzes were identical and graded using the same ten-point based grading scale. These scores were then analyzed and graphed to properly display the results. A chi-square test was run to determine if the hypothesis was statistically supported and the results of this test showed that there was an insignificant difference between the expected and observed data. After the first five weeks it was apparent that the subjects that did physical exercise had better scores on these weekly quizzes. Because of this, the subjects that participated in regular physical activities were requested to put the amount of exercise they did each week on the top of their paper. The reason for this was because a new variable had been added to the experiment and the goal was to see how much exercise is the ideal amount for maximum learning ability. As already stated, by the first five weeks of the experiment it was clear that physical exercise impacts learning ability in a positive way. The results of this research could help to teach the mentally slow and help them to be able to absorb more information in a quicker amount of time. During the final five weeks of testing a lot of data was collected and there was an obvious benefit of doing about four hours and thirty minutes of exercise each week. It was shown that the subjects doing this amount of exercise in the experiment had higher quiz scores than those people who did less than four hours or more than six hours of exercise per week. Overall the hypothesis that exercise affects learning ability in a positive way was strongly supported by this experiment and this research can go towards possibly helping those people that are a bit slow with their ability to learn new material.

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☑ 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.

Rochelle Latka                                      2/14/01
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.
Are Two Eyes Better Than One?
Alexander J Richberg
Heritage High School, Leesburg, VA, USA

The purpose of this experiment was to see whether fainter images could be viewed using binoviewing or monoviewing vision. Before beginning the experiment, extensive research on astronomy and the human eye were required to acquire background knowledge.

In the experiment, 5 different subjects viewed the starfield around Polaris, once with a binoviewer, and again with an lenspiece. This was done over a period of several days, until 21 trials were completed. The independent variable in the experiment was the type of vision used, either bino or mono. The dependent variable was the magnitude of the images the subjects had seen.

After the experiment, the data was analyzed using a star program and the Naval Observatory's star catalog. Unfortunately, discrepancies in these two resources made me switch my data to be qualitative. The data, instead of indicating the magnitude of the images viewed, was now a yes/no qualitative observation of whether subjects could see fainter images using the binoviewer or the eyepiece.

After analyzing all of the data, one major conclusion was drawn. In 20 out of 21 trails, subjects claimed they could see fainter images using the lens over the binoviewer. This disproved my hypothesis that the binoviewer would allow people to view fainter images. I had predicted that because human eyes are comfortable using binoviewing, that they would integrate to overcome some of the light lost through transmission and the prisms.

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

Alexander Richberg
Finalist or Team Leader Signature
2/23/06
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.
Impact Resistance: The Effect Of Impact On Three Pottery Types
Suzanne F. Rodgers
Potomac Falls High School, Potomac Falls, VA

Archeologists have found evidence of clay pottery in Virginia dating back to 7,000 B.C. Pottery is important to the archeological record because it identifies cultures and creates a chronological record. Native American tribes used clay mixed with something mixed into it called temper to reduce cracking during firing. The Native Americans commonly used burnt and finely crushed oyster shell or sand. Over the years, many pots have been broken because of impact from use, weather, construction, and farming. The purpose of this experiment was to test which type of pottery was the most resistant to impact.

In this experiment, clay pots were made with two types of temper: crushed mussel shell, and sand. The independent variable was the size of the temper. The control pots were made with pure clay. Each pot had a 1.3 kg weight dropped on it from a height of 53 cm. The amount of damage, the dependent variable, was measured by counting the number of pieces above and below a size of 25 square centimeters.

The results of this experiment showed that the sand tempered pots, with the smallest temper, were the strongest and most resistant to the impact of the weight, supporting the hypothesis. This experiment showed that just as the Native Americans' pottery was strongest with the smallest temper; the pots with the sand temper were also the strongest.

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

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Suzanne Rodgers 2/22/06
Finalist or Team Leader Signature Date

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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 project relates to the minds of students and how tests play tricks with students minds without them even noticing. The purpose of this project was to see if students would do better or worse on multiple-choice tests with patterned answers compared to random answers. The hypothesis stated that if answers on a multiple-choice test were in an obvious pattern, then students would get poor grades on the test as compared to a test with random answer choices.

The results of this project proved to support the hypothesis, although the results were not very strong. Students, as a whole, did one percent better on tests with random answers compared to tests with patterned answers. Therefore, one could assume that other factors played into the results. For example, the test could have been difficult for the students or they could have been in a different emotional or physical state each time they took the test, etc.

Even though the hypothesis was technically supported, this study did not show particularly interesting results. This experiment would have to be done many more times and more in depth to get a true result.

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Emily Smalling
02/21/10

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The Effect of Music on Reaction Time
Michael Villalobos
Park View High School, Sterling, VA, USA

The main purpose of this study was to find out if different types of music with various kinds of tempos had an effect on reaction time. The type of music one may listen to when doing a task such as driving that requires good reflexes could affect the performance of the driver. This experiment was to see what type of music affected reaction time the most, and the following songs were chosen to be tested since they each represent different musical styles: "Man of Constant Sorrow"-Soggy Bottom Boys, "The Trooper"-Iron Maiden, "Rhapsody in Blue"-George Gershwin, "The Fresh Prince of Bel Air Theme"-Will Smith, and "Fur Elise"-Beethoven. The human subjects listen to each of these songs on an Mp3 player with headphones while they took the SpecOps reaction test on the computer. The results were then recorded, as well as a control test taken while the subject was not listening to any music. The independent variable was the music they listened to, and the dependent variable was the score they got on the reaction test. One major finding is that most subjects got a better score during music which they were neutral towards, such as jazz or classical, but the highest scores of the majority were when they were not listening to music at all. One major question is obviously the subject's preference towards the songs they listened to, which could account for a variety of information.

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Finalist or Team Leader Signature: ___________________________ Date: 2/22/06

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<th>Title</th>
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Ellagic Acid as an Antioxidant  
Hassan Anwar  
Potomac Falls High School, Potomac Falls, VA

Ellagic acid, naturally found in raspberries, has been demonstrated to have antioxidant, anti-mutagenic, anti-bacterial and anti-viral properties. In this experiment, black worms (Lumbriculus variegates) were used to test the antioxidant property of ellagic acid.

The black worms were first exposed to a solution with free radicals (H2O2 + FeSO4) for 15 minutes and then placed in an ellagic acid solution for 15 minutes. The number of black worms that survived was recorded for each trial. The data from the experiment shows that ellagic acid can aid in the recovery of black worms from the damage caused by free radicals.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
   - [ ] human subjects  
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   - [ ] recombinant DNA  
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   - [ ] controlled substances  
   - [ ] human/animal tissue

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   - [X] Yes  
   - [ ] No

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   - [X] No

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   - [ ] Yes  
   - [X] No

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[Signature]  
2/21/06

Finalist or Team Leader Signature  
Date

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The effectiveness of aerobic vs. anaerobic decomposition in septic tanks was investigated by setting up miniature septic tanks and adding dissolved air to half the "tanks". Ground up lettuce, single ply toilet paper, and water were placed into ten separate jars. Air was introduced to five of the jars by using a fish tank bubbler and plastic tubing. The other five jars did not have air added to them. The jars were kept in darkness at a temperature ranging between 18-22 degrees Celsius. After four weeks of decomposition, the contents of each jar were separately filtered and the remaining matter was weighed to determine whether aerobic or anaerobic decomposition is more effective. The hypothesis, that the tanks using the aerobic decomposition would decompose a much higher quantity of lettuce than the tanks using anaerobic decomposition, was supported. The results were as follows: the weight of the matter in the jars with air were 22g, 22g, 14g, 22g, and 24g. The weight of the matter in the jars without air were 96g, 108g, 96g, 112g, and 102g. The Student t-test was used to show that statistically the two groups were very different, but the use of this test is questionable given the small sample size. From the data gathered, it was concluded that aerobic decomposition is more effective than anaerobic decomposition. A possible explanation for the data is that the microbes involved in decomposition thrive much better in an oxygenated environment, and therefore decompose more efficiently compared to in an oxygen free environment.

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Brittany Bading 2/15/06
Finalist or Team Leader Signature Date

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The Relationship Between Antibacterial Soaps and Bacteria
Katherine A. Crandell
Heritage High School, Lessburg, Va, USA

This project demonstrated the use of different anti-bacterial soaps versus not using anti-bacterial soaps. The purpose of this experiment was to show that the use of the soap, when washing ones' hands, is more beneficial to ones' health than not using anti-bacterial soap.

The general procedures include taking samples from a pencil sharpener, a tabletop, and a door handle. Soft Soap, Dial, and Target Brand anti-bacterial soaps and the samples were streaked across the Petri dishes. The Petri dishes were then sealed and left alone so that the bacteria could grow. The independent variable was the type of anti-bacterial soap. The dependent variable was the growth of bacteria within the Petri dish.

The results of this experimentation were that the use of anti-bacterial soaps killed more bacteria than not using anti-bacterial soaps. Dial soap killed the most bacterial colonies and had the least growth of bacteria. My results are supported by the chi-square test. For the tabletop the table value was 30.14. The table value of the pencil sharpener samples was 17.48. 9.49 was the table value for the door handle samples.

The results supported the hypothesis. If different types of anti-bacterial soaps are used then more bacteria will be killed. The conclusions of this experiment will help society to remain healthier through the use of washing ones' hands with anti-bacterial soaps.

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   □ 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

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Katherine Crandell  2.23.06
Finalist or Team Leader Signature  Date

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The Difference in Vitamin C levels in Organic vs. Non-organic Oranges
Jeanne Jeong
Broad Run High School, 21670 Ashburn Road, Ashburn, VA

This project measures the amount of vitamin C in organic versus non-organic oranges. This experiment was set up to determine if organic grown oranges contained more vitamin C than non-organic grown oranges, in which the chemicals used in the process may alter some aspects of the fruit.

To determine the amount of vitamin C in the oranges, a royal blue starch-iodine indicator was made. Then, juices were extracted from each orange and each was dropped into 15 mL of the indicator. The less drops it took to turn the indicator clear, the more vitamin C the orange contained. The independent variable was the type of orange used (organic or non-organic). The dependant variable was the number of drops it took to turn the indicator from royal blue to clear.

The results of this experiment indicated that there is no significant difference in the vitamin C levels of organic and non-organic oranges. The number of drops it took for each fruit to turn the color of the indicator varied from nine to eleven drops each.

The original hypothesis was rejected, and instead, the null hypothesis was accepted. This shows that though organic oranges may have other nutritional benefits that weren't tested in this experiment, there is no significant advantage in the amount of vitamin C over non-organic oranges.

Further questions that have arisen from this experiment include the amount of vitamin C in different types of orange juices, such as concentrate vs. fresh squeezed. Another experiment could test the nutritional benefits (other than vitamin C levels) of organic fruits over non-organic fruits.

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

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Jeanne Jeong 2/17/06
Finalist or Team Leader Signature Date

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The Effects of Temperature Change on Lactase Reaction Rate
Lara J. Mangum

Broad Run High School, 21670 Ashburn Road, Ashburn VA 20147

The purpose of this experiment was to test the effects of temperature changes on enzyme (lactase) reaction rates. If the temperature of the milk in which the lactase is added is heated to a temperature of 37 degrees Celsius, then there will be optimum activity in the enzyme.

The independent variable was the temperature of the milk in which the lactase enzyme was added, the temperatures of 20, 37, and 50 degrees Celsius. The dependent variable in the experiment was the rate of reaction of the enzyme lactase. The hypothesis was that if milk is heated to a temperature of 37 degrees Celsius, then the enzyme will separate the glucose from the milk the fastest. This hypothesis was proven.

The mean of the rates of reaction was 4.3. The results show that the experiment was significant considering a probability level of 0.05. In addition, the Null Hypothesis was rejected.

It was concluded that the temperature of 37 degrees Celsius is the ideal temperature for enzyme activity, when involving an enzyme such as lactase would take place in the body of a vertebrate, which is at an average temperature of 37 degrees Celsius.

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   ☐ non-human vertebrate animals ☑ controlled substances ☐ human/animal DNA
   ☐ human/animal tissue

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Lara J. Mangum 2-21-06
Finalist or Team Leader Signature Date

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The effect of triclosan concentration on its residual property
Mott, Stephanie M.
Broad Run High School, Ashburn, VA

Triclosan is a bacteria fighting agent that is included in many different brands of anti-bacterial soaps. The purpose of this ingredient is to leave a residue on human skin, protecting the skin on the hands from bacteria long after you have washed them. Four different soap brands with various percents of triclosan were tested in the experiment to find out if the triclosan would remain on a consumer's hands and keep fighting off bacteria for an extended period of time.

This was done by taking swabs from four different subjects' hands. Each volunteer was given a particular soap to wash their hands with at the beginning of the experiment. A swab was taken before the wash, one directly after wash, and four after the second swab was taken. The volunteers may not use anything to dry their hands with, they must let them air dry as to not contaminate their hands with unwanted bacteria. Obtain swabs every two hours for four trials. Once the streak method is used to smear bacteria onto the agar in the Petri dishes, make sure to incubate them at 37 degrees Celsius.

Before conducting the experiment, make sure that all the Petri dishes are filled with enough agar. The result of not enough agar is after a period of time in the incubator, the agar may dry out, which will quite possibly give you inaccurate results.

We concluded from this experiment that a consumer can buy whichever soap appeals to them the most. There was no drastic difference in the amount of bacteria found on the hands of the volunteer that used soap with 0% triclosan and the volunteer that used soap with 0.6% triclosan. The results may have come back more correctly if the agar poured into the plate at the beginning of the experiment was thicker, however, the agar dried and became very thin, making it hard for the bacteria to colonize.

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

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   No

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   No

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   No

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   No

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

Stephanie Mott  
February 17

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The Concentration of Pepsin on the Amount of Protein Digested
Muraleetharan, Saghana
Stone Bridge High School, Ashburn, VA 20147, USA

The general purpose for this experiment was to determine whether the concentration of pepsin, located within the gastric juices of the stomach, determined the amount of protein digested in the stomach. The hypothesis was: if the concentration of pepsin increases, the amount of protein digested will increase. Hydrochloric acid, 0.04M, was used with the pepsin to provide acidity, which was needed for digestion.

To synthesize stomach acid, a solution of hydrochloric acid and 0.25g of pepsin were used to represent the control. The experimental solutions were 100mL of hydrochloric acid mixed with 0.12g of pepsin and another of 0.5g of pepsin. The pH levels throughout all of the HCl and pepsin solutions remained the same, 1.5. Approximately 1.1 grams of albumin, in the form of cooked egg white, were placed inside the 45 test tubes. Next 3mL of each solution was poured into the fifteen test tubes. The test tubes were allowed overnight "digestion."

Next came finding the mass of the albumin after being "digested," the conclusion was that as the concentration of pepsin increases, the rate of protein digestion increased as well. The data from this experiment supported the hypothesis therefore rejecting the null hypothesis. The major differences were between the control, 0.25g, and the 0.5g.

For further experimentation, one should incorporate more pepsin to verify a physical change as well as simply a mass change. Also, the use of carbohydrates or lipids in further studies could change the rate of digestion in effect to the concentration of pepsin.

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

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Saghana Muraleetharan 2/23/06
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 role of soil nutrient levels and its relationship to non-structural carbohydrate (NSC) levels in pasture plants as it relates to the onset of laminitis in horses.
Gunnar Olgren
Loudoun Valley High School, Purcellville, VA, USA

Recently, scientists have discovered that the serious equine illness laminitis is associated with high levels of carbohydrates (sugars and starches) in the diet of horses. Laminitis is the second most serious disease to afflict horses and can lead to crippling changes in a horse's feet, and possibly death. This study seeks to explore whether a relationship exists between soil nutrient levels and the non-structural carbohydrate levels in pasture forage as it relates to the onset of laminitis in horses. A 10-acre field at the Middleburg Agricultural Research Center (MARE Center) was sectioned into four equally sized quadrants. Soil from each quadrant was collected and analyzed for nutrient levels and pH. Composite pasture samples were collected from each quadrant and analyzed for carbohydrate levels. This information was compiled into data tables, analyzed, and then graphed. The hypothesis that the effect of lowered nutrient levels in the soil will increase the non-structural carbohydrate levels in pasture plants, increasing levels of fructan, and subsequently increasing the risk of laminitis was supported in an inverse manner because excellent soil nutrient levels existed, and low levels of non-structural carbohydrates and fructan were found in the pasture forage. Second, data from on-going research at the MARE Center was then analyzed and graphed, that offered a look at insulin levels in horses, grazing behavior, and soil temperature taken from the same four quadrants during the same time period. An interesting relationship occurred when looking at grazing behavior and insulin levels from these quadrants. The horses spent 75% of their time grazing, and yet the insulin levels were at their highest during the sunlight hours, possibly revealing a risk factor for laminitis. Continued testing of carbohydrate levels in pasture samples is warranted due to possible factors such as seasonal changes, air temperature, rain, and amount of sunshine.

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

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

3. This project was conducted at a Registered Research Institution.  
   [X] Yes  
   [ ] No

4. Is this project a continuation?  
   [ ] Yes  
   [X] No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  
   [ ] 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.

[Signature]
Finalist or Team Leader Signature  
2/2/06  
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 the Gluten-free Flours Amaranth, Brown Rice, White Rice, and Millet on a Loaf of Bread
O'Neil, Colleen
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

Celiac is a genetic disorder that causes gluten intolerance. Gluten, found in all wheat products, gives structure to bread and helps yeast release its full flavor as it rises. People with celiac disease must use gluten-free flours when baking. In an attempt to find the best gluten-free alternative for bread baking, the experiment compared 4 types of gluten-free flours: amaranth, brown rice, white rice, and millet, to the control of all-purpose flour. 8 rounds of experimenting were completed, creating 5 loaves of bread in each round that followed an identical recipe altering only the type of flour used. The total change in volume was calculated, and a student's t-test was run comparing each gluten-free flour to the all-purpose flour (P=0.05, df=14). The t-values for each comparison revealed that the only flour with significant difference (t > 2.145) to all-purpose is amaranth. It can be suggested that the flour with the least significant difference, brown rice, is the best overall gluten-free flour because it is most similar to the total amount of rising for the all-purpose flour. The second aspect of the experiment involved human testers rating each type of bread on a scale of 1-10 (10 as the highest). The gluten-free bread achieving the highest rating was brown rice with a mean rating of 4.34 and the lowest rating was amaranth with a mean rating of 2.88. 46% of human testers answered "yes" they would eat the brown rice bread again while only 24% said the same of the amaranth bread. The final aspect of the experiment compared cost and nutrition values of the gluten-free breads. The flours highest in nutrition value were millet and amaranth and lowest was white rice flour. The amaranth was the most expensive at $3.92/ pound while the cheapest flours were brown and white rice at $1.33/ pound. Combined, the three parts of the experiment did not support the hypothesis that white rice flour was the best gluten-free alternative in baking. Instead, the data showed that brown rice was the most favorable because of its similarity to all-purpose in the categories of volume, taste, cost, and nutrition. Amaranth was shown as least favorable alternative due to its dissimilarities with all-purpose in these categories.

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   ☒ 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

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   ☐ Yes 
   ☒ No

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Colleen O'Neil 2-14-06
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.
Candida albicans is a pathogen that causes Candidiasis and lethal bloodstream infections from improperly sterilized medical devices and surfaces in hospitals. The yeast's biofilm production protects it from traditional antimicrobial drugs and treatments that cost the United States $10 billion annually. The eap1 gene codes for cell wall adhesins and was determined to be critical to biofilm formation. The purpose of this research was to suppress the production of mRNA transcripts from the eap1 gene. By transfecting the yeast with siRNAs targeted for the gene, the RNA interference pathway was initiated and transcripts of eap1 were identified and enzymatically digested. The experimental group was transfected with siRNA while the control group was not. Total RNA was then extracted from both groups. mRNA transcripts from eap1 were reversed transcribed to complementary DNA through gene-specific primers, and cDNA was amplified by PCR. The resulting cDNA of the experimental and control groups was quantitatively compared after gel electrophoresis by measuring the migration distance and its correlation to the number of base pairs. After statistical analysis of results via a t-test, the null hypothesis, that presence of siRNA would not suppress eap1 transcription, was refuted. siRNA-transfected Candida produced ten percent less copies of the gene than the control. This suggests that RNAi is an effective tool in controlling transcripts of a gene integral to biofilm development. Future exploration of controlling infectious biofilm production in other species using this method is warranted.
The Effect of Various Compounds on the Transforming Effectiveness of Escherichia coli
Dhruva Rajendra
Dominion High School, Sterling, Virginia

For over a decade, high-efficiency transformation of Escherichia coli in lab protocols has been accomplished through the use of calcium chloride. The purpose of this research was to determine whether transformation rates could be increased using chemicals other than calcium chloride. The compounds tested were KCl, NaCl, FeSO4. Each was separately mixed into a suspension containing the beta-deficient galactosidase E. coli and plasmid pBLU. The plasmid pBLU was used to mark the transformed colonies with a distinct blue color. The resulting plates yielded no noted transformation of any E. coli using the chemicals tested. However those plates containing the suspension with calcium chloride experienced high rates of transformation. The null hypothesis that compounds with charges different than calcium chloride would not affect the transformation rate was supported via statistical analysis. Further research would entail the exploration of other methods to open the membrane to enhance transformation rates.

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

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

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4. Is this project a continuation? □ Yes □ No

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The Comparison Between Alternative Fuels and Current Fuels on the Run Time of a Toy Car
Wepee, Matthew Jacob Chua
Stone Bridge H.S., Ashburn, VA 20147, USA

This project is the experimentation of using natural ingredients for fuel and energy sources. The main goal for this experiment was to create a fuel that would be able to be easily manufactured in response to the shortage of fossil fuels. The fuel itself was made from natural goods and easily manufactured goods. If successful, the new fuel source maybe used as a replacement for fossil fuels, although it may be less efficient than normal fuel.

The experiment was carried out using an alkaline energy car that uses the sodium chloride in liquids as sources of energy. The two fuels made were of mixed goods such as fruits, condiments, and household beverages. Each energy source was used in a meter long track drive to measure its speed. Each fuel source varied in their speed trials compared to the car's natural battery power source.

The trials of Fuel A proved to be very statically significant. Meanwhile, fuel B proved to be extremely significant. The fuel rivaling the car's battery was fuel A consisting of soy sauce, salt and milk. Statistics prove, that with 95% confidence, that the null hypothesis was rejected and the original hypothesis is supported.

There are two contributions given to this field as a result of this project. First, even though the fuel was not able to surpass the car's battery, it made a less efficient fuel that may supplement electric cars, thus fulfilling the hypothesis. Second, it provides additional information in the field of alternative energy sources.

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   - human subjects  
   - non-human vertebrate animals  
   - pathogenic agents  
   - controlled substances  
   - recombinant DNA  
   - 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

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  
   ✔ Yes  ❌ No

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Matthew Wepee  2/22/06

Finalist or Team Leader Signature  Date

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## 300 Botany

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The Effect of Bleach on the Germination and Growth of Bean Plants
Armina Amini
Broad Run High School
Ashburn, Virginia

In this experiment, the effects of bleach on the germination and growth of bean plants was tested. There were four main groups of plants, each with fifteen specimen (sixty in total). The first group, the control, received only water. The experimental groups of low, mid, and high concentrations received 1 mL of bleach with 14 mL of water, 5 mL of bleach with 10 mL of water, and 15 mL if bleach respectively. Their height was measured once every seventh day, with the first measurement taken ten days after the initial potting process in order to allow the plants to take root.

The independent variables in this experiment were the different concentrations of bleach, and the dependent variables were the effects that the plants experienced as a cause of the bleach; namely their stunted growth and apparent dehydration.

The data collected from this experiment was purely quantitative and also categorized as interval data. The statistics prepared include the standard deviation of each variable during each week, because measurements were taken weekly. Therefore, there are twenty modes and standard deviations as well as fifteen T-tests.

The null hypothesis for this data is: If the bean plants receive bleach in different concentrations then they will not be affected. This hypothesis was rejected in favor of the student's hypothesis that the plants receiving the most bleach would experience the most adverse effects. As shown in the raw data tables as well as the graphs pertaining to the high bleach concentration group, all of the plants in that group were dead by the fifth and final week of the experimentation process. The plants from the control group, which was given only water, were alive and very healthy.

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 ✓ Yes

3. This project was conducted at a Registered Research Institution. □ Yes □ No ✓ No

4. Is this project a continuation? □ Yes □ No ✓ No

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ Yes □ No ✓ No

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Armina Amini
Finalist or Team Leader Signature 2/22/06

Date 10B301

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 my project was to test traditional, slash and burn agriculture (used in 3rd world countries) vs. the modern chemically enhanced soils (used in richer, more developed countries).

First I planted and grew an initial set of bean plants. I then cut them down and let them dry. After a few days I burned them and the soil around them. I tilled the soil, and planted new beans in the burned soil. At this time, I also planted a control experiment, and a chemically enhanced setup. I let them grow in the same conditions for the same amount of time. I measured all three setups at the conclusion of the growing period.

I found that the first to sprout were the slash and burn plants. The most growth over the whole growing period was the chemically enhanced setup, with almost twice as much height per plant the the other two setups.

I concluded, that chemically enhanced soils, have more minerals and vitamins than the other two soils, thus gave the plants better growing conditions. If chemical enhancers are used, then the plants will grow bigger. This is why 1st world countries have more successful crops then 3rd world countries. They can afford these chemicals, and have better plants to sell and eat.
The purpose of this study was to demonstrate the effect of cigarette tobacco on bean plants. Tobacco is a natural pesticide which stimulates the nervous system and can cause death. However it is also a plant and as such has the possibility of making a very good nutrient for other living things to thrive upon. With this in mind one can imagine the true effect this weed would have on other plants health. This experiment was designed to test the growth of bean plants with and without tobacco placed in their soil.

In this experiment ten plants were given cigarette tobacco through their roots while another ten received only normal soil. Each plant received the same amount of water, sunlight, soil, and temperature. After sprouting, their growth was measured daily in centimeters and recorded onto a data chart in order to graph any findings.

Important findings of this study show that cigarette tobacco taken in through the roots has little to no effect on the growth of bean plants. The plants all grew to about the same heights and showed the same appearance of outward healthiness. These findings simply show that although tobacco can be deadly to many living things it doesn’t affect plants. This knowledge disproves my hypothesis which was that cigarette tobacco stunts the growth of plants since the experimental plants’ height was about the same as that of the controls.

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 ☐ controlled substances ☒ non-human vertebrate animals ☐ human/animal tissue

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Lauren Christoffersen 2/21/06

Finalist or Team Leader Signature Date

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Effects of the Zapper on the Growth Rate of Radish Plants
Eunjin Kim
Broad Run High School, Ashburn, Virginia

This study in its present form is the result of the electromedicinal device called zapper on the effects of radish plants. The initial idea was to determine the truth and the ways of the zapper, created by Dr. Hulda Clark. The purpose of this experiment is to examine how a zapper (electricity) affects the plant's rate of growth.

The radish plants were separated into two different groups: Zapper Group and Non-Zapper Group. Each of the plants under the Zapper Group were zapped for 15 minutes a day. The control was the Non-Zapper Group, without any zapping. The independent variable was the time of zapping of Zapper Group (15 minutes), while the dependent variable was the growth rate of radish plants. The researcher's hypothesis was that the plants that if the plants are zapped, then the rate of growth will increase.

Zapped plants exhibited a greater mean rate of growth (2.09 cm/day) than non-zapped plants (1.79 cm/day). Variations within the groups were similar; with zapped plants having a SD of 0.16 and non-zapped plants a SD of 0.19. The results are not significantly different based on the 0.05 t-test. The null hypothesis was rejected; therefore, the data did support the research hypothesis.

This experiment should be continued and extended. Although there was not a permanently visual difference in the heights of the radish plants, the radishes and the health of the plants (such as the roots) should be considered to view the full effects of the zapper. It is necessary to grow the radishes and observe its color, size, taste, etc. Further studies on different time frames (intervals) for zapping are needed to improve on the experiment.

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
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Measuring the Change of Pigments of a Coleus scutellarioides Plant When Exposed to Different Wavelengths of Energy
Blaine Morgan
Potomac Falls High School, Sterling, VA, United States of America

The purpose of this experiment was to determine how Coleus scutellarioides plants were affected by different colored wavelengths used as energy sources.
At the end of the experiment all three groups of plants had reacted differently. The regular white incandescent bulbs group performed the best. The plants themselves grew the greatest amount compared to the other types of lights. The shortest plant was 4 cm tall and ALL of the plants survived. The pigments in paper chromatography, in order from the bottom of the strip was a dark green, followed by a dull yellow, and on top a thin light purple. Next is the group under the red light. For chromatography it was dark brown, dark green, and then a light purple. The tallest plant was only 5 cm tall. One of the plants died one week before the set finished date. It was the second worst group of the three. The control group is not included. The blue light plants performed the worst. Two of the plants died, and a third was grown to except it was used for the testing before it could. The pigments were as followed: think brown, dark green, dull yellow. The tallest plant was only 3 cm tall. The last group was the control. The pigments were: light brown, light green, bright yellow faded to dull yellow. The height was 7 cm tall.

Procedure: edited
1) Buy red, white and violet 100-watt incandescent bulbs 2) Buy 20 same sized Coleus plants 3) Put plants in regular potting soil in a pot thirty cm in diameter 4) Add 5-10-5 fertilizer to the potting soil with the plants 5) Place plants in complete darkness except for the selected bulbs specific light color, at room temperature 6) Water plants with approximately 2 cl. of water two times a week for a period of 7 weeks to prevent the possibility of root rot or drought. 7) After 7 weeks observe the plants and their leaves and make graphs and take pictures 8) After observations, perform/complete paper chromatography to determine how much the pigments have changed 9) Complete the rest of the project-analyzing data, making graphs, support hypothesis, cleaning up etc.

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

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Blaine Morgan
Finalist or Team Leader Signature  1/25/00

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09P305
Effective Propagation of Wisconsin Fast Plant Cuttings
Sean Mosier
Potomac Falls High School, Potomac Falls, VA

This experiment tested the effect of different concentrations of fertilizer and/or rooting hormones on Wisconsin Fast Plant (WFP) cuttings. Rooting hormones are applied to the tips of freshly cut WFP stems, which are then placed in spring water with flowering stage fertilizer. Rooting hormones significantly shorten the time it takes for the plant to form roots, while fertilizer feeds the roots. Stems can develop roots within 3-4 days if hormones are added, whereas it would normally take several more days.

Plant shoot and root growth were measured and the general appearance of the root was observed and recorded. Survival rate of the cuttings was also noted.

The major findings were that rooting hormones do shorten the time for WFPs to root. The average time for root development was 4-5 days in the rooting hormone group, while the control group averaged between 5-7 days. All cuttings that were exposed to fertilizer died. Only 25% of the cuttings in the rooting hormone with fertilizer survived. It’s probable that the fertilizer concentration was toxic to the cuttings.

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[Signature] 2/21/06
Finalist or Team Leader Signature Date

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A Comparison of the Effect of Growing Plants Under Hydroponic Conditions Versus Soil
Laura Peters
Heritage High School, Leesburg, Virginia USA

This project in its present form is the result of botanical experimentation on the effects of growing plants under hydroponic conditions as compared to the effects of growing plants in a soil environment. The initial idea was to prove that hydroponic farming is a faster, more efficient technique than soil farming. To demonstrate this, fifteen Waldman lettuce plants were grown in a Nutrient Film Technique system and fifteen were grown in soil.

Data collected from the beginning of the experiment proved that the hydroponic plants grew faster than the soil plants. However, a sudden change in pH and a mechanical malfunction affected the results negatively.

PH had a larger impact on the growth and health of the plants than expected. A slightly acidic pH around 6.5, proved to be the optimum condition for plant growth in the hydroponic system. Once the pH climbed up to basic levels of 7 or higher, plant growth slowed. Acetic acid provided only a temporary pH buffer.

Although initially the soil plants were growing slower, they were able to maintain a steady growth and health while the hydroponic plants wilted and died. The soil plants gained more average growth per day over time.

A further study of the chemistry of pH could prevent interferences with hydroponic success. Hydroponics could possibly be the way of future farming. Under such conditions where pH can be accurately regulated on hydroponic farms, hydroponic plants can provide crop growth where fertile land is unavailable as well as possible farming in space exploration.

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

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Laura Peters 2-23
Finalist or Team Leader Signature Date

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The Effect of Wind and Light Versus the Occurrence of Plant Transpiration Using the Schlieren Theory and Technique
Schade, Morganne
Stone Bridge High School, Ashburn, VA 20147, USA

The Schlieren Theory was used to test the occurrence of transpiration in two different species of plants, the Aucuba japonica and the Nandina domestica. The Schlieren technique uses lenses, mirrors, and light to portray the internally heated plant tested as an image while visualizing density changes. The hypothesis was if a plant with larger leaves is placed on a Schlieren setup, it would transpire more than if a plant with smaller leaves was placed in the same setup and tested under the same conditions.

Each test group consisted of three plants. These plants were exposed to environmental conditions, including the sun (lamp), the wind (fan), and the control (no element). The ability to see transpiration was dependent on the environmental conditions tested. Procedures included placing each plant under each condition for 15 minutes to observe the occurrence of transpiration.

The result of this experiment was directly related to the surface area of the leaf. Within the test group, Aucuba japonica, all trials for the "sun" condition resulted in approximately the same amount of transpiration, yet no transpiration was observed under any other conditions. When testing the Nandina domestica, no transpiration was observed under any conditions or trials.

After testing both groups of plants, resulting statistics and data supported the hypothesis. Nevertheless, there was error because this particular Schlieren setup was not sensitive enough to detect transpiration in the Nandina domestica. Future investigations would include using stronger lenses and accounting for the physiologies of the different plants.

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ 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 also attest that the above properly reflects my/our own work.

Morganne Schade 2/22/06
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 Mortality Rate of Duckweed With Weed Killer
Katherine E. Spaalding
Park View High School, Sterling, Virginia, United States

This project was used to find the mortality rate of duckweed with weed killer. If weed killer was to accidentally go into a pond, how much would the duckweed be able to withstand? The initial idea was to observe the growth and decline of the leaves of the duckweed. However, the plants did not lose or gain any new leaves. A color key was made to help judge if the plant was dead or alive. The dying duckweed changed colors during its decline, so once it reached a certain color, it was considered dead.

1-7 mL of ‘Round Up Super Concentrate’ was used in order to find out how much the duckweed could withstand during a 15 day period. A color key was used to determine which of the plants were dead and alive.

The graph showed that from 3mL of weed killer and up, the slope gradually went down, ending at the death margin. 1mL-2mL’s of weed killer went only half way down the graph, ending at mid-graph, while the control group was relatively stable throughout the experiment.

From the cumulative information gathered, using 3mL of Round Up Super Concentrate, the duckweed reached its mortality rate within 15 days. Originally, the hypothesis was that 6mL of weed killer would be the mortality rate of duckweed. My original hypothesis was proven wrong when 3mL affected the duckweed and killed it during the 15 days. One could use different types of weed killer to determine which worked best to kill the duckweed, or to use various water plants to the effect of ‘Round Up Super Concentrate’ had on them.

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

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Katherine Spaalding 21/2/2020
Finalist or Team Leader Signature Date

10/3/09

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.
This project tested the hypothesis that nitrogen-fixing bacteria inoculant would be as effective as fertilizer for the health and growth of legumes. Some research has shown inoculants to be less damaging to aquatic environments within the watershed of agricultural areas.

Nitrogen only blood meal and an inoculant (nitrogen fixing bacteria) were applied to Phaseolus vulgaris. The independent variables were two groups of bean plants with inoculants and nitrogen fertilizer. The control group was plants without inoculant or fertilizer added. The dependent variables were plant height, stem width, number of leaves, leaf color, and plant mass. Data were recorded every few days, with plant mass recorded on the last day.

T-tests were computed comparing bacteria and fertilizer groups with the control and t-tests were computed comparing bacteria groups with the fertilizer groups. The t-tests between the bacteria and fertilizer groups showed statistical differences with respect to leaf color and number, (0.05 and 0.01 respectively) with fertilizer groups showing a greater number of leaves and better color. There were not statistical differences with respect to plant height, stem diameter and plant mass. Therefore, the null hypothesis could not be rejected and the hypothesis was not supported.

This project could be further enhanced by improving methods of inoculation, growing more plants and using different species of legumes. It is possible that the energy the plant uses to fix the nitrogen from the atmosphere may have resulted in lower yields.

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[Signatures]

Finalist or Team Leader Signature Date

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A Determination of the Elevational Correlation of Stomata Number and Carbon Dioxide Levels
Rose M. Wilson
Dominion High School, Sterling, Virginia

Carbon dioxide levels in the atmosphere change based on many factors including human and factory output. Plants depend on carbon dioxide to produce the glucose needed for their daily life activities. The purpose of this research was to determine whether the number of the stomata on a plant leaf could indicate carbon dioxide levels in the atmosphere around the plant. Stomata are crucial to the intake of carbon dioxide. Leaves from various plant species were collected from three elevations: sea level, 1500 feet, and 3500 feet. Two 1 cm² pieces from each leaf sample were bleached and the number of stomata on each section was counted. Statistical analysis indicated that the null hypothesis, that there would be no significant correlation between stomata number and the carbon dioxide level, was supported. There were, however, slight differences in stomata numbers at certain elevations in that there appeared to be more stomata at higher elevations. These plants were collected from Shenandoah National Park. High levels of carbon dioxide may indicate higher temperatures, which could be detrimental to plant life in our parks. This, in turn, would not only affect food chains but also impact the tourism industry within our National Parks. Further research would entail analysis of the carbon dioxide levels at the elevations the plants were collected from.

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Rose M. Wilson
Finalist or Team Leader Signature 2/16/06

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The Effects of Runoff Water on the Growth Rate of Plants
Qin Zhao

Broad Run High School, 21670 Ashburn Rd. Ashburn, VA, USA

This experiment related to the area of Botany. The purpose is to understand the effects of certain factors of runoff water on the growth rate of plants.

In order to simulate a natural environment, the subjects were exposed to two factors of runoff water changing soil porosity and acidity, or pH. The control was the radishes grown in soil with a neutral pH. The independent variable was the changing environmental factors - soil porosity and pH. There were five experimental groups, with the first grown in sand with a low pH. The second group was grown in soil with a low pH, the third in sand with a neutral pH, the fourth in soil with a high pH, and the fifth in soil with a high pH. The hypothesis was that the plants would grow the best in potting soil with a neutral pH.

The mean of the soil grown in potting soil with a neutral pH was 5.573 cm. With the low pH sand, low pH soil, neutral sand, high pH sand, and high pH soil, the means were 1.2192, 4.6482, 2.1082, and 5.519 respectively. Although the results supported the researcher's hypothesis in some areas, significance tests with a probability of 0.05 show that none of the comparisons to the control were significant.

Other factors could affect a subject's growth rate, such as the changing weather patterns, specific chemicals in the water without any changes in pH or the subject's ability to adapt to a changing environment. To completely isolate the factors of soil porosity and pH in a later study, the plants could be placed in an area similar to a green house that would be subject to a constant environment apart from the independent variable.

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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

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Qin Zhao
Finalist or Team Leader Signature 2/12/2011
Date

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The Effect of Vegetable Preparation on the Vitamin C content
Anissa L. Adas
Briar Woods High School, Ashburn, Va

The purpose of this project was to determine if cooking a vegetable causes it to lose a significant amount of its necessary vitamin C content. The hypothesis stated that all three raw vegetables would contain more vitamin C than all three boiled vegetables. The three vegetables that were tested during this experiment were; carrots, broccoli, and potatoes. Each vegetable was tested in a raw and boiled state. The boiled vegetable was the independent variable, where as the raw vegetable acted as a control. The vegetables were chopped, blended, then strained until they reached a liquid form. After collecting 300 ml of liquid the vegetables were titrated in 30 ml increments.

The data collected during this experiment was quantitative and provided the following results. The calculated t value of 1.3801 is less than 2.101 and therefore is significant. The null hypothesis is rejected and the research that raw Broccoli has a higher concentration of vitamin C than cooked broccoli is supported by this experiment. However the results for the potatoes and carrots were not significant and the null hypothesis was accepted. Over all the experiment supported the hypothesis that some raw vegetables contain a higher concentration of vitamin C than cooked vegetables.

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   - ☐ pathogenic agents
   - ☐ recombinant DNA
   - ☐ non-human vertebrate animals
   - ☐ controlled substances
   - ☐ human/animal tissue
   - ☐ Yes
   - ☐ No

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ 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.

Finalist or Team Leader Signature: [Signature]
Date: 2-21-06

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Lights Effect On Ink
Alex M. Beard
Potomac Falls High School, Potomac Falls, Virginia

As observed in museums and in everyday life, inks seem to change due to weather and exposure to light. Museums keep many archival documents such as The Declaration of Independence under specific environmental conditions, such as controlled exposure to light. The reason for specific conditions is, inks can be damaged due to prolonged light exposure, which is the basis for this experiment.

This project tested lights effect on four different ink types, Sharpie, Ballpoint, Water-based, and Felt-tip. For each different ink type there were four different colors of ink tested. The duration of testing was 20 separate 24 hour exposure sessions. After each exposure session the inks were observed and noted for changes as compared to the control ink sample which received no light exposure. This experiments' independent variable was the types and colors of ink, and the duration of exposure. The dependent variable was the amount of degradation measured.

The results for this experiment show that lights effect on ink is observable, and quite damaging over time. The ink type that had the greatest degradation results was Sharpie, followed by ballpoint, then Felt-tip, and lastly Water-based. The changing increase in degradation validated the original hypothesis. This shows that ultraviolet light degrades ink over a duration of exposure faster than if the ink had no exposure.

To enhance the results of this experiment one should measure the ink types degradation using a spectrometer for more precise measurement, and conduct multiple trials for each day on the same ink type.

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   ☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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

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Finalist or Team Leader Signature: ___________________________ Date: 2-23-06

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Effects of Diluted Household Antacids on Acid-Rain Damaged Soil pH Level
Kathleen M. Carnes
Freedom High School, South Riding VA, USA

This project tested the effect of household antacids on the pH level in acid-rain damaged soil in an attempt to repair the damage caused by acid rain. Several solutions for acid-damaged soil, and entire forests, caused by acid rain have been tried and tested in the past. Although successful, many of these solutions are prohibitively expensive.

This project simulated acid rain on four different soils (sandy, silt, clay, and loam soil), to see in which soil the greatest change in pH occurred. The sandy soil trials had the greatest change, with a difference of 1.3 from the original measurements (-1.3). Tums, Rolaid's, and Pepcid AC were then diluted to determine the effect of household antacids on the damaged soils' pH level. The antacids were found to significantly improve the pH level. Rolaid's was found to have the greatest effect on the pH level (+1.6). Tums and Pepcid AC helped restore the pH level to +1.5.

According to the data collected, it appears that magnesium hydroxide helped return the soil pH to the healthiest level (+1.6), compared to the ingredients of the other antacids. Rolaid's contains both magnesium hydroxide and calcium carbonate. Pepcid AC’s active ingredient is famotidine and Tums' active ingredient is calcium carbonate.

A continuation of this project would attempt to find a way to put the antacids in soils in an effective and less expensive manner by creating and testing a type of antacid doser or distributing technique capable of widespread distribution of the antacids.

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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
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Katie Carnes  Jan 21, 2003
Finalist or Team Leader Signature  Date

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A Taste of Egypt
Whitney Cavin
Potomac Falls High School 46400 Algonkian Parkway

A dried out mummy lies in the tomb of an Ancient Egyptian pyramid. Sounds like something one would only find in Egypt, right? Wrong! For this experiment, a modified natron solution (a mixture of baking soda/table salt and Epsom salts separately) was used to demonstrate and compare the effects of salt distributed on different apple slices. Salt is a desiccant, which means that it will absorb moisture from a substance until it becomes saturated. The composition of salt serves various purposes which work together in this chemical process.

To test the effects of the absorption of moisture from the apple slices, each were weighed before the baking soda/table salt mixture and Epsom salts were added. Then, an equal amount of each were distributed evenly to each of the 5 apple slices per substance. 5 untreated apples were used as well for further evaluation. After a period of one week, each apple slice was observed and weighed to determine the amount of moisture removed by the two substances. Altogether, the apples covered in Baking Soda/Table Salt removed 10.4g, while the Epsom Salts removed 9.8g, and the constants lost 7.6g of moisture.

After one week, each apple slice had lost a significant amount of moisture compared to its original weight. While this was true, the average amount of moisture removed from apple slices using baking soda with table salt was notably greater. The hypothesis of this experiment was supported because the basic composition of salt removed moisture from each affected apple slice. Who knew one could use these common household substances to model after such a fascinating, ancient process?

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4. Is this project a continuation? □ Yes ❌ No

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Whitney Cavin 2/23/16
Finalist or Team Leader Signature Date

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The Effect of Various Types of Over-the-Counter Pain Relievers on the Mass Difference After Dissolving in Hydrochloric Acid and Pepsin Solution
Cullen, Jacqueline J.
Stone Bridge High School, Ashburn, VA 20147, USA

The purpose of this project was to determine which over-the-counter pain reliever dissolves the fastest. From that it could be determined which pain reliever reliev ed pain in the least amount of time to see which analgesic is the most logical to take. Acetaminophen, aspirin, and ibuprofen were the pain relievers tested in this experiment.

For this experiment, the mass of each pill was measured. Then each pill was placed in a solution of hydrochloric acid and pepsin for two minutes. Next, the pill was filtered and the mass of the remains of the pill was measured. The difference showed how quickly they dissolved in a certain amount of time.

The results showed that aspirin dissolves significantly faster than acetaminophen and ibuprofen. Acetaminophen and ibuprofen were so similar that the t test showed they were not statistically significant.

The original hypothesis stated that the acetaminophen, being the most commonly used, would dissolve the fastest. This hypothesis was refuted because the aspirin dissolved significantly faster than acetaminophen and ibuprofen. It may seem that aspirin would be the best analgesic to take for pain relief because it dissolves the fastest. However, there were many possibilities for error in the results. There was no way to know how much of the drug actually dissolved because it was assumed that undissolved material was only inactive ingredients. To expand on this experiment, the filtrate could be tested directly to determine how much drug went into the solution.

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Jacqueline Cullen  2/27/06
Finalist or Team Leader Signature  Date

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A Comparison of the Corrosion Resistance and Cost Effectiveness of Hot-dipped Galvanized, Electro-galvanized, and non-galvanized Steel Nails
Andrew M. Cypher
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA

This study compares 3 nail types’ corrosion resistance to various environments, leading to insight in purchasing the most durable and cost-effective nail.

All nails were 6d 2" with approximately the same volume and mass. Nail #1 (hot-dipped galvanized) was predicted to corrode the least due to the thick zinc coating from a zinc bath. Nail #2 (electro-galvanized) has a thin, but strong bonded zinc coating from the process of electroplating; it was predicted to corrode slightly more than the hot-dipped. Nail #3 (non-galvanized) was predicted to corrode the most, due to completely exposed steel that lacks a protective coating. Every nail was mass initially and placed in test tubes with 5 mL of the following substances: 0.5 v/v% bromine water, chlorine water, 15.8 M HNO3, 18 M H2SO4, 12.1 M HCl, 10 M NaCl, distilled H2O, tap water, and one control tube with no substance. The nails remained in the environments for 1335 minutes. The nails were then removed from the environments, and massed.

The amount of corrosion was measured by % mass loss for each nail. Analysis of graphs relating the average % mass loss over all the environments, to the type of nail, along with a two-way ANOVA test, showed no variance in corrosion resistibility among the nails.

The hypothesis that ranked specific nail types in their corrosive resistance was invalidated by the results of no correlation. Thus, all 3 types of nails provide similar corrosion resistance and the most cost-effective nail is the cheapest, non-galvanized, steel nail.

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. [X] Yes [ ] No

3. This project was conducted at a Registered Research Institution. [ ] Yes [X] No

4. Is this project a continuation? [ ] Yes [X] No

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Andrew Cypher 02/11/3006
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.
Why does a bathing suit start stretching after wearing it a few times in the chlorinated pool? The purpose of this experiment was to find out what effect chlorine has on Lycra. In this experiment three different bathing suit brands were tested to see which one would stretch the least over time. Each bathing suit was cut into equal size pieces, one being placed in water as the control and the other being placed in a chlorine solution. After soaking for twenty-four hours, the pieces were measured to see the amount stretched. They were checked every four to six hours for the remaining period of time. The independent variable in this experiment would be the different brands of bathing suits and the dependent variable was the amount it stretched over time.

As a result, the Speedo bathing suit stretched the least which agreed with the hypothesis until performing statistical analysis. A t-Test was preformed in order to find this out. In order to reject the null-hypothesis the t-value needed to be greater than or equal to the table value which was 12.076. The calculated t-value .0303, was less than the table value and therefore the data was not significant. The null-hypothesis was rejected and the research that chlorine affects the stretch of Lycra was not supported.

For more comprehensive results, additional trials could have been conducted. In addition you could have tested and observed the effects of chlorine on coloring and see if it is related to fading.

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. X Yes □ No

3. This project was conducted at a Registered Research Institution. □ Yes X No

4. Is this project a continuation? □ Yes X No

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

Elizabeth A. DePasquale 2/20/06
Finalist or Team Leader Signature Date

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Acid Rocks
Michael C. Honig
Heritage High School, Leesburg, VA USA

This experiment was conducted in order to determine the effect of varying amounts of acetic acid has on crystal size, strength, and rate of growth. The hypothesis stated that a higher concentration would make crystals smaller, grow faster, and weaker.

The crystal's size and rate of growth was determined by taking pictures of the crystals every week for four weeks, and based on those pictures, ranking them from 1 to 4, 1 being the fastest or biggest, and 4 being the slowest or smallest. The strength was determined by taking any given crystal grown in a solution, and finding out how much weight it took to crush it into powder, and assigning it a number from 1 to 4, 1 being the strongest, and 4 being the weakest.

The statistics showed there was no correlation between the data produced by this experiment and any groups in the data were produced by random chance. The results of this experiment showed that acetic acid has no effect on crystal growth.

The conclusions of this experiment were very ambiguous. While the exponent showed that acetic acid has no effect on crystal growth, this could have been because there were countless other variables not taken into account in the hypothesis. In a future experiment, it would be wise to use an object of uniform size, weight, and composition as a medium in the solutions.

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
5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ 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.

Michael Honig
Finalist or Team Leader Signature

Date

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A Comparison of the Burn Rate of Various Woods for the Suitability of Home Construction
Shannon E. Karinshak
Heritage High School, Leesburg, VA, USA

The purpose of this experiment was to determine which type of wood used for construction is the most fire retardant.

Eight different types of wood were chosen and cut into pieces of the same size. Then the pieces were burned with the same type of flame. The wood was observed and any changes were recorded.

It was observed that the wood types with rings close together, also the densest seemed to take the longest to burn. While, in reverse, the ones with fewer rings, the less dense, burned quick. It was also observed that the aspen burned the fastest and the oak burned the longest. Some wood types broke in half; others simply extinguished the flame themselves.

All the wood types burned at different rates, the aspen being the fastest, the oak being the slowest. Thus, justifying my hypothesis that the aspen, being the least dense, would burn the fastest.

To further this research, a test on the different wood types with all having the same density would be a more accurate experiment. There were many reasons for error in this experiment, including weather and density.

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Shannon Karinshak
Finalist or Team Leader Signature

2-23-0
Date

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Quantitative Analysis of Vitamin C in Orange Juice
Kirsten Kiwior
Park View High School, Sterling VA, USA

Orange Juice is commonly known to have great amounts of vitamin C, also called ascorbic acid, which is necessary to the body for proper teeth, bone, and red blood cell formation. It is also a part of enzyme systems that regulate chemical reactions in cells. Still, how much vitamin C is enough and how much orange juice does a person have to drink in order to obtain the minimum amount of vitamin C per day required for the body to perform the functions utilizing it? Does the amount of vitamin C vary in different brands of orange juice?

An iodine solution was used as the titration solution, and starch as the end-point indicator. The starch was added to a sample of orange juice, which was then titrated by the iodine. When ascorbic acid reacts with iodine, the ascorbic acid is oxidized and the iodine is reduced. Reduced iodine cannot react with starch. When all the ascorbic acid has reacted, any added iodine will then be able to react with the starch. A purple color will form and remain, giving the end-point for the titration.

The results of this experiment conclude that although orange juices are not 100% vitamin C, orange juice is a very good source of obtaining about one-third of the vitamin C you would originally receive in a supplement. The amount of iodine taken by each brand of orange juice was very similar. Therefore, all brands of orange juice have roughly the same amount of vitamin C.

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Kirsten Kiwior
2/12/10
Finalist or Team Leader Signature Date

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This study relates to the area of Chemistry. The purpose of the experiment is to understand various methods of fingerprinting to expose latent fingerprints on different types of surfaces, superglue fuming or dusting with powders.

One set of fingerprints was used to leave behind the patterns for each method to test for exposure and clarity. The control was the single set of fingerprints on a separate piece of paper that were used to compare with the results of the powders dusted and superglue fumed fingerprints. The independent variables were the two different methods that were tested in the experiment, superglue fuming and dusting with powders. The dependent variables were the results of the superglue fumed and powder dusted fingerprints compared to the fingerprints that were only dusted with powders and involved no chemical processes. The researcher’s hypothesis was that the latent fingerprints would have the clearest results after being exposed with only dusting powder.

The clearer fingerprints received a score of 10 while the vague fingerprints received a score of 5. The mean of the fingerprints that were superglue fumed were higher than those of dusting powder. However, during the statistical tests, the null hypothesis was not rejected with a probability of 0.05 or 0.1, and therefore the comparison between the superglue fuming and dusting with powders was not supported.

It is believed that fingerprints on nonporous surfaces are most likely to be exposed the clearest with dusting powders. Fingerprints on porous surfaces are most likely to be exposed clearest with superglue fuming. One major factor to be considered is that the amino acids and oils excreted from the body can be absorbed into the surface after a certain amount of time, causing the clarity of the fingerprint to be decreased.

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Kelly Miller  21/11/06
Finalist or Team Leader Signature  Date

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The Use of Hexadentate Ligand Catalysts in the Remediation of Microbial Contaminated Water
Minh Nguyen
Dominion High School, Sterling, VA

There is growing concern that flooding due to hurricanes will lead to health problems caused by microbial pathogens. Microorganisms such as E. coli and Vibrio Cholera are common pathogens found in toxic floodwaters. The purpose of this research was to determine whether Fe-EDTA catalysts activating hydrogen peroxide could kill E. coli. Three E. coli broth cultures were serially diluted in 1:10, 1:100, and 1:1000 concentrations. These were plated, one plate per tube. Samples were plated from the full strength tubes as well; these served as a control. To two tubes each containing E. coli broth cultures, a 1:10 Fe-EDTA to hydrogen peroxide solution was added in the following amounts: one ml, three ml, and six ml. Samples from all tubes in the control and experimental groups were plated and bacteria were counted. It was determined via statistical analysis with a t-test that the null hypothesis, there is no difference between E. coli growth when a catalyst-hydrogen peroxide solution is added, was refuted in the case of the one mL and six mL groups. Further research indicates the necessity to explore more tests of Fe-EDTA on other bacteria.

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Minh Nguyen
3/16/06
Finalist or Team Leader Signature Date

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The Relationship Between the Amounts of Vitamin C in Orange Juice Versus a Multi-Vitamin Tablet
Scaggs, Madeleine
Stone Bridge High School, Ashburn, VA 20147, USA

This project relates to the debate between drinking a single serving of orange juice or taking a multi-vitamin tablet to consume the recommended daily amount of vitamin C. This is important due to the body’s need for vitamin C, and the repercussions of not satisfying this need.

The volume of a serving size of orange juice compared to a multi-vitamin tablet dissolved in water was directly related to the amount of vitamin C in the solution. To find all the vitamin C in a solution a spectrophotometer was used to find an absorbance reading. Then that value was computed in the standard curve equation from a stock ascorbic acid solution titrated with DCIP, an indicator, taken at a specific wavelength.

Results showed that there was little difference between the amounts of vitamin C in orange juice and a multi-vitamin tablet. Both amounts of vitamin C were extremely close to control solution. The orange juice contained a slightly higher amount of vitamin C than the multi-vitamin tablet when compared to the control. The t-tests run on these various solutions illustrated a statistical significance.

The experimental results showed that a person could consume a single serving of orange juice daily and still meet the recommended daily amount of vitamin C, sixty milligrams, instead of taking a multi-vitamin tablet. This supports the hypothesis and underlined the importance of consuming vitamins naturally versus synthetically. Future experiments could consider using solutions without any other substances that might elicit an absorbance reading on a red wavelength.

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[Signature]
Finalist or Team Leader Signature

[Date]
Date

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The Relationship Between Vitamin C and Various Juices
Kelsey M. Wince
Heritage High School, Leesburg, VA, USA

Ascorbic acid, better known as Vitamin C, is a water-soluble vitamin humans do not have the ability to make on their own, nor store in their bodies. Therefore, the initial idea was to determine the amount of ascorbic acid that humans consume in various juices to obtain Vitamin C needed to aid in bodily functions. The juices tested included Florida's Natural Premium Orange Juice Original, Florida's Natural Ruby Red Grapefruit Juice, Dole Pineapple Juice, and Campbell's Original Tomato Juice.

The amount of Vitamin C contained in the four juices tested was determined by releasing drops, one at a time, of the juices into a Vitamin C indicator until the blue colored liquid turned colorless. The independent variable was the different types of juices utilized in the testing while the dependent variable was the amount of Vitamin C contained in each juice.

The experiment revealed that the tomato juice had the highest content of Vitamin C of all four juices tested. It also indicated that the grapefruit juice had the lowest content of Vitamin C. These findings have altered the idea that most people associate orange juice as having the highest content of Vitamin C of juices on the market today.

The conclusion supports the 10 year study utilized in the background research of this project that orange juice has a higher concentration of Vitamin C than grapefruit juice. However, tomato juice came on top with the most Vitamin C content tested against the three other juices in this experiment.

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<td>Guarino Sean</td>
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<td>Khan Ibtsam</td>
<td>10B502</td>
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<td>Moss Paden</td>
<td>10H503</td>
<td>The Comparison of the Compressions of Images</td>
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<td>Shipman Jessica</td>
<td>10F504</td>
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<td>Vogler Jared</td>
<td>10H505</td>
<td>Is Your Wireless Internet Secure?</td>
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Recognition programs using biometrics are increasingly being developed in order to provide greater security measures to businesses and law enforcements agencies. A facial recognition program was created to explore whether or not it was possible to actively identify faces via a web cam. The possible use of a web cam would greatly decrease the use of expensive cameras, which are now used. Four photographs of twenty subjects were taken by a web cam and cropped to 80 by 80 pixels to show faces only. They were loaded into the created computer program and one individual picture was selected from the pool of twenty. Three trials using each person were conducted and the program correctly identified the subject with at least 90% accuracy. The null hypothesis that a facial recognition program would not identify people was rejected. Further research would entail increasing the accuracy of the program. This program may also have implications in animal tracking and in endangered species identification.

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[Signature]
Finalist or Team Leader Signature

[Date]
This study relates to the area of computers. The purpose of this experiment was to compare the speed of DSL to High speed cable internet access and see which one was faster. This project was mainly focused only on the speed of certain Internet type.

During the experiment a computer was hooked up to a subscribed Internet service. Then, it was tested regularly during different times of the day. In this experiment, the independent variable was the type of Internet service and the dependent variable was the speed. Many cable companies offer speeds up to 6 Mbps (6 Megabytes per second) and mainly DSL offers speeds only up to 3 Mbps (3 Megabytes per second).

As the researcher tested the speed, the mean for the DSL speed came out to be 7157 Mbps or seven million one hundred fifty seven bytes per second. And the mean speed for cable was 5948 Mbps or five million 9 hundred 48 thousand bytes per second. The result show that the DSL is faster than cable, actually a type of DSL, called Fiber Optic DSL, helped to increase the mean number of the speed for DSL.

There are many factors other than speed, which come into place while deciding between DSL and Cable. First of them all is availability, DSL is not widely available throughout some small parts of US. Another factor will be the cost; DSL usually costs lower than standard high-speed cable Internet access. Other studies could be done on how the above factors can make one type of Internet service the best.

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Ibtsam Khan 02/16/06
Finalist or Team Leader Signature Date

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The Comparison of the Compressions of Images
Paden Moss
Heritage High School, Leesburg VA, USA

An image is a still life capture of an event in either color or black and white. The goal of this science research project is to determine the image compression that produces the smallest compression ratio. Images of different sizes, and color were tested against five different compressions: Jpeg, PNG, Gif, BZ2, and Gzip. The data was compressed using a free application that produces results that did not support the original hypothesis. The data has great potential for further study and successfully answered the original question.

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Yours sincerely,

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The Relationship between Image Compression Type and Image Quality.
Jessica A. Shipman
Freedom High School, South Riding, VA, United States

A common problem that many digital photographers face is how to store their photographs. The many types of image compression often puzzle users. If an image is compressed too much, then there could be a loss of quality and information, but if an image is not compressed, then the image will take up a lot of space.

This experiment was completed by taking three pictures of different subjects, a human, a man made structure, and something found in nature. The pictures were compressed into nine different compressions and grayscale. The grayscale images were compressed. A text and a graphic image were also created and compressed. After compressing, the variance, entropy, and mean of the images were taken with Mathematica.

The hypothesis stated that the JPEG2000 would be the best compression for color photographs and PNG would be the best compression for the text and graphic images and grayscale photographs. The results show that PNG is the best compression for all types of images when quality is most important. PNG has the same measure of quality as TIFF (control) on all images. The entropy of the red channel of the human photograph is 7.49 for both TIFF and PNG. After PNG is GIF for text images and grayscale photographs and JPEG2000 for color photographs and graphic images. For the text image, the variance is only slightly different for GIF. The entropy of the grayscale man made structure photograph is 7.73 for both TIFF and GIF. The measure of quality of JPEG2000 is closer to the measures of TIFF, for color images, than any other type of compression except PNG. The mean of the blue channel of the human photograph is 119.98 for TIFF and JPEG2000s' ranges are from 120.00-120.02, but JPEGs' ranges are from 120.01-120.29.

It would be interesting to further research the relationship between image compression type, image quality, and image file size. In this experiment, the goal would be to find the optimal compression type for both quality and storage space of an image.

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Finalist or Team Leader Signature: Jessica A. Shipman  
Date: 2/21/06

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Is Your Wireless Internet Secure?
Jared A. Vogler
Heritage High School, Leesburg, VA, USA

The purpose of this experiment was to determine if Wireless Internet is secure. The idea was to test the strength of the router signals at varying distances. It was found that the signal of the router can achieve a distance of over 45 meters outside of a building. Showing that many people whom live nearby router can use a neighbor’s without buying their own. This opens a door for identity theft and harm to the owner of the router’s computer and Internet.

Wireless Internet signal strength was determined by walking around the perimeter of the house with a Wireless Internet card attached to a laptop. First, a cycle was done at ten meters from the perimeter. The greatest signal strength at ten meters, with the only object of obstruction was the window, being 82%. Following this were cycles from twenty, with the greatest strength of 63%. From thirty meters, the best signal strength being 59%.

The cycles continued from thirty-five--having the most strength of 21%--to forty meters, having only a strength of 16%. At forty-five meters, the greatest strength was 9%. Finally at fifty meters, the best strength was 1%. The routers furthest distance at which Internet was accessible was fifty meters outside of the building.

The experiment shows that from distances ranging from ten to fifty meters, it is possible to access the Internet using another person’s router. To minimize the risk of online predators, routers should be place in the center of the building.

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<td>Tippett Michael</td>
<td>10S616</td>
<td>The Effect of Large Explosive Tropical Volcanic Eruptions on the Number and Intensity of North Atlantic Hurricanes 1851 to 2004</td>
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<tr>
<td>Verdin Chelsea</td>
<td>10L617</td>
<td>Soil Improvement in Loudoun County</td>
</tr>
</tbody>
</table>
Effect of rainfall on Turbidity levels
Meaghan D. Allain
Briar Woods High School, Ashburn, Virginia

The purpose of this experiment was to find the correlation between rainfall and turbidity levels. Turbidity is a measure of the clarity of water. This experiment aimed to show that turbidity levels would increase after rainfall.

A LabPro turbidity sensor was used to measure collected samples from Goose Creek reservoir and bullfrog pond. Fifteen samples were collected from each water source and measured by the LabPro sensor. The control in the experiment was distilled water.

The results of the experiment showed that turbidity levels were significantly higher after rainfall than before. A t-test was calculated on the average difference in turbidity before and after rainfall. The calculated t values were 2.07 for Goose Creek and 10.6 for bullfrog pond. Both values were higher than the table value of 2.048 thus allowing the null hypothesis to be rejected.

Some of the readings collected by the LabPro showed a negative correlation, which could have been caused by inaccurate calibration or fingerprints on the glass cuvettes. Ways to prevent this error is by double checking the calibration of the sensor and cleaning off the cuvettes before testing.

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ 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.

Meaghan D. Allain 2/27/06
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.
Could New Orleans have been spared?
Kathleen E. Antonacci
Park View High School, Sterling, VA, USA

This project was done to test the current methods of slowing floodwaters using sandbags. During the experiment four different substances were tested, sand, gravel, dirt, and clay. The independent variable in this experiment is the different substances used in each trial, while the dependent variable is how long it takes for the water to pass through the substance and overflow the pan. Placing one kilogram of one of the substances into a new tube sock and placing the sock into a metal cake pan was how the experiment was conducted. After the sock was in the pan a hose was aimed at the sock and the water was turned on full blast, while the timer was started. The timer was stopped when the water started to overflow on the opposite side of the sock. The time was then recorded and a new substance was used. The data shows that sand works the best having the longest time of 8.54 minutes. If sand were not available at the time of a flood, the next best substance to use would be gravel. Sand works better in a sandbag then dirt, gravel or clay because sand particles are so small that they have less pore space then the other substances. This information is useful to the general public because it shows that if a flood were to come and they wanted to slow the flood waters from their city or house, they should use sand to keep the water away longer. The best “sandbag” is a large bag filled with the smallest sand grains that can be found at the time. The smaller the grain the less water gets through and the long it takes water to get through.

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   ☐ 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
5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ Yes ☒ No

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Kathleen E. Antonacci 2/21/10
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.
It's A Breeze  
Daniel C. Carter  
Loudoun Valley High School, Purcellville, VA, United States

This experiment was taken to determine which weather condition affect land and sea breezes and to expand on previous knowledge of the subject. The hypothesis was that weather conditions including heavy precipitation will have the greatest effect on land and sea breezes.

To complete the experiment one must place two thermometers six feet from each other one in the water, one in the land. Record all weather conditions for the day. One minute later record temperatures and evaluate breeze type. Two hours later repeat the experiment to observe any change. Repeat the experiment at the same time on seven different days with different weather conditions.

Results included, day one rain fell and resulted in an initial sea breeze that continued. Day two there was a weak sea breeze and then no breeze at all. Day three there was cool weather resulting in a sea breeze that retained. Day four there was warm air created a small land breeze which became a land breeze. Day five included rain and wind resulting in a land breeze which sustained. Day six brought torrential rain which created an unchanging land breeze. Day seven included snow which brought a slightly changing land breeze. Day eight brought freezing rain creating a strong land breeze. To conclude the experiment showed the powerful effects of precipitation on land and sea breezes. It was concluded that land breezes prevail during winter months.

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   ☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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

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Daniel C. Carter   January 31, 2006
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 Diverting Everglades Estuaries on Salinity as Measured by Molluscan Distribution in the Florida Bay
Kathleen M. Crosse
Dominion High School, Sterling, Va

In 1948, the estuaries of the Florida Bay were diverted from their natural flow areas to redistribute the water in order to control the flooding in South Florida. It is believed that this has caused a disruption in the salinity and therefore the ecosystem. The purpose of this research was to determine if salinity of water in redirected areas could be predicted in a certain time period from the molluscan shell assemblages. Samples from two sites in the Florida Bay were analyzed. The percent of the abundance of each species was multiplied by the mean of the specific species viable salinity range to determine the salinity that should be expected at the site of the sample at the time period in which it was taken. The null hypothesis, that rerouting the estuaries would have no effect on the ecosystem as based on species diversity, was refuted. There was less variability in species in areas of disturbances. Further research would entail collection from other affected sites to determine the severity of salinity and ecosystem disturbances due to the fact that when the bottom of an ecosystem/ ecological web is affected everything above it also experiences effects.

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   ☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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Kathleen M. Crosse
02-22-06

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.
Stabilizing Soils via Biofilms: A Hurricane Disaster Defense
Joseph Gusman
Dominion High School Sterling, VA

Natural disasters have the ability to cause massive environmental damage and disrupt the ease of human existence. The hurricane season of 2005 was particularly intense. Hurricane Katrina inflicted major damage to New Orleans particularly when the levees protecting the city were breached. If a method of strengthening soils could be devised, the cost of rebuilding would not be as high and human lives could be saved. The purpose of this research was to determine whether Flavobacterium johnsoniae, a biofilm producing bacterium, had the ability to strengthen soil by “gluing” soil particles together. Identical soil types were inserted into two separate PVC pipe containers, one with nothing added to the soil and the other inoculated with the Flavobacterium johnsoniae. Seven hundred milliliters of water was added and allowed to travel for one minute through the apparatus. The amount of water that penetrated through the soil and exited through the other end of the tubes was recorded. The soil inoculated with Flavobacterium johnsoniae displayed a dramatic decrease in the overall amount of water that flowed through the apparatus in comparison to the control apparatus. The null hypothesis that Flavobacterium johnsoniae would not have an effect in strengthening soil was refuted. Biofilms produced by the bacterium glued soil particles together hence strengthening them. Further research would entail determining whether the Flavobacterium johnsoniae can strengthen soil on a larger scale and in other areas such as those hit by earthquakes.

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   □ human subjects  
   □ pathogenic agents  
   □ non-human vertebrate animals  
   □ controlled substances  
   □ recombinant DNA  
   □ 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  

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   □ Yes  
   □ No  

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Joseph Gusman  
Finalist or Team Leader Signature  
2/17/06  
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.

12D605
The Effect of Methane Hydrate Gas Pocket Explosions on Tsunami Formation
Emily K. Henderson
Dominion High School, Sterling, Virginia

This science research project is demonstrating that dangerous effects, such as a tsunami, could occur if a gas pocket were to explode. The hypothesis was that a tsunami could occur if a gas pocket explodes. Methane Hydrate is a form of natural gas that is concealed in large gas pockets resting on the ocean floor. When oil drillers are mining this natural gas, they can dissociate the gas, resulting in an undersea landslide in a methane hydrate deposit. This phenomenon could easily create a tsunami because the majority of tsunamis are caused by high-energy events. This science research project can be very beneficial to mankind because it has the potential to depict whether waves have the ability to reach land and cause significant harm. Balloons were exploded in a bathtub to stimulate gas pocket explosions. Wave frequency was measured in waves per second using the unit Hertz. The speed of the waves was measured in meters per second, and the height was measured in centimeters. For the statistical analysis, the mean, variance, and standard deviation were found for each group of data. As a result of the t-test, the null hypothesis was rejected. The experimental data indicated a direct relationship between the explosion of a gas pocket and the formation of waves. It also demonstrated that the waves have the speed, frequency, and height to be considered a tsunami.

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
   ☐ non-human invertebrate animals ☐ toxic agents

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ Yes ☑ No

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Emily Henderson 2/22/04
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 Freshening on Movement of Saline Dense Currents
Marron, Sara
Stone Bridge High School, Ashburn, VA 20147, USA

This project was designed to explore the consequences of global warming, exclusively, freshening of the oceans. It simulates freshening of major convection currents such as the North Atlantic Conveyor, that when diluted with fresh water from melting glaciers, could slow enough to detrimentally damage the circulation of heat around the world.

The hypothesis stated freshening would slow the movement of warm water ocean currents. A Convection Current Chamber was used to simulate freshening by filling half with ocean water salt solution and the other half with fresh water. Movement of the salt water at different temperatures (cool, warm, and room temperature) through the fresh water was timed.

When the solution and water were mixed, the groups at the warmest temperature moved the slowest, taking three minutes to diffuse through the entire tank, and were statistically significant. The groups at the coolest temperate moved the fastest, some taking less than forty seconds. Overall, the trials of cool water were inconclusive, but not at all undermining the results of the warm groups which supported the hypothesis.

The conclusion was that freshening in the oceans would slow warm water currents in the Northern Hemisphere. In further tests, the freshwater should be cooled to provide a more exact replica of the freshening of glacial water, providing a more drastic difference in temperature of the cold water versus the warm. The addition of freshwater to the normal flow of warm ocean currents would slow them down until eventually they would be shut down.

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

3. This project was conducted at a Registered Research Institution. □ Yes [X] No

4. Is this project a continuation? □ Yes [X] No

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ Yes [X] No

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Sara Marron 2/23/06
Finalist or Team Leader Signature Date

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The Effects of Different Materials Acting as Barriers against Floodwaters
Kyle Masengale
Briar Woods High School, Ashburn, VA

This particular experiment was designed to determine what material would be the most effective barrier to minimize the loss of life and property in coastal areas susceptible to flooding. It tests the effectiveness of three reasonably priced materials in controlling floodwaters.

The three independent variables in this experiment were sandbags, soil, and gravel. The dependent variable was the amount of water that seeped through the materials. In order to conduct this experiment, three separate troughs were built, measuring 60 centimeters long, 17.78 wide, and 11.43 tall. Each barrier was placed 12.7 centimeters from one end of the trough. All three materials were tested with floodwater depths of 1.72, 2.54, and 3.81 centimeters. Measurements of water seepage were taken at five, ten, and fifteen minutes for each of the three floodwater depths.

A T-test was performed to measure the effectiveness of the experimental group in comparison with the control group. A sample of the measurements at 1.72 centimeters of water depth yielded T-test values of 323, 14.5, and 6.25 for the sandbags, gravel, and soil respectively. These values are statistically significant compared with the level of significance of 4.303, based upon degrees of freedom of two. Therefore, the null hypothesis is rejected.

The hypothesis for this experiment was supported, as the sandbags proved the most effective in acting as a barrier against floodwaters. Another idea for further experimentation would be to create several different combinations of these materials to see whether or not they would be more effective than sandbags alone.

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Kyle Masengale 2-21-06

Finalist or Team Leader Signature Date

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The Effect of El Nino, Neutral, and La Nina Years on Snowfall Totals on the East Coast of the United States
Mike McMullen
Loudoun County High School, 415 Dry Mill Road, Leesburg, VA 20175

The purpose of the project was to highlight potential differences between El Nino, La Nina, and neutral years. Differences in weather patterns between the three scenarios occur from year to year. Each alter steering patterns for major low-pressure systems and the crucial temperature conditions that need to occur so that snow will continue to fall from the upper atmosphere down to the ground. Data was collected from various east coast United States cities, and were associated with the type of year that the precipitation occurred. A t-test was then performed and revealed that the study was inconclusive. A significant difference in totals to show that the type of year affects snowfall totals does not exist. Therefore further study would have to occur. The hypothesis was irrelevant and could still be correct if additional locations were selected. For further study, suggested cities could be further to South and East of Richmond, VA. These areas are affected more by the changes in temperature between El Nino, La Nina, and neutral years.

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
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Mike McMullen 2/16/06
Finalist or Team Leader Signature  Date

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The Effect of Composition on Landslide Tsunamis
Pendola, Aaron
Stone Bridge High School, Ashburn, VA, 20147, USA

The experiment performed was a direct result of speculation done after the tsunami that had devastated Southeast Asia in 2004. After seeing what incredible damage the disaster had done, it seemed necessary to look into future disasters. Upon the discovery of landslide tsunamis, it appeared important to prioritize how much damage each type of landslide can cause and determine what type on measures should be taken to prevent them.

The methodology was simple; different simulated “landslides” were slid into a fishtank containing water and then the height of the wave was recorded. The types of landslides tested included a large rock, gravel, and mud, all standardized in volume with a water displacement method. The results indicated that the single rock delivered the most powerful “tsunami”. In comparison to the other two testing materials, the rock delivered dramatic results, as the gravel and mud gave marginal wave heights. The rock created a mean wave height of 11.3 cm compared to the other subjects with mud at 1.0 cm and gravel at 5.3 cm.

The results indicated that the hypothesis, stating that more dense material would create the highest wave, was supported. However, now that there are multiple sources indicating that dense landslides cause large tsunamis, research is now necessary to detect where and when these landslides may occur. From these results, it is now important to consider more dense landslides as threats from tsunamis toward people and property.

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

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

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   - No

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Finalist or Team Leader Signature
Date

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The Effect of Earthquakes on Different Building Structures
Peruri, Adithya V.
Broad Run High School, 21670 Ashburn Road, Ashburn, Virginia

The purpose of this project was to understand the physics behind the construction of buildings. Research during this project mostly relates to Earth Science and Physical Science. The purpose of this experiment was to see what materials such as wood or masonry would stand erect for a longer period of time while they were shaken. Experimentation was possible by recreating earthquakes and observing buildings.

This project required a device to shake the buildings on top of. Thus a shake table had to be created. To represent real buildings small structures made of sugar cubes and popsicle sticks were used. Then the structure was shook on the shake table. The brand of sugar cubes, popsicle sticks, glue, velcro and the shake speed were all kept the same. As a result of using either popsicle sticks or sugar cubes different data between them was gathered.

After much experimentation the results supported the hypothesis. The hypothesis was that buildings built with wood would stand up longer than those made of sugar cubes. This proves to occur even in nature because of two terms learned through research, elasticity and ductility. These both allow for a structure to go through deformations and bend in various directions before giving away.

By using these findings beneficial information could be applied to the construction of buildings. The main finding is that wood-frame buildings should be used because they are better and provide more time during earthquakes.

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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4. Is this project a continuation? □ Yes □ No

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[Signature]
Finalist or Team Leader Signature 2/17/06
Date

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The Durability of Rocks under Certain Conditions for Safe Activity on Rocks
Anthony T. Santosuosso
Potomac Falls High School, Potomac Falls, Virginia

The purpose of this experiment was to find out which types of rock are most affected by weight and moisture so that the safety of climbing on certain rock could be determined. The procedure used was to select samples of similar size of granite, limestone, dolomite, slate, sandstone, and quartzite. One sample of each type of rock was dry, one was damp, and one was soaked in water. Next, weights were added to each sample. The total amount of weight and the time elapsed until failure of each rock sample was recorded. The independent variable was the amount of moisture applied to each rock. The dependent variable was the strength of the rock and the time it took the rock to failure. The constant was the amount of weight applied to each rock. The conclusion was that granite was the strongest of all of these rocks; the other rocks all broke with less weight when damp than when dry, and less weight when wet than when damp. There was no pattern in the amount of time it took the rocks to break. Future studies might include heavier weights that are more than 350 kg.

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   ☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal DNA
   ☐ ☐

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

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Finalist or Team Leader Signature: [Signature]
Date: 2-23-96

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 Solar Cooking and Refrigeration: "Is It Cold Yet?"
Lindsay M. Schleifer
Harmony Intermediate School, Hamilton, VA

Imagine being able to cook food and refrigerate it in the same appliance! Can a simple solar oven, using the basic science of a "heat sink", work in reverse as a refrigerator? A homemade solar oven, set up exactly as it would be used to cook food, would be the vehicle for this experiment. Sixteen trials would prove whether or not the water inside the canister would achieve a temperature decrease when placed outside under the evening sky.

The starting temperatures of both the water and outdoor air were matched, and the process began. Hourly from 6:30pm to 10:30pm air and water temperatures were checked and recorded. The hypothesis predicted an average temperature decrease of 10 degrees Celsius, but at the conclusion of the trials the average temperature decrease was only 8.8 degrees Celsius.

The fact that the temperature did decrease and the solar oven used the sky, the atmosphere, and the Earth to achieve passive cooling, is a positive scientific result. If such a simple object can use nature’s energy in this fashion, then the possibilities for major advances in "heat sink" technology are endless. In a world where sources of energy are depleted every day, experiments such as this open the door to a healthier planet.

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

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

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Lindsay Schleifer
Finalist or Team Leader Signature
2/22/06

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 Depth of Water and the Speed of a Tsunami
Thomas Slothouber
Heritage High School, Leesburg VA, USA

Waves and Tsunamis are one of the most powerful forces on the Earth. Finding out more about these natural occurrences can greatly increase our understanding of the world around us. As such, these occurrences can have devastating effects if not studied. For instance, the tsunami in December of 2004 killed thousands of people.

The experiment done requires a tank. The tank is built long and high, but with little width. This is to measure in 2 dimensions. A wave is created using a pneumatic pump at one end of the tank. A sensor detects the wave at one end, and another will detect it at the other end. The two sensors send a signal to a computer that starts a timer at the first sensor, and stops the timer at the second. Then this time is recorded, and the depth is raised by 3 centimeters.

The findings of the experiment showed that as the depth of the water increased, the time decreased, meaning it gets faster. As the depth rises by three centimeters the time decreased by 0.2 seconds approximately. These results support the hypothesis that the speed of the wave is relative to its depth.

Although this was the result, it could have been conducted on a larger scale. At a max of twenty-two centimeters, the data may not be considered relevant, because the ocean is a great deal deeper and does not have a flat surface. An experiment on a larger scale could help support this data.

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
   □ Yes

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

4. Is this project a continuation? □ Yes □ No
   □ No

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ Yes □ No
   □ 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.

Thomas Slothouber 2-23-06
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.
Track Fields: Testing the Legibility of Materials and Their Ability to Preserve Animal Tracks
Sarah E. Talbot
Loudoun County High School, 414 Dry Mill Rd., Leesburg, VA, 20175, USA

This experiment tested legibility of animal tracks in different materials. It was designed to
address a hypothesis by setting up separate track fields with different combinations of
materials in each field. Materials included were water, soil, sand, sawdust, and flour.
After Trial 1 was performed, the hypothesis was supported with a combination of soil and
sand showing the best track results. After the first night, there was substantial activity in
and around each of the track fields, but there were no significantly clear animal prints.
According to the shape of the prints of the animals who had come to retrieve the bait
(which was corn), deer were the majority. To help attain more organized or clear animal
prints, water was added to each of the track fields the second time the experiment was
performed (Trial 2). To carry out this experiment, eight track fields (with different
combinations of materials in each) were set out in a wooded lot. Each of the fields was
one subtrial, summing up to eight subtrials in all. (The experiment was performed twice,
which equals sixteen subtrials.) After Trial 2 was performed it was apparent that the
hypothesis had not been fully supported. Instead of the combination of soil and sand
(with water), showing the best results, track field eight, which consisted of the
combination of sand and water, yielded the best results. Because of the results in both
Trials 1 and 2, it can be inferred that sand was the material that preserved the best prints.
Although the track fields were left messy and somewhat destroyed after both trials, each
field was rated on a scale of one to ten (one being the worst and ten the best) for each
trial. These ratings are presented on a bar graph. This experiment shows which of the
chosen materials was the most effective for track fields.

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

5. My display board includes photographs/visual depictions of humans (other
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I/We also attest that the above properly reflects my/our own work.

Sarah Talbot  2015.08.09
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 Effect of Large Explosive Tropical Volcanic Eruptions on the Number and Intensity of North Atlantic Hurricanes 1851 to 2004
Tippett, Michael
Stone Bridge High School, Ashburn, VA, 20147, USA

Large explosive volcanic eruptions inject sulfur dioxide into the stratosphere which becomes sulfate aerosols. The sulfate aerosols cause global cooling by reflecting sunlight back into space. The purpose of this project is to determine if there was a correlation between global cooling caused by sulfate aerosols and the number and intensity of hurricanes in the North Atlantic basin.

Data on large volcanic eruptions and North Atlantic hurricanes from 1851 to 2004 was collected and recorded in tables. The independent variable was a large volcanic eruption located between 25°N and 25°S with a Volcanic Explosivity Index of four or greater. The dependent variables were the number of hurricanes and the intensity of major hurricanes in the North Atlantic. Data on hurricanes was recorded for two seasons after the volcanic eruption. The number of hurricanes was counted for each year. The intensity was calculated for each year by adding all the Saffir Simpson Category ratings (3,4,5) for major hurricanes.

A data analysis showed no statistically significant difference between the control group and the first or second hurricane season after an eruption for either the number or intensity of hurricanes.

The hypothesis, if a large explosive tropical volcanic eruption occurs that injects sulfur dioxide gas into the stratosphere, then there will be fewer and less intense North Atlantic hurricanes the following hurricane season, was not supported.

Further research should include the amount of sulfur dioxide injected into the stratosphere in the criteria for the independent variable and should test several hurricane seasons.

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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

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Michael Tippett
Finalist or Team Leader Signature

2/22/16
Date

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Rapid Impact Compaction, Deep Dynamic Compaction and pre-loading techniques were tested to find the best technique to increase the bearing pressure of weak soils that are found in Loudoun County. The hypothesis stated that the technique of Rapid Impact Compaction would give the best results while trying to improve the soil matrix, which was supported by the data. This was supported by following a procedure that applied the same amount of energy to each test area. To keep the energy the same the RIC test had a small weight of 2.25 kg that was hit 40 times from four centimeters high. Deep Dynamic Compaction used a large weight of 3 kg and was dropped from a height of 120 centimeters, while a larger weight of 71.8 kg was applied for 5 days on the test area for preloading. These results would help to find the deformation and improvement of the soil. To find the deformation of the newly tested area, the difference in the two depths were taken. Next the DCP test was performed to see how much the soil had improved overall. A DCP test counts the number of hits it took to reach a certain point. The average depth of the RIC was about 6.198 cm; the average depth of DDC was around 4.274 cm, and the average depth for preloading was around 1.776 cm. In all of the DCP tests the RIC always seemed to improve better than the rest, especially in deeper amounts of soil. Expanding on this test would include a vast area of land and more precision when it came to the amount of energy for each test.

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

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

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Chelsea Verdin
Feb. 8th, 2000

Finalist or Team Leader Signature

Date

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## 700 Engineering

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The Relationship Between the Water Resistances of Household Products and the Water Resistances of Store Bought Water Sealers
Erica L. Absetz
Freedom High School, South Riding, VA, United States

Due to the recent tragedy in New Orleans, the idea for this experiment was born. The purpose was to test which products protect wood the best when exposed to water for a long period of time. The project helps to find the best water sealer while it compares household products to store bought products to find the optimum water sealer.

The study was conducted by selecting six water resistant products, applying them to 15 wood samples, and then submerging them under water for three weeks. The independent variables in this experiment were Danish Oil, Minwax Finish, Olympic Varnish, Johnson's Wax, Pledge, and Paraffin Wax. The dependent variable was the amount of water absorbed. This was measured by the difference between the original weight of the wood taken from the weight after they were submerged.

The data is quantitative ratio. The average percent of weight gained by household products was 74.95%. The average percent of weight gained by store bought products was 76.81%.

The information shows that the household products are more effective than the store bought products. The control had an average percentage of change 70.2%. The Paraffin Wax (44.19%) and the Danish Oil (66.33%) were more water resistant than the control. The other four products soaked up more water than the control.

Would the data be more accurate if the testing took place in a shorter time span? Would the results have been different if the containers had been in a location with a constant temperature?

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ 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.

Erica Absetz 21 Feb. 2006
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.
How does the size of the grains of sand used to make a brick affect its strength?
Nelab H Beria
Potomac Falls Highschool, Sterling, Virginia

Bricks are used everyday in construction and the stronger the better. Testing the strength of the brick is important for the engineering in bricks. They come in many different shapes and sizes but the strength of the brick is greatly affected by the size of grains of sand used to make the brick.

Engineering is used to make a more productive brick. The independent variable is the sizes of grains of sand used to make each brick. The dependant variable is the strength of the brick. Six of each kind of brick is made with three distinct sizes of sand, portland cement, and water. The bricks are set to dry for a week. They are tested by being dropped from a height of 2 meters. The number of pieces broken off determine the strength of the brick.

The bricks made with the largest grain size of sand had fewer pieces broken off than the other two types of bricks. The fewer pieces broken, the stronger the stronger the brick.

The hypothesis was supported by the data. The bricks made with the larger grain size of sand were the stronger bricks. The data shows that the brick made with the largest grain size of sand had the least number of pieces broken off making it the strongest.

What else affects the size of bricks? Does the temperature of where the bricks were dried affect the strength of bricks?

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Nelab Beria

Finalist or Team Leader Signature: Nelab Beria
Date: 2/24/06

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 Structure Design on Bearable Weight
Boysen, Samuel K.
Stone Bridge H.S., Ashburn, VA 20147, USA

This project, in its present form, is the result of strength experimentation on different structures. The goal was to find which structure, a standard 16" stud spacing made from balsa wood or a kingpost design also made of balsa wood, would hold more weight. The Kingpost design is not normally used on load bearing walls, primarily due to the fact that it is a Truss structure design (a bridge design that uses trusses for support). This experiment also tried to see if truss and other bridge designs could be applied to a building’s structure to add more stability and strength.

These variables were tested by constructing two different structures identical in size and other constants. The outer walls (load bearing walls) were the independent variable, changing only in design. The structures were put under a strength test that determined the maximum amount of weight each structure could endure before breaking. The results were remarkable.

The Kingpost design by far held more weight than the standard 16" stud spacing. An outstanding 31% more stable than the design used in today’s home, the results from this experiment suggest that bridge design can be applied to home making to achieve a stronger, safer building. However, applying these advancements to modern homes would cost more money and add to the time needed to complete a house. In time, if applied correctly, this technology will decrease the amount of deaths and destruction caused by a building’s failure to endure all the forces acting upon it.

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. X Yes □ No

3. This project was conducted at a Registered Research Institution. □ Yes X No

4. Is this project a continuation? □ Yes X No

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Signature
Date

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Does Light Effect a Fuel Cell
Zach Buckley
Park View High School, Sterling Virginia, United States

An electrolyzer separates the elements in water; this, along with the help of a solar panel and a fuel cell, allows for the production of electricity. However the fact that a solar panel is present allows for the question, does the time of day affect the amount of power produced.

To test this possibility I set up this system, got it to start working and then took measurement of the power input (solar panel) and power output (fuel cell), every half hour. The fuel cell, electrolyzer and solar panel can all be purchased, or built by hand; I built all but the fuel cell.

Due to a lack of power in the early morning, for about one hour prior to the experiment it may be better to use a bright light for a light source, this would allow the tubing connecting the fuel cell to the electrolyzer to produce an adequate amount of pressure to move hydrogen through to the fuel cell.

The end results produced little correlation between the input and output power readings, however the graph did display more power being produced after noon, which is very predictable as the sun is directly above the fuel cell at that time.

The results didn't support the hypothesis as much as the time of day, and in effect the amount of sunlight available, had very little effect on the overall power produced. An expansion would be further tests designed to go multiple days to test the effect of different seasons.

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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

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4. Is this project a continuation? □ Yes □ No

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Zack Buckley
Finalist or Team Leader Signature 2/21/06

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A Resonance Wave Tank Design That Enables Low Cost Prototype Testing of Oscillating Wave Generators
Case, Nathan
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The effectiveness of using a small scale resonant wave tank as a test bed for wave generator performance testing was investigated. As an alternative to high cost, limited availability large scale wave tank facilities, a small scale inexpensive test bed may help advance ocean wave generator development efforts. For this project, a dry test bed was built to characterize the voltage output profile of a magnetic induction generator under controlled sinusoidal motion, comparable to deep water ocean waves. A wet tank designed to promote wave resonance was then constructed and the same generator was adapted to function with the wet tank. The wave period of the wet test tank was approximately 1 Hz, so this was the frequency used in the dry tests. A typical test run was 120 seconds; therefore approximately 120 individual waves were generated for each test run. Data sets for equivalent wave displacements were collected and the results were compared to see if they were sufficiently similar to each other to support the hypothesis. The results of the comparative analysis support the hypothesis that oscillating wave generator designs can be successfully test validated using a small scale resonance wave tank. Several key aspects of the collected data were analyzed: average generator output - a measure of the integrated output of the generator over multiple wave periods; also maximum, minimum, average and standard deviation of the peak amplitudes from each individual wave in a test run. These last four parameters were considered a measure of the stability/variability within a test run. When the frequency and displacement for both the wet and dry tests were comparable, all of the above mentioned values for each test were within 10% of each other. The standard deviation of the peak amplitudes for the dry test was 2% of average; for the wet test it was 6% of average. While the wet test experienced more variability than the dry test, it still produced relatively stable wave behavior, which is critical to the utility of this type of testing.

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

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

[Signature]
Finalist or Team Leader Signature

Date

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Dancing Away: The effect of pointe shoe hardeners on the durability of the shoe
Caslin, Heather L
Loudoun Valley High School 340 N. Maple Avenue Purcellville, VA

Pointe shoes are expensive. Especially if you dance all day every day and go through pairs very quickly. That can add up to a lot of money. This experiment was designed to find the most efficient way to increase the life of pointe shoes which could get a dancer through those few extra rehearsals.

To increase the durability, Shellac, Future Floor Wax, and Jet Glue were tested for hardness. Each of the hardeners was put on one pair of shoes and the shoes were worn for a specific dance sequence. They were then assessed for their strength. The process of dancing and assessing was repeated for a total of 3 times per pair of shoes.

My results determined that shellac was the weakest hardener. It barely increased the strength. Future Floor Wax came in second place, but after drying originally, it was the hardest. Jet Glue hardened the shoes the most.

The hypothesis was disproved when Jet Glue was concluded to have the best results. For a quick fix that’s a one time thing, Future would harden the shoe the best for that circumstance. Jet Glue is most effective for multiple rehearsals and classes.

Further research that could be conducted includes using more shoe types and assessing with more trials to be sure that the results were accurate. Another alternative would be to put the hardeners on brand new shoes to see if over-time they would last longer.

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

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Heather L Caslin 2-7-06

Finalist or Team Leader Signature Date

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The Effect of the Ring Maille Weave on the Length of the Penetration of a Bolt
Chew, Collin
Stone Bridge H.S., Ashburn, VA 20147, USA

The purpose of this experiment was to see if a crossbow bolt could pierce ring maille, one of the types of medieval armour. The experiment tested two weave types of the ring maille. They were chosen because they were radically different in their style. Their style was the position of the rings, being vertical or horizontal.

The independent variables were two weave types, the European 4-1 weave style and the Japanese 6-1 weave style. The dependent variable was how much the bolt pierced the ring maille. The ring maille was set up upon nails on a wooden board. This board was set up upon a styrofoam target. Then, a crossbow, 6.4 meters away, was fired at the ring maille. When the ring maille was hit, the penetration length was measured (mm) and recorded.

The major finding of the project was the fact that the European 4-1 weave style was never penetrated while the Japanese 6-1 weave style was. Also, the bolts would always rebound from the ring maille, except for 5 times, hitting the Japanese 6-1 weave style.

The results supported the experimental hypothesis and enabled the ability to attain the objective, learning if the crossbow bolt could pierce the types of ring maille. A bolt was able to pierce the Japanese 6-1 weave much more because of its weave style. The vertical rings would deflect a sword blow better than a bolt. Knowledge was also gained from doing the experiment, and it could be applied to continuing the project.

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 ☐ Yes ☐ No

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

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Finalist or Team Leader Signature: [Signature]
Date: 2/22/06

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The Quality of Photographs When Taken Under Certain Light Sources
Bradley G. Jamison
Freedom High School, South Riding, Virginia

The light in which photographs are taken can cause a different appearance in color when comparing the photograph to the actual object. The purpose of the experiment conducted was to determine the effects that certain common light sources had on the hue and saturation of certain colors in a digital photograph. The information obtained from the experiment should help people create better quality photographs by allowing them to change light sources when possible.

In order to conduct the experiment, a standard Kodak color chart was placed under direct light of each light source being measured, with all other light sources blocked out. This was done to ensure that the controlled light source would have the solitary effect upon the photograph. After the photographs were taken, they were loaded onto a computer and the hue and saturation from four colors, red, yellow, white, and blue, in each picture were measured through the use of the Photoshop program. The outcome of the experiment showed that some light sources favored certain colors. The color blue was best supported by the cool white fluorescent bulbs, red and yellow appeared best with the use of a camera flash, and white was represented best under the lighting of a halogen light bulb.

Although the findings did not support my hypothesis that sunlit photographs would best represent the colors, they did indicate that different light sources created different effects on digital photographs and that some sources better represented certain colors. Because of the fact that measurements taken of white in the photographs widely varied, even for just one light source, a question brought up from the experiment was how much of a difference using a cameras white balance settings would make compared to pictures taken without any correction settings turned on.

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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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ 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.

Bradley Jamison 01/30/06
Finalist or Team Leader Signature Date

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The Effect of Different Types of Wood on Water Absorbency
Amanda Khalil
Briar Woods High School Ashburn, VA

The idea of constructing an outdoor deck may be tedious, but choosing the right wood is important. This experiment was designed to determine which type of wood, out of four different kinds, was capable of absorbing the least amount of water. The results of these tests showed which type of wood can withstand rainfall the most.

The amount of water that was absorbed was discovered by allowing each wood to soak in water for three days and then measuring the leftover water with a graduated cylinder. The independent variable was the different types of wood being utilized which included cedar, oak, redwood, and pine. The dependent variable was the amount of water being absorbed. All four wood pieces were the same size.

As a result of the experiment, cedar absorbed the most water at about 177.2 milliliters, thus concluding it would not be the greatest for building decks. However, oak was revealed to be the best for deck use, considering it only absorbed about 128.4 milliliters of water. Furthermore, evaporation did not affect the outcome of this experiment because each wood was covered during the tests.

This experiment supported the hypothesis that oak would absorb the least amount of water over a period of three days. It can be concluded that oak would resist rainfall the most, allowing the deck to last longer and better defend against damage.

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Amanda Khalil
Finalist or Team Leader Signature
2-22-06
Date

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Converting Analog to Digital
Jasmine Khan
Park View High School, Sterling, VA. United States

The purpose of this experiment was to study the relationship between the increase and decrease of resistance in comparison to the increase or decrease of power output.

Five resistors, each of a different resistance, were connected to a seven-segment display. Tested in a series of fifteen trials, each resistor was connected to a 9-voltage battery power source, from which they received power. This power, regulated by the resistor, then flowed through a system of wires, both upon the breadboard and those consisting in the infrastructure of the breadboard, to the LEDs of the seven-segment display. Depending on the independent variable, the resistance of the resistor, the dependent variable, the lighting of the LEDs, which constitute the seven-segment display, would either light or not light. The result of this experiment did not fluctuate, which was as expected. Prior to the testing, it was already assumed by a general statement of resistance, stating that the higher the resistance, the lower the power, and the lower the resistance the higher the power.

The conduction of this experiment concluded that the assumed general statement and hypothesis was correct. As the resistance increased, the power decreased beyond the sufficient amount needed to light the LEDs. In the opposite case, as resistance decreased, the power increased beyond the necessary, creating an overflow of power inadequate amount needed to light the LEDs. All other resistors, other than the resistor predetermined as the required amount of resistance, failed completely in lighting the seven-segment display.

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Signature: [Signature]
Date: 2-21-06

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Different Sandbag Interior Substances On Efficiency Of Floodwater Blockage In Sandbags
Jenny L. Kim
Freedom High School, South Riding, VA

The project conducted in its present form is the result of an experiment to test different sandbag interior substances (sand, plant soil, coarse gravel, and fine gravel) on the effectiveness of water blockage in sandbags. The hypothesis stated that if different sandbag interior substances (sand, plant soil, coarse gravel, and fine gravel) were used to block floodwater from leaking in sandbags, then sand would most efficiently block floodwater in sandbags.

To begin with, 45 bags of each interior substance and a flood table were constructed. Bags in groups of 3 were placed onto the flood table in a pyramid formation and 1L of water was run through the flood table for 25 seconds. All excess leaking water was caught underneath the flood table with a bucket and measured with a mL beaker. The data for each trial of each interior substance was compared to determine which interior substance most effectively blocked flood water in the sandbags.

Sand had the least amount of water that leaked through. Then was plant soil following, then coarse gravel, and lastly, fine gravel.

The efficiency in which each substance blocked water was determined by the amount of water that leaked from each trial. During this experiment, percolation was being looked for. Percolation is to cause a liquid to pass through a porous substance. Sand blocked water the most efficiently because sand has the least percolation, therefore the substance that blocked water the most effectively was sand. The hypothesis stated was accepted after the experiment.

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[Signature]
Finalist or Team Leader Signature

[Date]
Date

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The Strength of Concrete
Bennett C. Layman
Heritage High School, Leesburg, Virginia

The purpose of this experiment was to analyze how different aggregates in a concrete mix change the strength of the concrete. To begin, the concrete was mixed and different field tests were conducted. These tests included finding the temperature, the slump, which determines the workability of the concrete, and air content, to make sure that there are no air bubbles in the concrete that could change the properties of it. The concrete was poured into a standard sized 10.16cm X 20.32cm plastic cylinder. The cylinders were placed in a curing room, which is a wet room at 100% humidity and kept between 21.1 degrees C and 32.2 degrees C. The cylinders were later broken with a compression machine at 7, 14, and 28 days.

Data showed that while all but one mix were weaker than the control, none of them were far from the control mean. The strength of the mix containing only sand and no aggregate was far below the strength of the gravel mix. However, the beach pebble mix was stronger than the standard mix. The other aggregates were near the standard level, but below.

The conclusions are that while the strength of gravel can be exceeded, it is still the best aggregate for strength. The aggregate that defeated the gravel was very close to the same texture, which is why gravel is superior.
Effects of Different Soccer Shoes on the Ratio of Shots on Target
Jackie Lokie
Loudoun Valley High School, Purcellville, VA, United States

The Project "Shoes for Shots" is an experiment that was done to determine which type of soccer shoe would work best under certain conditions, such as shooting outside, and give the shooter the best number of shots on target. There is such a wide selection of soccer shoes today that it can become overwhelming to try to figure out which shoes work best where. This experiment shows someone buying shoes how cleats, turf shoes, and indoor shoes all test outside on an average field. The hypothesis stated, if a player uses an outdoor fitted soccer cleat, the he/she will have a better ratio of shots on target. This ended up being correct for the conditions in which the experiment was conducted. To test this, a bright cone was set into a regulation High School-sized goal. The ball was then placed on the penalty mark or 9.14 meters straight from the middle if there was no mark. The shooter then took 10 shots wearing each type of shoe and aimed for the cone. The number of times that the cone was hit in each different shoe was recorded over 10. As a result the hypothesis was supported and the fitted soccer cleat worked best in these conditions. Research was also done to explain why this would have been the best shoe and in doing this, the advantages and disadvantages of the other two shoes were also discovered. So not only did one learn that the cleat worked best in this case, but one can see where the other shoes would have been the choice to make.

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☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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

Jackie Lokie
Finalist or Team Leader Signature
1/24/06

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The Hot Airfoil
Austin J Lutz
Briar Woods High School, Ashburn VA

This project was used to figure whether or not heating an airfoil would decrease the amount of lift produced.

A special wind tunnel with a rig that measures lift with the strength of an electrical current was used in this experiment. The strength of the electric current was affected by how much pull the airfoil gave to the peg. The airfoil was placed in the wind tunnel and flown at a speed of 7 meters per second at 20 degrees Celsius. Then the airfoil was placed in a small toaster oven and heated to 37 degrees Celsius and run through the same wind tunnel at the same speed.

When the airfoil was heated to 37 degrees Celsius, the amount of lift produced was decreased by an average of 2 grams.

With the degrees of freedom of 28 and a probability of .05 the table value was 2.048, which my results needed to be lower than. They had a t-test number of -5.0043 that proved my results were statistically significant. The results of this project supported the hypothesis that heating the airfoil would decrease lift. The first explanation for why the lift decreased was that when the airfoil was heated, it warmed the air touching it, making it less dense. Upon further investigation, it was determined that it might have actually been the deformation of the airfoil once it was heated that decreased lift.

This raises even further question. Would more structural support have decreased or stopped this effect?

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Finalist or Team Leader Signature: Austin Lutz
Date: 2/17/06

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The Effects of Different Building Materials and Construction Techniques of Interior Walls on Sound Attenuation
Lyon, Wesley W.
Broad Run High School, Ashburn, VA

This project is the result of sound attenuation experimentation on the effects of different building materials and construction techniques on interior walls. The idea was to determine the most effective way to reduce sound transmission through interior walls.

The effectiveness of each building material was determined measuring the decibel levels. A digital sound level meter was used to determine the decibel levels of each material. Each recorded decibel level was the average reading within a time period of twenty seconds.

The results showed that placing two sheets of drywall on one side with one sheet on the other side is the most effective way to attenuate sound. This is surprising because there was no insulation involved. Insulation is supposed to reduce the sound transmissions through the wall. These results did not support my hypothesis and require further investigation. The materials that are said to be the most effective by contractors were actually the least effective. The results showed that buying insulation for interior walls is not worth it because the walls with no insulation attenuate sound more.

Many contractors use insulation to stop sound from traveling through walls. The fiberglass insulation was found to be the least effective at attenuating sound. Further research is required to find out why fiberglass insulation is used in homes.

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   X Yes

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   X No

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   □ Yes □ No

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

Wesley Lyon
Finalist or Team Leader Signature 2/17/06

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Enhanced Maneuverability of Rocket Torpedoes Using a Porous Plate Skin Design

Robert F. Minehart III
Dominion High School, Sterling, VA, USA

This is a fourth year continuation project that has identified a unique design to enhance the maneuverability of a rocket torpedo using a porous plate wall. The first year demonstrated that drag could be reduced by supercavitation. The second year demonstrated that a shock wave could force envelope closure. The third year research demonstrated that micro-foils improve lateral stability. This research identified the ratio of gas ejected through a porous plate wall vs. the tip of the torpedo as a function of turning angle.

A model was mounted in a water tunnel using a dual tube fixture that served as both a structural support and a means for delivering separate gas supplies. Airflow was measured using two identical Venturi flowmeters. Gas flowrate was controlled using separate throttle valves. The volume of air ejected via the tip and porous wall were recorded for various turning angles from (0 to 45 degrees) in 5 degree increments. The turning angle was measured using a protractor.

It was determined that the ratio of gas ejected via the porous plate to gas ejected via the tip was 6.22 Sin (Θ) where Θ represents the turning angle. The hypothesis that a supercavitation envelope could be maintained through extreme maneuvers, and that an ejection ratio could be identified, was supported by the data. Torpedoes using a porous plate wall design can resist envelope closure during extreme maneuvers. These findings also have broader application to the field of fluid mechanics.

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   - [ ] non-human vertebrate animals  
   - [ ] controlled substances  
   - [ ] recombinant DNA  
   - [x] human/animal tissue

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   - [ ] No

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   - [x] Yes  
   - [ ] No

4. Is this project a continuation?  
   - [x] Yes  
   - [ ] No

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   - [ ] Yes  
   - [x] No

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[Signature]  
Finalist or Team Leader Signature  
2-21-05  
Date

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Magnets and electromagnets are becoming increasingly applied to create new technology. This project was meant to show how electromagnetics work and to apply them to transportation. When this project was over the final product would mimic a miniature maglev or bullet train. A track with the electromagnets on it would repel a "vehicle" with static magnets attached to it. After this idea initially failed the idea was modified multiple times until it worked. The hypothesis stated if a strong enough magnetic field was produced electronically then a repelling static magnet would be able to fight the force of gravity and glide along the length of the track. This was not supported after many variations on the original idea and, instead, the strongest magnetic field was generated by highly polarized static magnets spaced along the length of the track. To correct for that problem if attempted in the future, static magnets should be used and the design of the vehicle would be the independent variable and not the track design.

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[Signature]

Finalist or Team Leader Signature  02/08/06

Date

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Why do rock climbers trust the nylon fiber with their lives? I tested nylon and four other rope fibers; polypropylene, sisal (hemp), manila (natural), and cotton; to see which could hold the greatest amount of weight. Eighteen inch pieces with 0.025 diameters were tied to a bucket handle and then suspended from a metal text fixture. First each fiber was tested once for a range weight using fixed weights of three and four pounds to secure a minimum and maximum break weight. Then each fiber would be tested again by adding the minimum break weight then lead shot until the fiber broke, giving us the actual break weight of the fiber.

After testing all the fiber in five trials, as predicted nylon proved to be the strongest with an average break weight of 13,200 grams and cotton the weakest with an average break weight of 3,500 grams, and polypropylene in second, manila in third, and sisal in fourth. Overall nylon was proved to be the strongest as expected proving why it is used in climbing ropes.

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Caitlin Reeves 2/10/05
Finalist or Team Leader Signature Date

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Running Time of Small Engines Using Different Fuel Types
John D. Rodeffer
Loudoun Valley High School, Purcellville, Virginia

The purpose of this experiment is to show how long a small engine will run, using different fuel types. Results could be used to find the most effective and efficient way to power a small engine using different fuels. It could also be used to show the cheapest way to buy the best kind of fuel. This could be used to save money, a useful trick for companies frequently using small engines.

To find the fuel efficiency I filled a small engine gas tank with 20 ccs of 87, 89, or 93 octane gasoline. I ran each fuel type 16 times and recorded the results. I also recorded factors such as temperature, weather, barometric pressure, and humidity. This would help show if outside factors could play a part in engine running times. To record the engine running times I used a watch to measure the time the engine ran.

To find the data I recorded the results and put them in charts to show and compare all results of that particular fuel type. I also created graphs to show the effects of outside factors, such as weather, on the running time.

After gathering data and recording results I have come to the conclusion that while 93 octane ran the longest, it wasn’t much ahead of 89 and 87, but the price was. This shows that even though it was the longest lasting, it was not the most efficient, which is what the experiment was intended to find. In conclusion, The most efficient fuel type would be 89 octane, as it was not much more expensive than 87, but ran longer, and was much cheaper than 93, but didn’t run much shorter.

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[Signature]

Finalist or Team Leader Signature Date

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"I See You"
Michael L. Ryan
Loudoun Valley High School, Purcellville VA, United States of America

The photocell is a variable resistor that responds to light, the more light that shines into it, the less resistance there is from the photocell. Data was collected with the intention of finding trends in the data graphs. The experiment was done by setting up the eye and reading what each cell sees on the "Black Level". The photocells were read in the same order every time. From a back view, the photocell in the top left corner is photocell "0" and the one in the bottom right is photocell "15". Then, a piece of white paper was placed in front of the eye at the same distance to read what each cell sees at the "White Level". This gives the range that each reading should be. The readings of each photocell should be no more than the white level, but no less than the black level. The final results were obtained by taking the photocell reading then expressing this value as a percentage of the photocell range. This is called a data filter. White level Black level=range. Reading-Black Level=cell value. 100/Range=value/increment. Cell value*value/increment=photocell percentage. Every photocell reads differently but by making the results a percentage of the original voltage, one can supposedly reduce those variable readings.

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

Michael Ryan
Finalist or Team Leader Signature

4/24/06
Date

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Comparison of Stationary and Rotating Solar Panel Designs
Sawtelle, Renee H.
Loudoun County High School, Leesburg, VA

As the population increases and countries industrialize, energy demands increase. Continuing fossil fuels usage will increase pollution and global warming. Using solar panels will reduce these and other problems, since they use no fuel, create no emissions, and require minimal maintenance. This project's purpose was to design a solar panel that would show increased productivity, while still maintaining simplicity, cost efficiency, and minimal running power.

This project compared the efficiency of two panel designs: a stationary panel and a panel that would make one rotation once a day, so it will always face the sun. A simulation was used to test these two panels. A spotlight was run across a metal semicircle to recreate sunlight. Angles of the sun in the sky and above the horizon were used to simulate sunlight in Loudoun County. Data was then collected for every hour of sunlight for the first day in each month. This simulation was run twice for both the rotating and stationary panels, and data was measured in volts and milliamps.

A Paired-t Test was conducted for both the volt and the milliamp data. The rotating panel will create between 0.91 and 1.02 more milliamps and between 0.61 and 0.73 more volts than the stationary panel for 95% of the data. The rotating panel creates significantly more energy than the stationary panel, which supports the hypothesis. The energy it would take to run the rotating panel was not taken into account. However, this should be a relatively small number.

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The Effects of Heat and Cold on Battery Life
Alexei Shaporenko
21670 Ashburn Road
Ashburn, Virginia 20147

It is known that temperature affects battery cycle life. This experiment tested what affects battery life more, heat or cold. This project is the result of experimentation with regular alkaline batteries under different temperature conditions.

This project required the construction of electric circuits, which included a regular alkaline battery, a light bulb as a battery load, and a switch. To speed up the testing process, three circuits of the above configuration were assembled on a single test board, so that three batteries could be tested at the same time. The effects of temperature on battery life were determined by placing batteries under three different temperature conditions: -15°C, 22°C, and 40°C. To get accurate results, each set of batteries was placed in each temperature condition for 20 minutes prior to the start of the experiment so that the batteries could reach the desired test temperature. Periodically, measurement of the voltage took place until the battery charge decreased from 1.5 V to 1.0 V. The dependent variable in this experiment was the battery life and the independent variable was the temperature applied to the batteries.

This experiment shows that cold decreases battery life faster than heat does. Under the same load, the batteries of the same type showed a faster speed of discharge in cold conditions compared to higher temperatures.

This project's results help people understand how battery life is affected under different temperature conditions. The hypothesis that was established at the beginning of the experiment was disproved by the test results.

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   ☐ 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

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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.

A. Shaporenko
Finalist or Team Leader Signature
Date 2/17/06

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Comparison of the distances that each brand of baseball will fly
Aaron Sweger
Potomac Falls High School 46400 Algonkian Pkwy Sterling, VA 20165

This investigation was completed in order to show that the materials in higher priced baseballs make the balls go farther in distance than those in lower priced baseballs. It also concludes that they are worth paying extra money for. During the experiment, a pitching machine was used to keep the power and the angle that the ball was being projected at, equal. After each ball was shot from the pitching machine, their distances were collected and later averaged together, determining the baseball's average distance traveled after all the trials. The data in the experiment showed that the higher priced baseballs performed better than the lower priced baseballs. The hypothesis, which stated: if the baseball is more expensive, then it will travel farther, was proven true using this experiment.

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Signature: ___________________________ Date: 2-22-06

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The Mulch That Retains the Most Water
Jimmy Adams
Potomac Falls High School, Potomac Falls, VA

This research experiment's purpose was to find which commercially available mulch was the most effective at retaining water. Four different types of mulches were tested by pouring two liters of water into each type. The data collected was the amount of water not absorbed by the mulch.

The data showed that regular hardwood mulch retained the most water. The hypothesis, which stated that the Cypress mulch would retain the most water, was not supported by the data.

However, further research should be done because at the time of the experiment it was raining and even though the testing device was under shelter the air could still have a large amount of moisture. The moisture in the air could have put water into the mulch.

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[Signature]
Finalist or Team Leader Signature

[Date] 2/17/06

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 roads, forest cover, soil, water mobility, and salinity on the algae populations of five different water sources was determined by observing eight samples from each source and recording the exact number of algae cells present. This was to discover what factors may cause an increase or decrease in the algae content of these sources, including what factors could trigger harmful algal blooms. All five factors were considered when choosing the water sources from which to sample. Each of the forty samples was observed using a compound-light microscope. The number of green algae, blue-green algae, and brown algae was recorded. A chi-square test was run for each water source. The degree of freedom was 4, and the total chi-square value was 5.74. This indicates that the difference in the expected algae content and the observed algae content is not significant. Water sources with low mobility yielded higher algal populations, as predicted by the hypothesis. The salt-water samples held a high amount of brown and green algae, but did not have any blue-green algae. Water sources with greater forest cover generally yielded lower populations of green algae while sources with no forest cover had greater amounts of algae. Sources with nearby roads of heavy to moderate traffic showed higher populations of algae than sources with no nearby roads. It was anticipated that the pollution produced by heavy-traffic roads would boost algal populations. Water sources that had rocky soil tended to yield lower populations of algae than the sources with sandy soil or clay. The data collected supported each aspect of the hypothesis in regard to each of the five factors tested.

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Katherine B. Barnes
March 14, 2006
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 project's main purpose was to investigate whether plants can effectively remove contaminants, such as Arsenic, from soil. Arsenic is located in many places that humans use everyday, including pressurized wood in backyards and playground equipment. By planting the plants in contaminated soil and growing them for a few weeks, the amount of contamination was able to be measured in both the plants and the soil.

The pH of the soil was obtained by placing soil from each pot in a beaker and then measuring pH using a pH meter and a pH electrode. Also, nitric acid was used to digest the plants so that they could easily be measured. Many other tools were used to make general observations and to help complete different steps, like a drying oven and a growth chamber.

After the investigation was complete, results consisting of the Soil Arsenic concentration and the pH were able to be observed. The results show that, most importantly, plants can remove the contaminants from soil. Along with this, it was also found out that certain plants can remove more contamination than others, such as in this experiment where the Pteris cretica plants removed more significant amounts than did the Indian mustard. Further experiments of this type would include testing different plants with the soil, adding more contamination to the soil, and also using the same amounts of contamination with the same plants, but using different types of soil.

It can be concluded, therefore, that it is wise to plant plants and ferns to remove contaminants in backyards or in general, contaminated soil. The results supported the hypothesis, and it concluded that, by the process of Phytoremediation, the environment can be "cleaned" in a tremendous way.

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

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Braedon M. Blaylock
Finalist or Team Leader Signature: [Signature]
Date: 1/25/06

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.
Infrared light is part of the electromagnetic spectrum, it is often referred to as thermal radiation because of the heat it emits. Infrared rays are detectable in the visible spectrum even though the rays are not visible because of the emission of heat. Using this characteristic, infrared light is detected by finding the area where the highest temperature is concentrated. This experiment was meant to locate infrared rays in the visible spectrum using the heat emitted in specific parts of the spectrum as a guide.

Infrared rays were detected in this experiment by placing thermometers in the blue, yellow, and past red parts of the spectrum to measure the temperature of each. After the thermometers return to room temperature, repeat the experiment 19 times. The independent variable for the experiment was the location of the thermometers. The dependent variable was the temperature in degrees Celsius of the thermometers.

Using the t-test and calculating the mean, range, variance, standard deviation, and degrees of freedom for the raw data the results showed that the temperature of the light past the red spectrum, where the infrared rays are supposed to be located, was warmer than the other areas. Thus disproving the null hypothesis stating that the area in the spectrum does not affect the temperature of the thermometer in that section. It also proves the hypothesis that if light is separated into the visible spectrum that the infrared rays will be on the red end. The major find was that the infrared rays are located just past the red end of the spectrum.

The results prove the hypothesis, showing that infrared rays are past the red part. the conclusions are in accordance with previous studies by Sir William Herschel. The temperatures just past the red end were the highest and showed the location of the rays on the infrared spectrum. With heat being the signature of infrared rays, finding the location meant determining the hottest area in the visible spectrum.

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□ non-human vertebrate animals □ controlled substances □ human/animal tissue

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

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Caitlin Boulware 2-21-06

Finalist or Team Leader Signature Date

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Controlling the Weather
Jonathan Bryan
Briar Woods High School, Ashburn VA

Influencing the weather is not too out of reach. Controlling it is another story. Humans have always pondered the way weather works. With today's available technology leading scientists have developed ways to control key aspects of what makes up weather. This experiment involved using electromagnetic fields as a makeshift deflector against cold air (i.e. cold fronts). Using 12, 9 and 1.5-volt batteries, a copper length of wire was bound together in a coil and attached. Compressed cool oxygen was then injected into an enclosed environment containing only the coiled wire. Wind direction and temperature measurements in the coils vicinity were measured for each voltage level. The results yielded that the higher the voltage battery it was able to sustain its base temperature (temperature without coolant) better than lower one. At df of 14, the table value was 2.145. Calculated t-test results were: 104.9426 for the 12 volt battery, 59.3349 for the 9 volt, 78.6317 for the 1.5 volt, and 10.3 for the HF radio emitter. Therefore the null hypothesis was rejected but possible complications due to frictional temperature may have occurred.

Wind direction seemed to change as well when the voltage was increased. With the electromagnetic field on, the direction differed from east to west. These findings led to the belief that the electromagnetic field was responsible for a change in both direction and temperature.

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Remediation of Heavy Metal Contaminated Water via a Photobioreactor
Ashley E. Butland
Dominion High School, Sterling, VA

Point-source contamination of water by human activities is perhaps one of the greatest modern-day threats to environmental health. Successful treatment of heavy-metal contaminated waters could have important environmental, wastewater, and superconductor applications. The purpose of this research was to determine whether Scenedesmus quadricauda, a species of green micro-algae, grown in a photobioreactor could effectively remove copper ions from contaminated water. Water contaminated with low, medium, and high levels of copper (concentrations 1.8, 3.3, and 5.0 ppm respectively) was run through a photobioreactor containing the microalgae over a period of 24 hours. Experimental trials were compared against control set-ups and statistical analysis was conducted via a t-test. The null hypothesis stating that the presence of the live algae would have no effect on copper concentration over time was rejected. The water with an initial copper concentration of 1.8 ppm was remediated to 0 ppm; water with an initial concentration of 3.3 ppm was remediated to levels below 1 ppm, and water with initial concentration of 5.0 ppm was remediated to approximately 1 ppm. Data implies that there is a saturation point at which the algae can no long take up copper. Further experiments can be conducted to determine the mechanisms by which the algae capture copper ions.

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(Signature) Ashley Butland  02/17/06

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Water Purity and Specific Gravity
Thomas Christensen
Heritage High School, Leesburg, VA, USA

The purpose of this experiment was to determine which water purification methods were most effective at purifying creek water. Specific gravity was used to monitor the water; the closer the water's specific gravity was to one, the purer the water should have been.

Various purification methods were used to purify samples of creek water. The water purification methods included filtering the water through a piece of cotton cloth, boiling the water, adding bleach to the water, adding iodine to the water, using water purification tablets, and filtering the water with a store-bought filter. After the samples were purified, their specific gravity was measured. The results of this experiment found that adding bleach to water is the most effective way to purify it. However, the results of this experiment varied little and were close to that of the control group.

Since specific gravity was shown to be an unreliable water purity monitor, it is still difficult to say whether the results of this experiment are accurate or not. The hypothesis was not supported by the results. It is interesting to see that the store-bought filter was not as effective at lowering the creek water's specific gravity as one would expect.

The major question that has risen from this experiment is whether specific gravity was the proper measurement to use to monitor water's purity. As stated before, the results of each testing group were very close together, making them inaccurate. Specific gravity also fails to recognize any harmful substances that could still be present in water. In a future experiment, it would be more useful to test water for such substances.

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

Finalist or Team Leader Signature: Thomas Christensen
Date: 2-23-06

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The Effects of Urbanization on Tuscarora Creek
Ian A.R. Claar
Heritage High School, Leesburg, VA

The purpose of this project is to determine what effect urbanization is having on Tuscarora Creek and to get a sense of the health of the creek. Should the quality of the water in the creek be poor in specific criteria as defined by the Loudoun County Soil and Water Conservation District then urbanization is having a negative effect on the creek.

Over a seven month period Tuscarora Creek was tested in three different sites for each of three seasons; summer, autumn, and winter. Twenty-seven (27) tests for phosphates, nitrates, Biochemical Oxygen Demand (BOD), pH, turbidity, and coliform bacteria were performed at each site. Collection and analysis of Benthic Macroinvertebrates were performed at each site. Bank erosion, water odor, and air and water temperature data was collected.

Results from the tests performed suggest that the health of Tuscarora Creek is declining. Specifically nitrate, phosphate, and pH levels were more often negative, with pH levels suggesting a leaching of alkalines. Higher nitrate and phosphate levels seemed to be supported by the observance of algal blooms. The readings for fecal coliform bacteria were consistently positive indicating the water is unsafe to drink.

Any stream testing project is a snap-shot of the health of the water at that moment. The results from this monitoring suggest that the health of Tuscarora Creek may be in jeopardy and warrants further investigation. A long term monitoring project with expanding criteria, controls, and sites would be beneficial to protecting Tuscarora Creek and the local community it serves

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Ian Claar 2/23/06
Finalist or Team Leader Signature Date

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The Relationship Between Different Types of Water Treatments and the Effect on the Environment
Clieit, Meredith
Stone Bridge High School, Ashburn, VA 20147, USA

The environment is fragile; any tampering could have dramatic consequences. For this experiment, the effect of three commonly used water treatments were measured through their effect on the environment. This effect on environment was inferred by measuring height of grass grown.

The hypothesis was if water was filtered through activated charcoal, then that water would have no effect on the environment. This experiment involved collecting water from a local creek and then treating it with activated charcoal filter, chlorine, or boiled water. The pH and hardness were measure before and after treatment. (The pH and hardness indicated chemical characteristics of the creek water.) After two weeks, the height of grass grown with the treated water was measured to determine the effect of the different types of treatments on the environment.

The results of this experiment concluded boiled water had no effect on the rate the grass grew as these plants grew no differently than the control. Chlorine had a negative effect, including killing some of the samples. One cc was added to every two liters of water. Activated charcoal also had a negative effect though not as severe as the chlorine. This shows that a chemical left behind in chemical treatments could affect the environment.

The hypothesis was refuted, because the findings showed that activated charcoal did have an effect. This information concludes that chlorine used in water treatment plants could have a negative effect on the environment when compared to non-filtered creek water.

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Meredith Clieit
Finalist/Team Leader Signature 2/22/06

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THE RELATIONSHIP BETWEEN DISSOLVED OXYGEN LEVELS AND FISH POPULATIONS
Caitrin Dwyer

Broad Run High School, 21670 Ashburn Road, Ashburn, VA USA

This study relates to Biology. The purpose of the experiment was to find the correlation between dissolved oxygen levels in three Ashburn Village lakes to the population of fish in those three lakes.

The concentration of dissolved oxygen in three Ashburn Lakes was measured once in December by the Ashburn Village Parks and Lakes Committee. The researcher also measured the dissolved oxygen in the three lakes but it was cost prohibitive to use an exact meter. The Parks and Lakes Committee also recorded the approximate number of fish in each of the three lakes. The dependent variable was the amount of dissolved oxygen and the independent variable was the population of fish in each Ashburn Village lake. The researcher's hypothesis was that the amount of dissolved oxygen would have a direct affect on the population of fish in each lake.

The results, quantitative descriptive, did support the researcher's hypothesis. In the eight acre Pavilion Lake, the dissolved oxygen was 13.4 parts per million (ppm). The fish population was roughly 8,000. In Cedar Lake the dissolved oxygen was 13.6 (ppm). This lake is almost six acres and has an approximated fish population of 6,000. The last lake, Beech lake is approximately three acres and had a dissolved oxygen count of 13 (ppm). The fish population in Beech Lake was roughly 3,000. The lakes have a healthy level of dissolved oxygen and the fish counts are correctly proportional to the size of the lakes. Therefore, the researcher can conclude that the stable dissolved oxygen levels are partly responsible for the fish populations.

Many other factors can influence the amount of fish in a lake, such as pollution, and the amounts of algae. To conduct a more complete future project, the dissolved oxygen levels could be tested using an accurate meter once a day for fifteen days. Another way to better a future experiment would be to have a control group, perhaps by setting up a fish tank with dissolved oxygen levels corresponding to the levels in the lake.

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   □ 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

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[Signature]
Finalist or Team Leader Signature
Date 2/7/06

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 Levels of Turbidity and the Amounts of Dissolved Oxygen
Nabela Hasan
Harmony Intermediate School, Hamilton, Va 20158

The objective of this experiment was to observe how different levels of turbidity affect the amounts of dissolved oxygen in a given water source. Turbidity is defined as the murkiness of the water due to suspended material. In this study, it was necessary to go and collect samples of water from streams to test the amount of dissolved oxygen in it. A sample of water was collected, capped and then stored for later use. Later, two dissolved oxygen test tabs would be dropped into the sample and shaken until they dissolved. It was then set aside for five minutes to let the test tabs do their job. The independent variable in this experiment was the amount of turbidity in the water; the dependent variable was the amount of dissolved oxygen in the water. In the water samples, two sources had an average of four parts per million as their measurement for dissolved oxygen. Another source had an average of eight parts per million as their amount of dissolved oxygen in them. It was proven that the more turbid the water had a greater average of parts per million.

The results proved that the hypothesis was not supported. It stated that if turbidity levels were increased, then the amount of dissolved oxygen would decrease in a sample of water. The results proved that the more turbid the water, the more dissolved oxygen it contained. This experiment satisfied the question, how does turbidity affect the levels of dissolved oxygen in water.

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Nabela Hasan
Signature 02/23/06

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Bacterial Contamination in Streams Across the Catoctin Watershed
Hiser, Diana
Harmony Intermediate School, Hamilton, VA

This experiment was designed to see how runoff from human septic systems and animal feces runoff compare in contaminating streams in the Catoctin Watershed. Three locations were each chosen from two different streams, one that goes through a more agricultural setting as a measure of animal feces from water runoff, and one that goes through a more suburban setting as a measure of human septic runoff.

For eight straight weeks, water was collected from these six different sites and tested for E. coli bacteria. E. coli was used as an indicator of the health of the water as the professionals in this field use it to determine the health of the streams. The tests used were Coliscan Easygel from Micrology Labs. The simple process is to add 4 ml of water to a bottle of the Coliscan Easygel, put it in one of their pre-treated petri dishes and wait 48 hours at room temperature in order for the enzymes to attach to the bacteria. After two days, they were then examined and the E. coli colonies were counted.

My hypothesis was that the most downstream location on the agricultural stream would have the most bacteria as animals contribute more bacteria to water areas. This was not supported since my results were that this location only had the highest bacteria levels for three of the eight weeks.

Hopefully these results will help as more area in Loudoun County is becoming more populated so that the proper measure will be taken to keep our streams healthy.

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Diana Hiser 2-22-06
Finalist or Team Leader Signature Date

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The Effect of Timed-Released Fertilizer Versus Immediate-Release Fertilizer on the Environment
Horin, Emily M.
Stone Bridge High School, Ashburn, VA 20147, USA

Nitrogen and phosphorus are chemicals found in many lawn care products and essential nutrients in the environment. When water run-off leaves the soil and enters the water systems, it carries nitrogen and phosphorus with it. Nitrogen and phosphorus increases underwater life though nitrification. However, when nitrate and phosphate levels become too high, so much algae grows that it actually suffocates underwater life and has a chain effect on the entire ecosystem. If the water runoff from immediate-release and timed-release fertilizer were tested, then timed-fertilizer would be better for the environment.

Timed-release and immediate-release fertilizer contains different amounts of nitrates and phosphates and at what rate they are put into the water. By testing water run-off from plants with different fertilizers, results showed the nitrogen and phosphorus levels of immediate-release fertilizer were far higher after day one of testing than that of timed-release. However, on days five and ten, the results were opposite. The results showed the significance of timed-release, immediate-release, and control.

The hypothesis was accepted because the immediate-release fertilizer had statistical differences from the timed-release fertilizer. Therefore, the null was rejected. The nitrate levels of the immediate-release fertilizer were lower on days five and ten than the timed-release, unlike day one. There was no statistical difference in phosphate levels. The recommended fertilizer would be immediate-release because it has lower overall nitrates. With more money and time available, further conclusions could find the total effects over several months, concluding the best fertilizer for lawn care use.

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   Yes □ No

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Emily Horin
Finalist or Team Leader Signature
2/22/06

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The Effect of Water Pollution on Aquatic Plants
Sravya Kambalapally
Brair Woods High School, Ashburn, VA

This project is to show the everyday effects of pollution. Using vinegar as a substitute for acid rain, and plant fertilizer as run-off materials, the plants being grown in the "pollution" showed great results. To substantiate, the T-Test was used as a measure; the T-value for the plant fertilizer was 2.2108 and 6.2432 for the vinegar.

For the experiment, some plants were grown in 2ml of vinegar contaminated water, and others in 2ml of liquid plant fertilizer. To compare results, some plants were grown with unpolluted water and these were used as the control group to study the effects of the pollutants. When compared to the control group plants, the vinegar plants died immediately, and the fertilized plants grew darker and in an abnormal way.

Over a period of two weeks, the control group plants grew about 0.3 centimeter. The plants that were being grown in the fertilizer grew approximately 0.7 centimeter, more than twice the height of the control group plants. But the vinegar polluted plants did not grow at all and died in about 6 days.

The results of this experiment supported the null hypothesis because the plants reacted by growing abnormally to the pollutants placed in the water, proving that even the most useful growth enhancers can affect the water when used in excess. The best way to maintain the purity of life-sustaining water is to keep it from being polluted.

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3. This project was conducted at a Registered Research Institution.  □ Yes  □ No  ✗ Yes

4. Is this project a continuation?  □ Yes  □ No  ✗ No

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Sravya K.  02/22/06
Finalist or Team Leader Signature  Date

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Many people do not know the significance and many uses of compost. Compost breaks down organic matter and material and provides a rich earthly soil with many nutrients. This process provides our habitat with many positive effects such as serving as a base of things to grow on, or to get rid of materials that can be harmful or are of no use. This project tests the different ways compost can improve its significance and produce maximum positive results to benefit our environment.

The method to this experiment is quite simple. 45 containers containing soil, coffee grinds, and apple peels were used as a compost base. Compost Alive was added to 15 containers, and worms were added to another 15. Weight was recorded at the beginning of the experiment and at the end and the difference was calculated. The independent variable of this experiment was the adding of Compost Alive and worms to the containers while the dependent variable was the rate of decomposition and substance lost that occurred in the containers.

The containers which contained the Compost Alive during the experiment experienced a higher decomposition rate than that in the worm containers or the natural containers. The containers filled with worms were the second to receive the most decomposition in the compost followed by the natural or control group. This showed the different ways compost can be decomposed as well as which produced the best results.

The results that were produced after the experiment supported the hypothesis. The Compost Alive proved to be a better substance when decomposing compost. However, these results provide evidence of what great payoffs can be created when compost is used in everyday life and shows how effective it can really be in getting rid of waste and unneeded materials.

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Finalist or Team Leader Signature
2-22-06
Date

105815
The Effect of Soil on the Concentration of Nitrates in Runoff Water
Kotadia, Arati R.
Stone Bridge High School, Ashburn, VA 20147, USA

High nitrate concentrations, found in various waters, can be destructive to diverse organisms, initiating a need to be concerned for drinkable waters. This environmental project investigates the effect of soil on nitrate concentrations in runoff water. The fundamental purpose of the experiment was to detect if nitrate concentrations can be reduced if soil is present in the runoff.

The nitrate concentrations in the water were determined by a Nitrate test kit, with results recorded in parts-per-million (ppm). Topsoil and clay soil were placed in different water trays, and the water was later tested for nitrates. The average nitrate concentration was 27.5 in runoff water, 80.67 in the topsoil mixture, and 49.13 in the clay-soil mixture, which was significant. This shows that nitrate concentrations proliferated with the existence of soil in water, primarily due to nitrates in soil, which merged with nitrates in runoff water. A conclusion drawn was that water-soil mixtures could be harmful to organisms because they increase nitrate concentrations.

The hypothesis of the experiment (reduction of nitrates) was refuted considering outcomes. However, based on the results, it was determined that the average nitrate concentration in topsoil was higher than clay soil, instigating further studies. Another question that arises is to why plants, tested in a different experiment by another scientist, were proficient in reducing nitrate concentrations, but the soil in this experiment was not. A follow up experiment would be to test nitrate concentrations in water from various sources to find waters that are harmful to organisms.

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The Effects Wetlands Have on a Waterways Flooding Frequency
Latka, Nathan
Loudoun County High School, 415 Dry Mill Rd., Leesburg, Va, 20175, USA

The wetlands effect on the flooding frequency of nearby waterways was investigated by choosing 15 waterways with different areas of wetlands around them. One of these had no wetlands and the rest varied in wetland acreage. Then the area of wetlands around each waterway was calculated and compared to the number of times each waterway displaced more than 334.8 cubic feet of water per second. Each of the waterways had a drainage basin between 20-100 acres to try and zero in on the wetlands effects instead of the drainage area effects. Next data was obtained that showed exactly how much water each waterway displaced between 2003-2004. Then the number of times each waterway displaced more than 334.8 cubic feet of water per second between 2003-2004 was calculated. 334.8 cubic feet of water per second was found by adding up all the maximum discharge values of each of the waterways then dividing by 15. Once the number of times each waterway displaced more than 334.8 cubic feet of water per second was found, they were compared to the area of wetlands to see if there was a direct relationship. The chi-square test indicated that there was a factor, with set constants this was hopefully the wetlands effects, that bumped the waterways tendency to flood above and below the expected value. Because geography, drainage basin, and other outside effects were kept constant, the factor that affected the chi values was, for the most part, the area of wetlands. In several other charts used to compare the data, including a regression chart, a pattern is present. The pattern is in support of my hypothesis, the greater the area of wetlands around each waterway the least likely they were to displace more than 334.8 cubic feet of water per second between 2003-2004.

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[Signature]
[February 14th, 2006]

Finalist or Team Leader Signature Date

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The Effect of Air Tire Pressure on Fuel Economy
James Morano
Heritage High School, Leesburg, Virginia

This project was performed in order to find any effects of air tire pressure on fuel economy. The purpose was to help find an advantage to drivers to save fuel and indirectly money.

In the project, a gasoline-powered scooter was used to simulate an automobile. The tires of the vehicle were then set to a specific air tire pressure and the fuel tank was filled with a quarter of a liter of a 25:1 gas to oil ratio fuel. The vehicle then was driven around a 500-meter track until it ran out of fuel.

This experiment had two experimental groups and one control group. The control group was the recommended air tire pressure and its mean distance traveled was 10.5 laps or 5.25 kilometers. The experimental group with a lower air tire pressure than what was recommended traveled an average of 9.5 laps or 4.75 kilometers. The experimental group that had a higher air tire pressure than what was recommended traveled a mean of 10.6 laps or 5.3 kilometers.

The results of this experiment show that vehicles travel greater distances when they have the recommended air tire pressure than when they have less. These findings show that in order to have the best fuel economy, tires should have the recommended air tire pressure.

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Finalist or Team Leader Signature
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The Effect of Sampling Time on Benthic Macroinvertebrates Community Structure in a Loudoun County Stream
Ellyn K. Moulton
Heritage High School, Leesburg, Virginia

Biological communities are frequently sampled to study the quality of biological health of aquatic ecosystems such as streams. Biologically healthy streams are characterized by having a diverse community or organisms whereas unhealthy or impaired streams are typically lower organism diversity, measuring the diversity or a biological community such as benthic macroinvertebrates (BMIs) is greatly influenced by sampling effort.

In this study, the researcher hypothesized that the diversity and abundance of BM's would increase as sampling increased. This study design includes sampling time as the independent variable with the number of BMI individuals and taxa as dependent variables. The identification and abundance of BMIs collected during each time interval on Tuscarora Creek was recorded on a field data sheet and later transferred to a spreadsheet for statistical analysis.

The results showed that the mean number of BMI organisms and taxa appear to increase as sampling time interval increases. The analysis showed that the mean number of BMI individuals and taxa collected during the four different sampling time intervals were significantly different. The mean number of BMI individuals increased among the four sampling time intervals as follows: 15 seconds< 30 seconds< 60 seconds<120 seconds.

The results of the study design and analysis supported the original hypothesis that the diversity and abundance of BMIs would increase as sampling time increased. These results suggest that stream monitoring studies should expend approximately 1 to 2 minutes in sampling effort to adequately describe a BMI community for stream monitoring purposes.

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[Signature]
Finalist or Team Leader Signature: Ellyn K. Moulton
Date: 2/16/06

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Synthetic Musk Inhibition of Efflux Transporter Protein Activity in Mytilus sp.
Emily Nebergall
Dominion High School, Sterling, Virginia

Synthetic musks are chemicals used in almost every artificially scented product to add or to stabilize a fragrance. These chemicals are persistent pollutants of marine and freshwater and of air all over the world, and are not degraded by conventional waste water treatments. It was the intent of this research to determine whether synthetic musks exhibit an inhibitory effect on efflux transporter proteins which are used by almost every organism from bacteria to humans to flush toxins from cells. Mytilus (mussel) gill samples were treated with Rhodamine B dye and Polo Blue cologne. A spectrophotometer was used to compare the amounts of dye flushed from treated and untreated tissue. Untreated tissue was consistently less capable of flushing dye from cells than treated tissue to determine whether synthetic musks in the cologne blocked the efflux protein pumps. The null hypothesis that synthetic musk has no effect on efflux transporter proteins was refuted. Because of their inhibitory effect on efflux transporters, synthetic musks pose an indirect threat to any organism exposed to contaminated water or air. Future research could examine the effects of various specific types of synthetic musks on efflux transporter protein activity.

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Emily Nebergall 2/14/06
Finalist or Team Leader Signature Date

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Monitoring the rate of decay in peaches, based on the pH of the soil
Gina Nord
Broad Run High School, Ashburn VA, United States

This project in its current form is the result of an environmental science experiment on the effect of the pH of the soil on the rate of decay in peaches. The initial idea was to use soil from outdoor sources that have a natural pH, but this was vetoed when it was discovered that there could be organisms that would skew the results. Instead regular potting soil was used and there were additives of gardening lime and ammonium sulfate to influence the pH of the soil.

The rate of decay was determined by measuring the weight of the cups with the peaches in over a 20-day cycle. The peaches, along with the cup, soil, water, and pH additive were weighed every 5 days. At the beginning of the experiment it appeared that the hypothesis would need to be thrown out because the peaches in the more basic soil decayed at a faster rate. Around day 10, changes were shown and the peaches buried in the more acidic soil began to decay at a more rapid rate. Finally, the results showed that the acidic peaches decayed at a faster rate, followed by the neutral, and then the basic peaches.

There are endless ‘real world’ problems that this experiment may be able to aid if experimentation was on a larger scale. It could be affective to further the study of forensic science or when dealing with waste materials that take a long time to decay, though the effects of the acidic pH on the earth around would have to be researched. This project could be applied to helping the global issue of pollution and waste products.

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Vijayini Naid
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Effects of Waste Removal Sites on Nearby Communities
Samantha L. Owens
Freedom High School, South Riding VA, USA

Homeowners usually assume that living with well water is fine, but some newer cases have emerged where wells, particularly near waste removal sites, received higher concentrations of unhealthy chemicals in their water caused by substances seeping into the water table.

This project in its present form locally tested this hypothesis. Forty-five different residential well water samples were collected throughout Culpeper, Virginia. Three different distances were tested, one kilometer, two kilometers, and three kilometers from the site of the landfill, fifteen samples each. Each sample was tested for six harmful substances: nitrates, nitrites, iron, alkalinity, pH level, and hardness. The original hypothesis suggested that the propinquity to the dump had drastic effects on the water quality.

Results showed that the nitrate concentration augmented as the residences became closer to the landfill. Nitrates, (NO3) found in many of our foods, are very unlikely in groundwater, making this information significant. They are also known to cause Methemoglobinemia, or “blue baby” syndrome among infants. The pH levels were also affected by the relativity to the waste removal site. Higher pH levels show escalation in the water’s alkalinity, the water tested tended to have a pH level higher than seven, similar to that of seawater and baking soda. However, alkalinity levels tended to increase the further the residents lived, rejecting the original hypothesis. The hardness and iron tests proved insignificant, remaining high no matter where the location. The nitrites remained inconsequential, due to a lack of nitrites found in the water samples.

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Effects of Motor Oil and Fertilizer on Elodea and California Blackworms
Elise H. Sawtelle
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175 USA

The experiment was designed to model the effects of dumping contaminated floodwaters from hurricane Katrina into Lake Pontchartrain. Motor oil and fertilizer were the two contaminants chosen to model contamination from oil refineries and raw sewage. Elodea and California blackworms were the two test organisms investigated by exposing the organisms to the two pollutants. This experiment was done to see how exposing the organisms to different levels of single and combined pollutants would affect them. For each experiment three control beakers, three beakers with .25% of the pollutant, and three beakers with .5% of the pollutant were set up. Three experiments were run: one with motor oil, one with fertilizer, and one with the two pollutants combined. The effects the pollutants had on elodea were determined by measuring the amount of dissolved oxygen produced once every 24 hours for seven days. The hypothesis that motor oil would significantly decrease the amount of dissolved oxygen produced was not supported. T-tests were run on all three of the experiments for each separate day. The t-test on the effects of motor oil and fertilizer on elodea showed that there was not a significant difference in the amount of dissolved oxygen produced. The t-test on the effects of fertilizer on elodea showed no significant difference in amount of dissolved oxygen produced at first, but after a few days there was a significant difference ($P=.01$, df=2, calculated t value of 6.7). The hypothesis that motor oil would kill California blackworms was not supported. The t-test on the effects of motor oil and fertilizer on elodea also showed that there was not a significant difference of the amount of dissolved oxygen produced. The tests with motor oil on California blackworms showed that there was not a significant difference of the number of live worms.

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   - [ ] human subjects
   - [ ] pathogenic agents
   - [ ] non-human vertebrate animals
   - [ ] controlled substances
   - [ ] recombinant DNA
   - [x] human/animal tissue

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

3. This project was conducted at a Registered Research Institution. [ ] Yes [x] No

4. Is this project a continuation? [ ] Yes [x] No

5. My display board includes photographs/visual depictions of humans (other than myself or my family): [ ] Yes [x] No

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Elise Sawtelle
Finalist or Team Leader Signature
Feb 22, 2006

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The Effect of Inflated Gasoline Prices on Transit Ridership
Kristi Sieber
Loudoun County High School, 415 Dry Mill Road SW, Leesburg, VA 20175

Following Hurricane Katrina, gasoline prices skyrocketed causing commuters to focus on finding an affordable yet convenient form of transportation. The American Public Transportation Association is an alternative for cost-efficient transportation. It has multiple modes of transportation including heavy rail, light rail, commuter rail, trolleybus, bus, and demand response. Heavy rail is used for a large amount of people, light rail is a sole operating passenger car, and commuter rail is used for urban passenger train service. Trolleybus mode uses vehicles powered by current from overhead wires. Diesel, gasoline, battery or alternative fuel engines power bus mode. Demand response is cars, vans or small buses functioning as taxicabs.

The statistics collected from transit ridership and gasoline prices from 1999 to 2005 are analyzed with regression statistics. The independent variable is the rise of the gasoline prices. The dependent variable is the effect of gasoline prices on driving habits, such as the change of a daily commute.

Ridership was regressed with time and residuals were standardized by dividing by predicted values. Residuals were then regressed with standardized gas price residuals. Heavy rail, light rail, commuter rail, trolleybus, and bus total were positively correlated with gasoline prices. Demand response was negatively correlated. Heavy rail, light rail, commuter rail, and trolleybus had significant regressions. Bus total and demand response had insignificant regressions.

As gasoline prices increased, the majority of transit ridership increased, except for demand response. These conclusions support the hypothesis and describe the relationship between inflated gasoline prices and the increase of transit ridership.

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KristiSieber
Finalist or Team Leader Signature

2 - 14 - 04
Date

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Comparing the Efficiency and Longevity of Alternative, Recycled Decking Material to Traditional Wood
Caitlin Wilmot
Loudoun County High School, 415 Dry Mill Rd SW, Leesburg, VA

The purpose of this experiment was to determine the optimum decking material for outdoor use. Such information could aid homeowners in building long-lasting decks or additional landscaping structures, and in providing environmentally sound materials.

Independent variables, including untreated cedar, TREX, Evergrain, and pressure-treated pine, were each subjected to three tests. To test exposure of materials to natural elements, samples of each were placed outside for four weeks, and changes in mass and appearance were identified. To test daily wear and tear, samples were rubbed with sandpaper and before/after mass data were gathered. Lastly, to test leaching of metals into soil, samples were placed in soil/water mixtures, and after three weeks, changes in pH were noted.

In testing daily wear and tear, all woods differed regarding mass loss (ANOVA, P< 0.05), with TREX losing the least (average loss= 0.34 g) and cedar, the most (average loss= 1.89 grams). In testing exposure to elements, all samples differed regarding mass gain (ANOVA, P< 0.05), with cedar gaining the most (average gain= 5.06 g) and Evergrain, the least (average gain= .05 grams). Lastly, pH soil differences were insignificant (ANOVA, P> 0.05).

The results of the experiment were similar to those hypothesized. One notable difference was that in testing exposure to the elements, the samples all gained mass due to precipitation. Also, in testing the leaching of metals into soil, the results occurred arbitrarily and therefore solid conclusions were not drawn. Overall results, however, did support the hypothesis that alternative, recycled decking material is longer-lasting and more durable than traditional, untreated wood.

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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

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Caitlin Wilmot 
Finalist or Team Leader Signature 01/03/06 
Date

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# 900 Mathematics

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A Study on the Effects of a Gravitational Pull by a Spacecraft on an Earth-Bound Space Rock
Anthony C. Bauer
LCPS Academy of Science, Dominion High School, Sterling, VA

The purpose of this project is to assess the practicality and feasibility of using an extremely massive spacecraft as a tow to pull a comet or asteroid out of a collision trajectory with the earth using only the force of gravity between the two bodies. All of the equations were developed to quantify the change in the comets position in terms of the mass of the spacecraft, the time allotted, and other constants associated with the rock. A numerical approximation of the orbit of the rock was also developed to determine its position at any point in time. A current threat named 2002 NT7 was used as an example and the mass of the spacecraft needed to impart the required force was prohibitively large. The costs of sending such a craft would have astronomical and therefore highly impractical.

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4. Is this project a continuation?  □ Yes  □ No

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Order in the universe?
Erica Cohoon
Lounoun Valley, Purcellville Va, USA

The purpose of this experiment was to find out how the Fibonacci sequence effects how planets are positioned. To first start this experiment an abundance of information was necessary. Information acquired was then analyzed and the applied to numerous amounts of math equations and a form of geometry.

To find if planets followed some order when being formed, looking at the situation from different angles was a necessity. Viewing the problem through the way NASA thinks and by how independent researchers think greatly differed, so the major part of this project was seeing how these two ideas varied. With the information gathered from scientist and math equations used in physics, the beginnings of a equation with the use of Fibonacci was being formed.

Though the hypothesis stated was neither null nor correct, there was a great deal of information learned about our solar system. Through many hours of research the project is well on the way to becoming correct, but as of now no concrete pattern has arose, but many small relationship were formed.

This experiment thus far has shown that some order was most likely present when the forming of the universe occurred, and not just a random process. If this relationship between planets holds true for other solar systems, then in years to come, much information could be found through this sequence.

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_____________________________  2-12-2020
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The Effect of Hand Size Compared to Basketball Size on Free Throw Percentages
Hughes, Jasmine
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The effect of hand size on free throw percentages was experimented by nine female basketball players, from LCHS. This was to see if physical characteristics affected free throws, or if it’s just the level of the player's shooting ability. Hand sized compared to basketball size is a factor that affects the results of the free throws. First, the players had their hands measured, length and width in centimeters. Then, the players each shot one hundred shots with a men’s basketball and on hundred with a women’s ball. Finally, their percentages were added up and compared to their hand size. All together, the average percentage for women’s ball was fifty-nine and the average percentage for a men’s ball was fifty-six. Therefore, the team averaged about the same for both basketballs and almost all the players had a consistent free throw percentage between men and women’s balls. The hypothesis, the smaller the hand, the lower the free throw percentage was not supported. It was estimated that the small the hands would score around sixty, which was supported and the larger hands would score around seventy-five, which was not supported. For instance, the player with the largest hands, with a width of eight and a half centimeters and a length of eighteen and a half centimeters, scored sixty percent with a women’s ball and fifty-seven with a men’s ball. While the player with the smallest hands, with a width of seven and a half centimeters and a length of sixteen and a half centimeters, scored sixty-two percent with a women’s ball and fifty-three with a men’s ball. From the looks of the rest of the results, you can conclude that ability level is a factor that effect free throw percentages. Mentioned earlier, almost all the players had a consistent average except the player with the third largest hands. She has hands with a width of nine centimeters and a length of seventeen and a half centimeters, scored forty-four percent with a women’s ball and seventy-three with a men’s ball. This is a large difference that could be caused by some other factor. As a conclusion to the results, hand size does not affect free throws; it is just the level of the player’s shooting ability.

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Jasmine Hughes
Finalist or Team Leader Signature 2/15/04

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Luck of the Draw; Probability Applied to Gambling
Adam T. Odegaard
Loudoun Valley High School, Purcellville, VA, USA

This experiment was designed to test a theory of probability on a game of blackjack. By playing 500 separate hands of blackjack and recording each score, it was determined that the odds of winning can be significantly increased by using a series of newly developed strategies and tactics. For example, if a person were to surrender each time that he or she received a total between 13 and 15, then he or she would regain half of the previously bet currency to be used at another time in the game. Through these tactics, a player can win a lot more games than if they simply played each hand and hoped for the best.

In order to test this hypothesis, 5 separate trials of 100 hands were recorded. One player was responsible for dealing while another player tested the new strategies and tactics. As a control, one other person would hit each time they had a total of 16 or below and stay each time they had at least 17.

The results of these trials supported the hypothesis. Each time, the person who used the strategies and tactics had a noticeably higher win rate than the control player. In trials one and four, the player who used the new tactics had an amazing score of over 60 wins. In trials two and five, the same player had a total of just under 50 wins. These results indicate that these new strategies can make a significant difference.

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[Signature]  02/2006

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The main idea behind this experiment was to create a real-life representation of a mathematical equation, particularly, the binomial curve. The experiment was expanded on by creating several different designs of pin arrangements, then comparing them to each other to see which one had the most even distribution. The hypothesis is that design II will cause the most even distribution.

To do this experiment, a bunch of pins were screwed into a board. The board was clipped into an apparatus that had a hole at the top and twelve bins on the bottom. Fifty balls were dropped through the hole per trial. At the end of the trail the number of balls in each bin was counted and documented.

At first glance, the results seem extremely varied with little or no correlation. Yet upon closer inspection, every design except VII roughly shows a binomial curve. Though, some are more skewed than others. Design VII shows an inverse binomial curve.

The data clearly shows that the hypothesis was refuted. Design II had the second steepest bell curve, after the control. The design that had the most even distribution was I followed by VII and VI, respectively. After checking the statistics, this experiment shows substantial evidence that pin arrangement does, in fact, effect ball distribution.

Further experimentation in this area might include choosing one core design and changing the spacing between the pins. Another experiment is to add things other then pins, such as ramps or wheels.

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Victoria Oosterhout Date
2/21/06

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 the Pythagorean Method is to estimate a team's average winning percentage based on points scored and points allowed. It is normally applied to baseball, but this experiment applies the equation to basketball, football, and hockey as well. A team's Pythagorean expectation will probably be accurate if the individual scores are not extreme.

For this experiment, baseball, basketball, football, and hockey scores were obtained for all professional teams available. The scores were all from the same year for each team (2004 and 2005 were used). The Pythagorean percentage was then calculated with the following formula:

Points scored 2 / Points scored 2 + Points allowed 2.

The difference was calculated between the Pythagorean percentage and the actual percentage for comparison and the data were recorded in graphs. Any teams that differentiated greatly were further reviewed with individual game scores.

The main data were baseball, football, basketball, and hockey scores and percentages. The Pythagorean expectation was received from the scores, and from there the differences were obtained.

Individual scores were not a major factor in the outcome. The exponents of the equation, however, changed the results greatly. Because the equation was designed for baseball, those percentages were the most accurate. The scores seemed to have the opposite affect on the results than what was previously hypothesized. Smaller score differentials tended to cause the percentage to deviate more. For example, Miami's basketball team had a seventy-two winning percentage, but the difference between the points scored and allowed was only 615 points. The Boston Red Sox (baseball) did not have a close run difference (180 run difference), but the percentages were almost exact (0.1% difference).

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Kaitlyn Reid 7-2-05
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 the experiment is to show the visible link between mathematics and music. The thing is, most people do not really associate both fields together. Mathematics involves formulas and laws in various equations, while music involves counting, knowing beats, rhythms in a song. Both seem very different to each other. It seems that there is no way to compare each other whatsoever.

The procedures were very simple. With fifteen songs divided by three genres, one shall examine each piece in a minute with sheet music as a guide. Afterwards, one shall record the data onto a sheet of paper that will be later graphed. During that, one shall look at the graphs and determine if there are any comparisons between each other.

The data in the end of the experiment did not go along with each other. Each one was all different, and they had different results. The conclusions did not match with the hypothesis at all. Each song did not match in its own genre, or to other genres as well. It can be said, that each song is different in its form.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):
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Mathematical Prediction of Agricultural Yield
White, Lauren
Loudoun Valley High School, 340 North Maple Ave., Purcellville, VA, 20132

This experiment was performed to determine if a production function could be utilized to accurately predict the agricultural yield of the United States. Labor intensity, tractor use, irrigation, fertilizer, farm size and total farm land were all used as factors in developing this equation.

The factors were minimized to four variables and constrained to reflect the cereal yield (Hg/Ha) of the United States. The natural logarithm was taken of all the variables before multiple linear regression was performed. This allowed the coefficients to be transformed into the exponents of each variable, causing the equation to resemble a production function.

The achieved constraints and exponents of the equation produced a fairly accurate prediction for cereal yield. A Pearson R Correlation showed the predicted data to have a .88 correlation with the actual yield. A T-test indicated with a probability of .50 that the two data sets were equal.

This significantly suggests that the developed equation is a reasonably accurate method of predicting agricultural yield for the United States. This supports the purpose and hypothesis by showing that an equation could be developed.

If furthered, comparison with other and specifically developing countries should be performed. If proved legitimate, this equation could be used to actually predict future agricultural yield or to calculate yield taking into account available resources. Another continuation would involve further identification of individual variables to increase accuracy.

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Lauren White 2/9/06
Finalist or Team Leader Signature Date

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<td>09P1017</td>
<td>Basal Metabolic Rate Diet vs. Diet and Exercise</td>
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<td>Silver Jessica</td>
<td>10B1018</td>
<td>The Relationship Between the Amount of Fat in Different Packages of Beef and The Weight Loss Once the Meat is Cooked</td>
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<td>Snee Molly</td>
<td>10V1019</td>
<td>What Song Does Your Heart Beat For?</td>
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<tr>
<td>Spurlock Kaitlin</td>
<td>10L1020</td>
<td>Selenium Levels in Horses From Loudoun County</td>
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<tr>
<td>Stephens Kathryn</td>
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<td>The Relationship Between Pacing Strategy and Running Performance in a 3200m Event</td>
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<tr>
<td>Stevens Elizabeth</td>
<td>10C1022</td>
<td>The correlation between doctors, nurses, and hospital beds per population, the mortality rate, and the infant mortality rate</td>
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<tr>
<td>Wilson Katelyn</td>
<td>10S1023</td>
<td>Relationship Between an Instrumentalist's Athleticism and Lung Capacity</td>
</tr>
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<td>Woodard Dana</td>
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<td>The Movement of an Injured Arm</td>
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<tr>
<td>Zuke Ashleigh</td>
<td>10F1025</td>
<td>The Effect of Artificial Sweeteners on Streptococcus mutans</td>
</tr>
</tbody>
</table>
Smallpox Simulation: Modeling the Outbreak of Smallpox in a Clustered Social Network
Maura Bardos
Loudoun County High School, 415 Dry Mill Road, Leesburg, VA 20175

The purpose of this experiment was to determine the initial growth of a smallpox epidemic in a clustered environment. The initial growth is important in developing a vaccination strategy to contain the spread of disease. The initial growth is exponential in an epidemic with random homogenous mixing while the initial growth rate in this study was polynomial. In this study, many of the contacts overlapped. An increased probability that a subject’s contacts will have contact with each other was found. The more clustered the social network, the more often contacts are shared resulting in less rapid initial growth. 9 subjects completed the survey of contacts. The subjects wrote the name of each student they had contact and described the type of contact (face-to-face, within 6-7 feet, prolonged (approximately 3 hours), with clothing, or with bodily fluids). For each of the 9 trials, the initial growth rate (1 day) was polynomial. For each trial r2=1 for the polynomial function of best fit. The average number of contacts equaled 11.33 or 2.266 per class period. 14.62% of contact throughout the day was consisted of critical exposure contact. Using the average number from 9 trials the equation of the line y = 0.1249x + 0.0479x^2 - 2.1879x^2 + 10.467x - 7.008 was graphed to determine the time needed for the entire population of the school to become exposed. Using the assumption that no contact takes place outside of school, it would take 2 complete school days for the entire student body to be exposed to smallpox.

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ Yes ☑ No

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Maura E. Bardos
Finalist or Team Leader Signature Date

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Estimating the effectiveness of different influenza vaccines by analyzing DNA sequences of influenza vaccines and influenza viruses.
Cameron, Ashley
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

In the experiment conducted, DNA from influenza vaccines was compared to the DNA of influenza viruses to test the effectiveness of vaccines on the influenza virus. This was to determine that if the DNA’s of both the virus and vaccine were a strong match than the vaccine would be more effective. Along with the DNA sequences, the amount of outbreaks was also used to determine the effectiveness of the vaccine. Therefore, the effectiveness was shown by the strength of the DNA match and the number of outbreaks during that specific season. First, the vaccine of a season was chosen and then compared to virus strains from that season by use of the BLAST program. The Influenza Sequence Database (ISD) BLAST results showed the list of DNA sequences of virus strains that have a good match. The virus strains, only dealing with the United States of America, description, score (bit), and E value were recorded. Next every virus strain from that certain season was recorded. The two lists, one of the virus strains with a good match and all virus strains, were compared, and a percentage of the positive matches were found. Historical data or a summary of the influenza seasons was collected. The summary showed the percentage of mortalities from influenza. After comparing the percentage of positive matches and percentage of mortalities, the conclusion was that the hypothesis was not supported. The data showed that the effectiveness of the vaccine does not solely rely on a match of DNA between the vaccine and virus. Even though there can be a strong match, the mortality rate could still be high due to other factors.

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Ashley Cameron 7/15/00
Finalist or Team Leader Signature Date

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How Does Bleach Affect Hair?
Wenfan Chen
Harmony Intermediate School, Hamilton, Virginia

The purpose of this project is to determine whether the amount of time that hair strands are soaked in bleach has any effect on the number of breakages on the strand. If there is to be a relationship, then what is it?

In this experiment, data was collected for eighty minutes altogether. Every twenty minutes, a strand of hair is taken out of the cup of bleach, to be observed under the microscope with a total of 400X magnification, for breakages. The number of breakages was counted for data, under a view of one millimeter under the microscope.

The results showed that the independent variable of time measured in minutes, affected the dependent variable of breakages on hair strand positively; as the time increases, so does the number of breakages. This result is reasonable because as the time that strands are submerged increases, the degree of damage to the strand increases as well, and breakages on the strand are just a sign of the damage. Therefore, hair bleach products often have a maximum amount of time that you should try to arrive to your desired color.

The results support the hypothesis that was made earlier in the course of the project. Although time does have an exponential effect on the number of breakages, this does not occur forever. At some point of time, the strand will reach its peak number of breakages and damage possible; after that, a logistic growth would follow.

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(Chen) 2/22/06
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Effect of pH on Bone
Rebecca Clark
Potomac Falls High School, Potomac Falls, VA

This project studied the effects of pH levels on bone dematerialization. Bones were used as a model for teeth because of their similarities in composition and structure. The basic idea was to determine if a liquid is more acidic if there would be more dematerialization. This would be used to study these effects in relation to baby bottle syndrome.

The pH of a liquids was determined by the standard litmus paper test. Four liquids were tested and had bones placed in them. There were allowed to sit in the liquid for six days and then to dry for one. The decrease in mass was measured by subtracting the starting mass from the ending mass. The results of this test showed a general decrease in mass due to dematerialization. This decrease in mass was not enough to show a statistically significant amount and the hypothesis was not supported. This may be due to the small amount of time the procedure was done for. The contribution of this study showed how devastating the effects of dematerialization of teeth could be to a child.

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

Rebecca Clark 2/17/05
Finalist or Team Leader Signature Date

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Detecting Metals in Invertebrate Larval Tissue: A Forensic Application
Kristina M. Cole
Dominion High School, Sterling, Virginia

Insects are used extensively in forensic research to determine post mortem interval and the approximate location of a crime. Blowflies' larval tissue can be tested for metals such as those found in heavy metal poisoning cases. The purpose of this research was to determine whether metals such as those found in poisons could be detected in invertebrate larval tissue. Ten 2 cm x 2 cm cubes of liver were injected with 1 milliliter of cupric sulfate and placed into an aquarium with 150 blowfly larvae. At each critical life stage, larval, pupal, and death, thirty blowfly larvae were removed and placed in a jar with distilled water. After one day, the larvae were removed from the jar and ground in groups of two with 2.5 milliliters of water and tested. The null hypothesis, that the larval forms of Sarcophaga bullata will not encorporate copper into their bodies, was refuted. Although the larvae that ingested the copper were killed, tests indicated that out of all the larvae tested 32.5% showed no signs of copper, 52.5% showed 0.5 ppm of copper, 12.5% showed 1.0 ppm of copper, and 2.5% showed 2.0 ppm of copper. Further research could examine the effects of different chemicals on Sarcophaga bullata larval tissue and the use of these flies in determining poisonings.

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☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue

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Date: 2/16/06

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[Seal]

12D1005
The purpose of this experiment was to determine which teeth whitener provides the best results. The teeth whiteners were tested to see which one turned teeth the whitest, over a span of five days. Crest Whitestrips, Plus+ White Gel, Pearl Drops Toothpaste, Crest Toothpaste and Simple White Gel were the different teeth whiteners tested. The methods of application and brands were the independent variables. How white the teeth became was the dependent variable. Each teeth whitener was applied to stained porcelain tiles, and over five days reapplied according to instruction and compared to the Advance White shade chart to see how much of a difference the Whitener was making.

The major finding of this study was that Crest Whitestrips showed the best results, by far. They turned the "teeth" white very rapidly and drastically along all five days. Surprising results included that the toothpastes made a big impact as well, and Simply White Gel barely made a difference at all.

The major conclusions include that the strip system is the best for application, in this case the Crest Whitestrips. The strip system holds the hydrogen peroxide in teeth whiteners right on one's teeth. Toothpastes make a change in whitening shades, though not as significantly as the strips. The results support the hypothesis, which was that Crest Whitestrips will provide the best results.

There are many further studies that can be done on this topic. This may include Dentist whitening vs. Home applications, or a test to see if certain foods or drinks have influences on teeth whiteners. There are many things to be done to expand this topic even more.

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Maddy Dannenberg
Finalist or Team Leader Signature

Date

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The Relationship between the Lung Capacities of Athletes vs. Musicians vs. Non-active Individuals
Susan Geiger
Park View High School, Sterling, VA, USA

This project's goal was to find a relationship between an individual's lung capacity and his/her level and type of activity. The chosen test subjects were divided into three groups: athletes, musicians/singers, or sedentary individuals. A peak flow meter was used to measure, in liters, the lung capacities of each of the 45 subjects. Three trials were performed for each subject and the highest recording from each trial was recorded for comparison. The means of each group were compared and formed the basis of the conclusion.

This experiment was interesting due to its medical background and its focus on the various groups of people; especially its interaction with athletes.

In the experiment, the musicians/singers had the highest average lung capacity (443.667 L), followed by the sedentary individuals (424 L), then the athletes, having the lowest average (399.667 L). These results disproved the starting hypothesis that stated that the athletes would have the highest average, then the musicians/singers, then the sedentary individuals with the lowest.

The experiment produced these results because the musicians and singers that were tested are taught how to use their lungs properly. When questioned, the singers and musicians said that they do breathing exercises before each music practice or class. For the athletes, they are not expected to know how to breathe properly; they just focus on how to play the sport.

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   ☐ 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

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Susan Geiger
Finalist or Team Leader Signature: 2/21/06

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The Effectiveness of DEET and Picaridin on Repelling Mosquitoes
Andy Gonder
Potomac Falls High School, Potomac Falls, VA

Mosquitoes are known to host and spread fatal diseases such as West Nile Virus and Malaria. This experiment tested the two repellants used for mosquitoes; Picaridin and DEET. Three identical environments were designed using glue boards with lactic acid alone, lactic acid and DEET, or lactic acid and Picaridin. The lactic acid was the attractant to lure mosquitoes toward the glue boards. The repellants were expected to keep the mosquitoes away. The number of mosquitoes stuck on the glue boards was counted.

Both chemicals were successful in repelling the mosquitoes with only a slight difference in strength. The results did not support the hypothesis, which stated that the DEET would be more effective for repelling mosquitoes. The data was consistent between two trials.

This experimental design models human protection because lactic acid produced by humans is thought to attract mosquitoes. It was clearly demonstrated that DEET and Picaridin are effective repellants and it can be inferred that their use would lead to the prevention of mosquito borne disease.

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

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_________________________  2/21/06
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The Efficacy of Equimax vs. Ivermectin De-Wormers
Hailey Huebner
Loudoun Valley High School, Purcellville, Virginia

The purpose of this experiment was to prove the efficacy of two different equine de-wormers. A total of 28 horses were used in the first collection of samples. The samples were placed in sealed Ziploc bags, then labeled with the horse’s name and the date collected. It was determined that only 13 of those 28 had equine internal parasites, based on the fecal egg count. The egg count was determined by a process called fecal float, where a sodium nitrate solution is used. Those 13 were de-wormed randomly with Equimax and an Ivermectin de-wormer. There was a waiting period of 10-14 days before the samples could be collected again. The second and final collection was collected approximately 12 days after the first de-worming. The samples were collected, then brought to the lab, where a fecal float was performed, as before. The slides were analyzed under a microscope and the number of parasite eggs was determined. After analyzing and comparing the data, it was determined that the hypothesis was not supported. Both the Equimax and Ivermectin de-wormers were equally effective in eliminating equine internal parasites.

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
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Hailey Huebner
2/03/00

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The Effects of Materials on Blocking Radiation from Cell Phones
Naomi M. Lockley
Briar Woods High School, Ashburn VA

This project tests the effect of different materials on the blocking of cellular phone radiation. The goal of this experiment is to observe emitted the radiation and relate it to the potential effects on the consumer. The experiment resulted in evidence that in some cases, cellular phones do indeed have an affect on those who use them by giving off radiation strong enough to affect living tissues directly.

Verizon cell phones were used against glass, pine, leather and cinder. The materials used as deterrents and the distance of all the materials from each other were the independent variables and the radiation was the dependent variable. Each trial was repeated five times for each of the four materials.

The findings concluded that of the materials used, the blocking of radiation from the cell phone was not significant. For example, the difference between the majority of the results was only .005. This is a very small percentage of blockage. The results supported the hypothesis in the smallest of fashions. The purpose of this project was to block cell phone radiation, though the results were not as notable as hoped.

Further questions arose about using the original materials for the project. One of the questions was if granite, lead, and denser woods had been would the results have been significantly different? Due to the inaccessibility of the original materials, they were replaced. If those materials were used, the possibility of more radiation being blocked would increase greatly based on their properties.

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

Naomi M. Lockley 04-22-010
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Relationship of the Frequency of Injuries to Morphometry in Distance Runners
Andrew Lyford
Loudoun County High School, 415 Dry Mill Road SW, Leesburg, VA

This project studies the relationship of a runner's body shape and size, specifically through leg length, height, weight, and calf girth, and the probability of the runner developing an injury.

In the study, the anonymous participant was assigned a number. After that, the runner was weighed on a scale and had his or her height, leg length, and calf girth measured with a tape measure. The runner then filled out a questionnaire asking for age, injuries received over the last three years, and gender. The independent variables in this study are the runner's height, weight, leg length, and calf girth. The dependent variable is whether or not that runner was injured or not.

The findings of the study were inconclusive with a P-value slightly greater than .05. A trend was beginning to form that as leg length increased, the risk of injury grew but without more data, this trend can not be made conclusive.

This project lends itself to open up many more questions. Further research could be done on the probability of injury between men and women. Research could also be performed on whether or not foot size has any effect on a runner's probability of injury.

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Andrew Lyford 2/19/2006
Finalist or Team Leader Signature Date

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The Relationship Between Bacteria and Contact Lenses
Jennifer M. Maas
Freedom High School, South Riding, VA, United States

This project focuses on the time a contact lens is worn in relation to how much bacteria is grown off the contact. The idea was to calculate how long a contact could be worn and still be of good use to the wearer.

The experimenter developed the idea of testing a contact lens’ bacterial growth at the variables of 0-hours (as a control), 5-hours, 10-hours, and 15-hours. The contact was exposed to the eye for the set time and then swabbed for bacteria, which was then incubated for a 2-day period and counted. The experimenter’s hypothesis was that after the 10-hour marking period a significant amount of bacteria would appear rendering the contact less useful to the wearer.

The data was ranked into 8 categories of bacterial growth based on the colonies developed. The results showed that the higher categories could only be obtained once the contact had been worn for the 10-hour variable. The null hypothesis was rejected and it was apparent that there was a significant difference in the data due to the change in the independent variables.

The conclusions were the longer the contact was worn the more bacteria was grown. The results supported the experimenter’s hypothesis. These results helped in showing the appropriate amount of time a contact should be worn to be of best use.

If the experimenter were to further on with this project the next step would be to figure out at exactly which time period the bacteria begins to raise in colonies.

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Jennifer M. Maas
2-22-06

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A Barrier To Evaporation: Which Brand of Moisturizer Is Most Effective In Preventing Moisture Loss?
Katie Mercuro
Broad Run High School, 21670 Ashburn Road, Ashburn, VA

Dry skin is a problem faced by millions of people. Although not terribly serious, it can be very inconvenient and bothersome. There are many different moisturizers on the market today, all with different active ingredients and claims. This experiment tested the efficiency of various brands of moisturizers on their ability to hold in water. Much of the water in the skin is trapped in a protein known as collagen. When heated, collagen produces a simpler protein, namely gelatin with similar water holding properties. As a result, gelatin was used as a model skin in this experiment.

In this experiment, various types of moisturizers were applied to samples of gelatin. These samples were compared to the control, which consisted of a sample of gelatin without any lotion. All of the samples were weighed each day for three days to determine how much water had been lost.

The most effective brand in preventing moisture loss was Eucerin, which lost an average of 1.4667 grams over a three day period. On the other hand, the control lost 2.2467 grams over the same period. This data supported my hypothesis, which stated that Eucerin would be the most effective moisturizer in preventing water loss. This most likely occurred because Eucerin is a cream based moisturizer and therefore much thicker. This thicker consistency reduced evaporation and helped the gelatin retain water.

Although there were no obvious sources of error, this was a very primitive experiment that only tested the main factor that contributes to dry skin; lack of moisture. Nevertheless, this experiment was very successful and proved the effectiveness of moisturizers in general.

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□ non-human vertebrate animals □ controlled substances □ human/animal tissue
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I/herby 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] 2-17-06

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An Analysis of Nitrogen Containing Compounds in Balloons and Meat
Sierah Nguon
Dominion High School, Sterling, VA, USA

Nitrosamine is a chemical that has been noted to have carcinogenic properties. It is formed by the reactions of nitrites. Nitrites may possibly be found in every day items such as the meat we eat and balloons. It was the intent of the research to determine whether nitrites, which could form harmful nitrosamines, were found in meat and balloons. Steaks were cut into 1 cm by 1 cm cubes and placed in a beaker with water. They were allowed to sit for 24 hours. The steaks were then tested for nitrites to see if any had leached out of the meat. This was also repeated with the balloons and fried bacon. The balloons and fried bacon showed no discernible nitrite levels. However, the steak showed the presence of nitrite. The null hypothesis, that there would be no nitrites in balloons, meat, and bacon were partially supported in the case of the balloons and bacon and refuted in terms of the steak. Further research would entail testing other products for nitrites in order to determine human exposure to harmful nitrosamines if formed. This may reduce the occurrence of some cancers in people.

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

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

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

4. Is this project a continuation?  □ Yes  X No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  □ Yes  X No

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Sierah Nguon
Finalist or Team Leader Signature  2/16/106
Date

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The Accuracy of Ishihara Test on Color Vision
Pyntikov Ilya O.
Briar Woods High School, Ashburn, VA

This project is about testing the accuracy of Ishihara test on colorblindness. The idea is to prove that Ishihara test is an inaccurate test on color vision. The Farnsworth test was used as a comparison to the Ishihara test because it is 95% accurate in its results and it clearly identifies the colorblind people. The people, who were tested by Ishihara test and diagnosed as colorblind, disagree in the accuracy of Ishihara Test.

Both tests (Farnsworth and Ishihara) were performed by seventy four people from whom five people were colorblind. The Farnsworth test contained the full set of materials while the Ishihara test had 10 slides to show. The results were recorded on the data paper and then converted into percentage (i.e. 6/10 = 60%). Then, the average was calculated in order to obtain the similarity of the two tests.

The results were almost similar in both tests with averages of 93% (Ishihara Test) and 95% (Farnsworth Test) from all people tested. The five colorblind people failed both of the tests while the rest of the people tested passed both tests with similar scores on both of them. T - Test was used in order to obtain the information. The calculated value of the tests were: Ishihara test = -3 while Farnsworth test = -2. The degrees of freedom for both tests were the same, 144.

The original hypothesis was rejected as the experiment showed that Ishihara and Farnsworth Tests are almost similar with no significant difference in the accuracy of both of them.

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

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Ilya Pyntikov 02/22/06
Finalist or Team Leader Signature Date

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Impact of Motor Task on Reaction Time in Children without ACC, with partial ACC, and with complete ACC
Richard, Emma B.
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

Agenesis of the Corpus Callosum (ACC) is a disability in which a person is missing some, or all of their corpus callosum. In an effort to learn how therapists can use a simple motor task to increase a child with ACC's reaction time, an experimental design has been thought of and carried out. This experiment will show if a child with ACC can improve their reaction time by bouncing a ball 15 times. There were 30 children used for testing: 10 had complete ACC, 10 had partial ACC, and 10 did not have ACC. In the first stage, a child would have their initial reaction time measured. The reaction time was measured by asking a child to grab a yard stick that was dropped into their hand. The slower the reaction time, the farther down the yard stick had fallen. Then in the second stage the child would bounce a ball back and forth 15 times with a person who is 4ft. away. Lastly the child would participate in another yard stick reaction test. After testing all 30 children, the hypothesis that a greater percentage of children with partial ACC and complete ACC would have improved their reaction time versus those without ACC, was not supported. In fact, no one group had the majority of their children improve. For the children without ACC, only 5 improved and the other 5 did worse the second time. The children with partial ACC only had 4 improve, 2 did worse the second time, and 4 would not partake in this experiment, or they stopped after the first reaction test. And out of the children with complete ACC, 4 improved, 4 did worse their second time, and 2 would not participate at all in this experiment. Another conclusion, besides the initial hypothesis that was being tested, was that a larger percent of the children with partial ACC would either not participate at all, or they stopped after the first reaction test. Coming into this experiment, it was thought that the children with a partial connection between the 2 hemispheres of the brain would do better, react more quickly, and participate more than the children with complete ACC. But only 20% of the children with complete ACC would not participate, compared to the 40% of the children with partial ACC who would not participate.

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

3. This project was conducted at a Registered Research Institution.  □ Yes  X No

4. Is this project a continuation?  □ Yes  X No

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Emma Richard  February 14, 2006
Finalist or Team Leader Signature  Date

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Effects of Dieting and Exercise on the Body
Kathleen A. Rickard
Potomac Falls High School, Sterling, Virginia, United States of America

Obesity along with its associated health problems has become a national problem. All too often individuals in addressing weight control have a tendency to focus on diet alone without considering the benefits of a combined program of diet and strength exercise. Historically, strength exercise and weight lifting has been limited to young athletic individuals as a component of sports training and not utilized in combination with a weight loss program. There is much in the literature regarding weight loss associated with nutrition and diet control. However, very little research has been done on exploring the relationship between diet and strength exercise. Understanding the significance of exercise in correlation with diet has been determined to have significant beneficial effects with women. The major finding of this research project, demonstrated that by combining diet and exercise, individuals not only lose pounds but also exhibited an overall improvement in total body measurements, which diet alone did not demonstrate. Therefore, this research project determined that a weight loss program that combines both diet and exercise is feasible, practical and has long term beneficial effects for women.

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

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Kathleen Rickard  2.17.06
Finalist or Team Leader Signature  Date

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The Relationship Between the Amount of Fat in Different Packages of Beef and the Weight Loss Once the Meat is Cooked
Silver, Jessica A.
Broad Run High School, Ashburn, VA

This experiment was ultimately designed to test the relationship between the amount of fat in different packages of beef and the weight loss once the meat is cooked. A number of tests were performed in order to prove a hypothesis stating that portions of beef containing a higher fat content would initially lose more weight when cooked.

In order to carry out the procedure, beef from packages marked with different amounts of fat were formed into patties weighing 56 grams each. The three groups of beef used in this process were 80%, 90%, and 95% lean beef. The patties were cooked on a grill for eleven minutes, and were weighed for a second time, showing the percentage weight loss for each patty.

When the experiment was completed, the results showed that the 80% lean beef lost the most weight. The 95% lean beef lost the least weight, and the 90% lean beef averaged between the two. The results proved the hypothesis to be correct, with the fattiest meat losing the most weight, and the objective was reached. There was, in fact, a significant difference in weight loss between the three groups of beef.

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

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The Effects of Music on Human Heart Rate
Molly C. Snee
Park View High School, Sterling, Virginia, US

The human heart and music both possess rhythm, beats and patterns. This project will test to see if the musical beats and rhythms found in different songs will affect the beats and rhythms found in the human heart.

The study was conducted to test the hypothesis stating that three different genres of music would have a significant impact on the heart rates of human subjects. People of all ages, races and genders were asked to sit quietly in a room with no distractions while their pulse was taken before listening to any music. These heart rates were in the control group. Then, they each listened to three different genres of music and had their pulses taken after five minutes of each one. The music selections acted as the independent variables, while the outcome heart rates were the dependent variables.

As the test subjects' heart rates were recorded, many of their starting and ending heart rates were very different from each other's. Where some were predicted to rise when listening to a certain music selection, some fell, some did rise, and others stayed relatively moderate. Even the heart rates that were very similar to each other to start with would end up being very different from each other after the music.

The main conclusion that was drawn from this experiment was that music does not in fact show any pattern of being able to significantly impact human heart rates over a large group of people. The hypothesis was rejected and the graphs instead showed that the change in the people's heart rates were instead occurring do to a reason other than the music selection they happened to be listening to.

The test conducted may have covered too broad a range of test subjects to gather any meaningful results. By narrowing the group down to certain categories, more significant results may show. One possible experiment would be to test the performance of athletes while they are listening to different kinds of music. Even testing a certain group of people with a specific physical condition in common could show an impact in the results.

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

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4. Is this project a continuation? □ Yes ☒ No

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Molly Snee 2/22/06
Finalist or Team Leader Signature Date

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Selenium Levels In Horses From Loudoun County
Kaitlin Spurlock
Loudoun Valley High School, Purcellville, VA

Before experimentation began, it was hypothesized that horses maintained only on forage
grown in Loudoun County would be selenium deficient. Through testing, this hypothesis
was supported. 10cc blood was drawn from ten different horses living in the Loudoun
County area. The blood was then separated and sent to a lab where it was tested for
selenium as well as vitamin E levels. The forage these horses consumed was then sent to
the lab to be tested, along with hay and grain samples.

The results for the levels varied. The pasture was found to be selenium deficient. Two
types of hay, Ohio grown, and Virginia grown, were also tested and found to be severely
deficient. The grain, however, was in a normal range for selenium levels. The horses that
were maintained only on pasture and hay were found to be severely deficient. However,
those horses whose diets were supplemented by grain were in a normal range for
selenium levels.

It can therefore be concluded that horses maintained on pasture alone in Loudoun County,
could benefit from selenium supplementation. However, in depth knowledge of each
specific horses dietary intake is vital to the success of any feeding regimen.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL
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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
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[Signature]  7/4/06
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 Relationship Between Pacing Strategy and Running Performance in a 3200m Event
Kathryn Stephens
Heritage High School, Leesburg VA, USA

The purpose of this study was to determine if runners with the fastest race times changed their running speeds differently compared to those runners who ran slower overall race times and to answer: What is the most efficient way to run a race?

Two groups of runners (10 male and 10 female) ran three 3200m races. Using a printing stopwatch, three different pacing strategies were evaluated: Even, Negative (faster 2nd half), and Positive (faster 1st half). The mean running speed for each strategy’s 400m was calculated using each runner’s split times.

Using the mean 400m splits of each pacing strategy, data was analyzed by conducting an ANOVA on the female, male, and combined gender running times. A Repeated Measures ANOVA with a Tukey’s HSD post hoc test indicated there was a Lap effect (p < 0.01), meaning lap times changed significantly over time, and that there was an interaction between lap time and pacing strategy, meaning groups responded differently over time. A One-way ANOVA with a Tukey HSD post-hoc test concluded that the men ran faster than the women and that there was no difference between the performance times of the three pacing strategies—at least when running 3200m.

Improvements include enlarging both the sample group and number of trials, varying the race distance, and normalizing the data to reduce variation in ability among runners. Questions raised by this project include: Does gender play a role in regards to pacing strategy? At what distance should runners employ a pacing strategy?

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

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Kathryn Stephens 2/1/10

Finalist or Team Leader Signature Date

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The correlation between doctors, nurses, and hospital beds per population, the mortality rate, and the infant mortality rate
Elizabeth S. Stevens
Loudoun County High School, 415 Dry Mill Rd., Leesburg, VA, 20175, USA

The effect of the number of doctors, nurses, and hospital beds per population on mortality and infant mortality rates in the United States was analyzed by graphing these variables and population in 1980 to 2004 by region and comparing them to one another, selecting most relevant comparisons and graphing major trends over time. The correlation coefficient test was used on the minor trends to determine relation between variables. Comparisons in nurses and doctors to infant mortality, and doctors to mortality, were most related. The data for 2001 was then tested by standard deviation and concluded that no factor had a significant effect on the mortality rates on its own, which refuted the hypothesis that each factor would, when increased, lower the mortality rates on an individual basis. However, general patterns were found in the number of doctors and nurses affecting mortality, such as above a certain number per population causes decline in the rate. In the second segment, the major trends were examined to determine whether the factors combined had an effect on the mortality rates. The results supported the hypothesis in that a region with a high number of doctors per population, nurses per population, and beds per population tended to have a lower mortality and infant mortality rate. It was therefore determined that when combined, the number of doctors, nurses, and hospital beds per population do have some effect on the mortality and infant mortality rates, but that other outside factors also influence the rates.

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

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

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Elizabeth Stevens 2-15-06
Finalist or Team Leader Signature Date

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Relationship Between an Instrumentalist's Athleticism and Lung Capacity
Wilson, Katelyn M
Stone Bridge H.S. Ashburn, VA 20147, USA

The purpose of this study was to determine if a wind instrumentalist who is an athlete has a greater lung capacity than a wind instrumentalist who is not an athlete. If an instrumentalist has a greater lung capacity, then they should be able to play with more efficiency than other instrumentalists.

The independent variable in this experiment was an instrumentalist's athleticism. The dependent variable is the subject's lung capacity; however, this study tests four different groups of people to maximize comparability. The first group of four subjects contained people who were not wind instrumentalists or athletes. The second group was comprised of athletes. The third group included wind instrumentalists, and the final group contained wind instrumentalists who were also athletes. To find the lung capacities of the subjects, the experimenter used a peak flow: a small device that measures how much air is exhaled and with how much force. Each of the 12 subjects are to exhale 15 times into the peak flow and the measurement was recorded after each breath.

The results of this experiment supported the experimental hypothesis. The athletic instrumentalists had greater lung capacities than any other subject category tested.

In conclusion, the null hypothesis was rejected and the experimental hypothesis was supported; therefore in theory, an athletic instrumentalist should play their instrument with more air support, better tonality, and note sustainment.

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
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Katelyn M Wilson 2/22/06
Finalist or Team Leader Signature Date

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The Movement of an Injured Arm
Dana Woodard
Heritage High School, Leesburg VA, USA

The athletes main focus is to return to practice as soon as medically cleared. The majority of cases the injured athlete has not completely healed. Therefore, the goal is to allow the athlete to practice and simultaneously prevent any further damage to the underlying soft tissue. The athlete trainer needs to distinguish which medical tape wrap is most effective for each phase of the injury recovery period.

Evidence based treatments are being conducted to determine the most effective way to treat athletic injuries. There are primarily three different wrist wrap styles each is different wrist wraps: Neutral, reinforced neutral, and hyperflexion prevention, the hyperflexion preveisionwrap is expected to eliminate any flexion of the wrist. The measurement of flexion is any movement below the horizontal line. The hypothesis was refuted. The results indicate that hyperflexion wrap has the highest degree of flexion proceed, however it does not always eliminated flexion past horizontal line.

Although the goal of this experiment is to evaluate which wrap provides the greatest limitation of movement. As the injury heals the need to limit mobility will decrease which in turn allows the athlete to return to normal function. It is feasible that during the course of recovery that the athletic trainer could utilize different styles of wraps for the same injury.

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[Signature]
Finalist or Team Leader Signature

[Date]
7/23/06

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The Effect of Artificial Sweeteners on Streptococcus mutans
Ashleigh Zuke
Freedom High School, South Riding, VA, United States

The purpose of the experiment was to determine whether or not artificial sweeteners cause the bacteria, Streptococcus mutans, to produce more or less acid when they ingest sugars. The acid produced by the bacteria can cause caries in teeth and lead to serious tooth decay. The hypothesis being tested is if the bacteria, Streptococcus mutans, are fed both table sugar and artificial sweeteners then the bacteria being fed artificial sweeteners will produce less acid than they bacteria being fed table sugar.

To test the acid levels, the pH of different combinations of sugars and bacteria will be taken. Table sugar, sucrose, along with the artificial sweeteners sorbitol, saccharine, and aspartame will be tested. The experiment will consist of five test groups. Four sweeteners and the control, water, will be mixed into a solution containing the bacteria and the pH will be tested immediately. Then the pH will be tested again after 48 hours. The results will be compared to the average starting and ending pH for each test group.

The results and conclusions of the experiment will be available after all of the testing is conducted.

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

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

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

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Ashleigh Zuke
Finalist or Team Leader Signature

Date

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Drinking Bacteria
Seth Bond
Briar Woods High School, Ashburn, VA

In this experiment you check the amount and type of bacteria from three different water sources. It shows the amount of bacteria that you from normal drinking/tap water. It shows how bacteria can amazingly get into things that we consider clean. If bacteria is grown from tap water then it will be numerous in amount.

The experiment consisted of Petri dishes with a nutrient called agar, for the bacteria to consume. The bacteria then grew for a period of three weeks and then were destroyed using an autoclave. After this the amount of bacteria growing on the plates was recorded.

In the experiment it was found that a great amount of bacteria thrive in the places no one expects to be unclean. Also it was found that just from three water sources that people consume regularly, that there were four main types of bacteria.

The results show the hypothesis of the experiment was correct by showing that common sources of drinking water have bacteria not healthy to consume. Also all three tests reject the null hypothesis the third of which having a T-test value of 2.17 while the table had a value of 2.101. Through this experiment it is shown that bacteria are everywhere, even the place we consider to be thoroughly clean.

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. X Yes □ No

3. This project was conducted at a Registered Research Institution. □ Yes X No

4. Is this project a continuation? □ Yes X No

5. My display board includes photographs/visual depictions of humans (other than myself or my family): □ 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.

Seth Bond
Finalist or Team Leader Signature
2/24/06

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.
Mining the Deep: Preventing Microbial Growth via Heterocyclic Chemicals in Spongilla
James Choi
Dominion High School, Sterling VA

With the problem of antibiotic resistant bacteria constantly evolving, scientists have to find a way to fend off diseases caused by these microbes. The answer may lie in heterocyclic compounds. Heterocyclic compounds are cyclic compounds that contain at least two different elements as ring member atoms. The purpose of this research was to determine whether the freshwater sponge, Spongilla, contained heterocyclic compounds and exhibited antimicrobial properties. Twenty cultures of Escherichia coli were split into two groups, an experimental and a control. The control was not treated. The experimental cultures had segments of Spongilla added in the following masses: .01g, .03g, .04g, .08g, .15g, and .18g. Plates were incubated at 37 degrees celsius for 24 hours and then examined for the inhibition of bacterial growth. The null hypothesis that Spongilla would have no inhibitory effect on E. coli was refuted. Zones of inhibition existed on all plates. Further research would indicate that the extraction of the antimicrobial chemicals in Spongilla is warranted.

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
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Finalist or Team Leader Signature  02/17/06  Date

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The Effect of Time on Bacteria Growth
Erica Gusssgard
Briar Woods High School, Ashburn, VA

This project shows how time affects bacterial growth. Dots candies are dropped on the floor for 5, 10, or 30 seconds. The hypothesis was that Dots dropped on the floor for 30 seconds would collect the most bacteria. The Dot that was not dropped on the floor was the control. After they had been dropped on the floor, they were placed in a petri dish with agar. The Dots were observed and data was collected throughout the week. The petri dishes were placed on a graph board, and the squares that the bacteria occupied were counted. The independent variable is the amount of time that the Dots are left on the floor. The dependent variable is the amount of bacterial growth. The results show that a Dot left on the floor for 10 or 30 seconds had more bacteria. On the control Dots, there was hardly any bacteria growth. The amount of bacteria growth varied. On the seventh day, the most bacteria was on the Dots that had been left on the floor for either 10 or 30 seconds. The Dot that collected the most bacteria was one that had been left on the floor for 10 seconds, with 75% bacterial coverage. These findings mostly support the hypothesis. If the Dots had all been dropped in exactly the same location, then the results would be more accurate. In the Chi-Square Test, the results show that the degrees of freedom were six and the level of significance was 12.292.

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☐ 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

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[Signature]
Finalist or Team Leader Signature

[Date]
Date

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Antiseptic Agents Versus the Diameter (mm) of No-Growth Halo Around Disc
Hiatt, Hanna
Stone Bridge High School, Ashburn, Virginia 20147, USA

The purpose of this experiment was to test sage against penicillin in terms of prevention of Escherichia coli growth. Research has shown sage to have antibacterial properties, especially against drug-resistant bacteria such as E. coli. Penicillin is effective against many bacteria. Medicine in its family is prescribed to treat E. coli.

Penicillin discs and sterile filter paper discs dipped into a sage decoction were placed onto plates covered in E. coli. These were left to culture for 96 hours. After that, "halos" of no bacterial growth were formed surrounding the discs, and measured in millimeters. The larger the halo that was formed, the greater the strength of that agent against E. coli. The average halo size found around penicillin discs was 18.1 millimeters, and the average halo size found around sage discs was 6.0 millimeters. There was a statistical significant difference between sage and penicillin.

The results supported the hypothesis that penicillin would more effectively prevent E. coli growth than sage, but brings up a point of interest. Although sage is not as powerful antibacterially as penicillin, it prevented growth with a maximum halo length of 15 millimeters. This could bring up ideas for further research and a continuation of the project, perhaps employing different herbs or alternative medicines, different doses of antiseptic agents - for example, a stronger sage decoction, or different bacteria.

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
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4. Is this project a continuation?  □ Yes  □ No
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Finalist or Team Leader Signature: Hanna Hiatt
Date: 2/23/06

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 Microbial Contaminated Floodwaters on Body Identification via DNA  
Elizabeth Bratton Martin  
Dominion High School, Sterling, VA

Hurricane Katrina caused intense damage to Louisiana and much of the Gulf Coast. The class five hurricane left many bodies submerged in contaminated floodwaters. Scientists were unable to identify many of the human bodies due to possible degradation of DNA. The purpose of this research was to determine whether microbially contaminated floodwaters disrupted DNA integrity. Drosophila were allowed to reproduce and were subcultured for a three month period. They were then divided into control and experimental groups. The experimental group was divided into five test tubes, each containing two milliliters of E. coli. containing broth. The control group was submerged in uncontaminated water. DNA was extracted from the flies after five days and tested using gel electrophoresis. After the gels were allowed to run for two hours, they were removed and placed on a light box in order to make the bands visible. The null hypothesis stating that there was no correlation between the E. coli. contaminated floodwater and DNA was rejected. The Drosophila that was exposed to E. coli. provided no bands on the gels, suggesting that the DNA had been degraded by the bacteria. The DNA gel from the control group displayed bands as was expected. This research suggests the necessity of pulling bodies out of water as soon as possible so that identification via DNA is possible.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
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   - [ ] recombinant DNA  
   - [ ] non-human vertebrate animals  
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2. Student independently performed all procedures as outlined in this abstract.  
   - [x] Yes  
   - [ ] No

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   - [ ] Yes  
   - [x] No

4. Is this project a continuation?  
   - [ ] Yes  
   - [x] No

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   - [ ] Yes  
   - [x] No

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Finalist or Team Leader Signature: [Signature]  
Date: 3/14/06

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 Temperature on the Rate of Fermentation in the Wine Making Process

McNichols, Kelsey
Stone Bridge H.S., Ashburn, VA 20147, USA

This project was conducted in order to determine whether temperature affected the rate of fermentation in processes such as wine making. The hypothesis was developed based on the studies of microorganisms and biochemistry. Grape juice, containing the microorganism yeast, was controlled in three different room temperatures. One room was warm, one room was cool, and the last room maintained room temperature. Each room contained 15 bottles of grape juice.

The purpose of this experiment was to identify in which room the bottles would complete the fermentation process first. To determine whether the bottles had completed fermentation, daily readings were measured using a hydrometer. Once the hydrometer reach zero, the fermentation process was complete.

The results of the experiment were statistically significant. The control room completed fermentation within a week, which is average. As expected, the cool and warm rooms did not complete fermentation within this period. These results supported the hypothesis. However, there were results often showing no pattern. This made it hard to draw conclusions relating to why the sugar content increased and decreased. Even after researching, there was no evidence found to conclude those scattered results. Because of this, it was unclear to determine whether the bottles in these rooms would eventually complete fermentation, or not. Therefore, all readings ended when the control group reached zero.

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 [x] controlled substances [ ] human/animal tissue

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

3. This project was conducted at a Registered Research Institution. [ ] Yes [x] No

4. Is this project a continuation? [ ] Yes [x] No

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[Signature]
Finalist or Team Leader Signature

Date

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Bacteria In Our School
Jana Snelgrove
Loudoun Valley High School, Purcellville VA, USA

In this project seven environments in Loudoun Valley High School were swabbed to see how many bacterial colonies would grow. The purpose of this was to see which environment in a school might be more susceptible to bacterial growth. When an environment is exposed to more people, then a large amount of bacteria may be grown. Seven environments were swabbed with sterile swabs, three samples of each environment were taken, and the samples were placed in Petri dishes and grown in an incubator at body temperature for 3 to 5 days. The water fountain was the environment that grew the most bacteria. Because the environment is dark and damp, prime conditions were present for bacteria growth. The environment that grew the fewest colonies was the bathroom lock, although this environment is exposed to many people, it does get regular cleaning. This was not conclusive with the hypothesis.

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

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[Signature]  2-9-05

Finalist or Team Leader Signature  Date

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The Effect of Aseptic Technique on the Preparation of Micropropagation Jars
Vomdram, Kelly A.
Stone Bridge H.S., Ashburn, VA 20147, USA

This project in its present form is an observation on the effects of using aseptic technique on contamination of micropropagation jars. The beginning idea was to observe whether using aseptic technique in preparing micropropagation jars will effect how much contamination each jar contains.

The amount of contamination was put into a scale that was based on the degree of contamination and the time it took for it to occur. There were two groups of fifteen jars. Each set of jars received nutrient agar, were autoclaved and then received a plant piece.

For one group the plant pieces were handled with aseptic technique. Aseptic technique includes having the instruments that handled the plants dipped in rubbing alcohol and then burned over the flame of a Bunsen burner.

The other group was prepared with the instruments just being dipped in alcohol but not put through a flame. All of the jars were sealed and placed in a room temperature area where they both received indirect sunlight. Observations were taken throughout a four week period and a scale was created.

The results were proven to be statistically significant and the group using aseptic technique did produce less contamination than the group that did not use aseptic technique. The experimental hypothesis was supported and aseptic technique seemed to be necessary when preparing micropropagation jars.

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
5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ Yes ☒ No

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Kelly Vomdram
Finalist or Team Leader Signature
2-22-06

Date

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<td>Wellington Thomas</td>
<td>10V1220</td>
<td>Cheating In Baseball</td>
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</table>
If a curveball is thrown with raised seams will it have a more dramatic illusion to the hitter? The purpose of this experiment was to find if raised seams on a baseball are an ally of the pitcher or a foe of the pitcher. The pitch could be headed dead center right down the middle of the plate and break suddenly for a swing and a miss, strike three, or the pitch could stay dead center with just some spin and be knocked for a game winning home run.

The experiment was conducted in one day. The independent variable was the type of ball being used, raised seams or regular seams. The control was a batting practice ball with no seams. Carbon paper was hung on mats about 15 meters away from a pitching machine. All three types of balls were shot in both fastball and curveball form at the mat. Data was collected off of the paper of where each type of ball was landing in the strike zone.

Results concluded that raised seams do not help the curve of the ball, per se, movement horizontally, but they do help the drop of the ball vertically. The balls with no seams, however, moved the greatest average distance horizontally.

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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

3. This project was conducted at a Registered Research Institution. □ Yes X No

4. Is this project a continuation? □ Yes X No

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Finalist or Team Leader Signature: Zach Anderegg
Date: 02/22/06

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The Burden of Bowling With Bumpers
Chelsea Andrus
Park View High School, Sterling, VA, USA

This Experimentation of physics tests a bowler's knowledge of the friction released when using bumpers. The original point of this experiment was to determine if the amount of times a bowling ball hits a bumper affects the rate at which the ball travels. But it eventually became a matter of if the ball hits the bumpers more, does it take longer for the ball to travel down the lane.
Different angles (independent variable) were measured and placed so that one could use a handicap bowler to plot these angles. The ball was released (without extra force) at each angle and timed. The amount of times the ball came in contact with the bumper was recorded. The dependent variables were the time it takes for the ball to travel the lane and the amount of times the ball hits the bumper.
As the angle increased, the amount of times the ball hit the bumpers increased. Thus, the speed of the ball decreased. For every bump added the ball's time increased about .25 seconds. This means the speed of the ball decreased with each bump.
If it takes longer for one to bowl a game with bumpers, bowling alley managers may want to charge by time when bumpers are used. Experienced bowlers may want to spin the ball from different angles to knock more pins down. The hypothesis was accepted due to time decrease of the ball after hitting the bumpers. To further this experiment, one could test if the speed of the ball affects how many pins are knocked down.

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

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

4. Is this project a continuation?  □ Yes  □ No

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[Signature]
Chelsea Andrus  2/17/04

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The effects of different shaped iron steel on magnetic fields
Grant Bell
Broad Run High School, 21670 Ashburn Rd. Ashburn, Virginia 20147

The purpose of this experiment is to test to see whether two different shaped pieces of 22-gauge iron steel will affect the magnetic field of certain objects, and which one will do so more efficiently. The two different shaped pieces that are being used for this experiment are a straight piece of iron steel, and one that is curved. The five objects being tested are a bar magnet, a cellular phone, a hairdryer, a CD player, and an electric shaver. A magnetic field sensor is measuring the tesla of each magnetic field.

To start the experiment, the magnetic field for each object needed to be obtained, which was the control. First the magnetic field of each piece of steel was measured, which were the dependant variable. After finding each object’s own magnetic field, the magnetic field was then found of the object when it was behind the straight iron steel and then the curved iron steel. There were ten trials for each time a piece of iron steel or an object was tested. The mean of the each piece of steel would then be subtracted from the mean of the object with that piece of steel, which represents the independent variable.

The means of each object against the straight steel were then compared with each object against the curved steel, to discover which piece of steel insulated the magnetic field more affectively. According to the data, in four out of the five objects, the straight piece of iron steel insulated the object's magnetic field more efficiently then the curved piece of iron steel, supporting the hypothesis. However, when the null hypothesis was tested, it was discovered that the tests for four of the objects with both shapes of steel were not significant. The bar magnet with the straight steel and curved steel proved to be the only two tests that remained significant.

Although both shaped pieces of iron steel seemed to isolate the magnetic fields of the objects quite well, the straight iron steel did so more affectively than the curved iron steel. More studies could be done with greater magnetic fields to further test the topic.

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

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4. Is this project a continuation? [ ] Yes  [X] No

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[Signature]
Finalist or Team Leader Signature  2/21/06
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 identify various design parameters that will reduce drag on torpedos as they travel through water. Specifically, the experiment was intended to determine if biologically inspired innovations to the design would reduce drag. This was simulated by using silicon lubricant to simulate the potential benefit of the protective mucus coating that covers the scales of most fish. The hydrodynamics of the model torpedoes was measured by dropping them through a 182.88 cm tube filled with water to simulate acceleration and drag on various model designs. In this experiment the rate at which the torpedo fell determined the amount of drag created by each test design. (The slower the rate of descent, the greater the drag assuming other variables were held constant) Acceleration was measured by recording the amount of time that it took each model to travel from the top of the tube to the bottom. Several shapes and designs were tested as well designs with the application of surface lubricants. Testing in phase one of the experiment validated the concept that more "aerodynamic" shapes tended to reduce overall drag and accelerated faster. In phase two of the experiment, more traditional torpedo designs were tested utilizing the most optimum torpedo nose shapes identified during phase one. Finally, two of the four torpedoes were sprayed with silicon lubricant to reduce the amount of friction the torpedo encountered in the water. The hypothesis being that the pointed torpedo with silicon lubricant sprayed onto the surface (similar to the slick substance covering a fish’s scales) would have the least drag of any of the test torpedoes.

The results of the experiment validated the initial hypothesis. The more hydrodynamic shapes clearly could move through the water in the test apparatus faster and with less drag (Phase 1). Phase 2 of the experiment further confirmed that application of silicon to the model torpedo designs reduced drag though had less impact than the shape.

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

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Bryant Black
Finalist or Team Leader Signature

2/14/06
Date

10C1204

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Effectiveness of Plate Armor, Chainmail, Scalemail, and Steel, Aluminum, and Leather Against a Blunt Force in Terms of Peak Acceleration and Penetration

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

Finding the armors with the least peak acceleration and penetration was set up by putting together a testing model on which to place the armor to be tested and a consistent bashing device to test the effectiveness of the armor. An accelerometer and plasticine clay (implemented on the testing model) were used to measure the peak acceleration and penetration, respectively. The peak acceleration was gathered on a computer after each test (in m/s^2), while the penetration was obtained from the difference in the length of the clay before and after each test (in cm). The tests were grouped in two ways: same material versus different construction (including steel plate, steel chainmail, and steel scalemail), and different material versus same construction (steel plate, aluminum plate, and leather plate). The control (no armor) was tested (4 trials), then each 4-trial test for each armor was completed, it would be replaced with another armor continuing with the same bashing device.

The part of the hypothesis that the steel plate would have the least penetration was supported in both tests, as well as the part of the hypothesis that the steel chainmail would have the least peak acceleration in the same material versus different construction test. The part of the hypothesis that the leather plate would have the least peak acceleration in the different material versus same construction test was not supported. No test was used because this is a sample, not a population, nor were there any expected results. Averages and standard deviation are present on the data tables. Significantly enough, the leather plate had the most peak acceleration of all the armors, though research showed differently. Also, aluminum plate had more peak acceleration than steel plate; this may have been due to a armor-forming error. Peak acceleration in the same material versus different construction test was in a more reasonable order (from greatest to least): steel plate, then scalemail, and last chainmail. In both test groups, penetration followed a normal pattern as well. In the same material, varying construction, it was (from greatest to least): steel chainmail, scalemail, then plate. And in the varying material, same construction test (from greatest to least): leather plate, aluminum plate, and steel plate.

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

5. My display board includes photographs/visual depictions of humans (other than myself or my family): ☐ 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.

Andrew Budiansky
Finalist or Team Leader Signature
2/15/06

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The Effect of the Angle of Attack upon Rpm's and Thrust
James R. Callen
Heritage High School, Leesburg, Va, USA

Have you ever wondered what determines how fast an airplane can move? The propeller is the driving force of an airplane. The angle of attack on a propeller is the determining factor of how much thrust is to be produced.

This experiment was designed to test the effect of the angle of attack on thrust and Rpm's. The independent variables were the thrust produced, and the Rpm's. The thrust was measured with a gram scale, and the Rpm's were measured with a tachometer.

The results of the experiment show that the most effective angle of attack is 15 degrees. The highest Rpm's occurred at 0 degrees, but there was no thrust. These results supported my hypothesis that a 15 degree angle of attack would produce the most thrust.

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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

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Signature: James R. Callen
Date: 2/23/06

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Extreme Temperature Environments and Their Effect on the Resistance of Electricity
Caulfield, Joshua M.
Briar Woods High School, Ashburn, VA

This project was designed to imitate the possibilities of changes in our climate that may influence our current technologies. The circuitry that is present in our society may be affected if the resistance of the metal was changed because of the possible extreme climate. The results could show whether preparations should be made.

The imitations, of climatic changes, that were used for this project included heat lamps and dry ice. The results proved inconclusive, but to have had significant results, the t-test for the heat experiment needed to be above 2.048, as it was 1.05 the null hypothesis has been accepted; the t-test for the cold experiments the result of 11 needed to be lower than 2.048, so again the null hypothesis has been accepted. These results went against the original hypothesis, which stated that the cold would increase the resistance.

Special precautions had to be taken because of the dangerous nature of dry ice, which due to its near −100 degrees C burns skin on contact. The necessary precautions were taken and accidents avoided. The heat lamp also caused some problems because the flammability of the wood under the wire was not taken into account.

The implications of the results led to the conclusion that no preparations would have to be made for copper wiring since the only environments that it would be affected, are unsuitable for human habitation. However it may be advised that similar experiments should be conducted on other parts of common circuitry.

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

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

3. This project was conducted at a Registered Research Institution.  
   - [ ] Yes  
   - [x] No

4. Is this project a continuation?  
   - [ ] Yes  
   - [x] No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  
   - [x] Yes  
   - [ ] No

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[Signature]
Finalist or Team Leader Signature

Date

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The purpose of this experiment is to find the effect of the cartridge on the degree of accuracy or the most accurate in the size of the group and distance from the center. The hypothesis was that the soft point bullets would be the most accurate upon firing, which was not supported. The soft point head with a copper coating was the most accurate. The procedure starts out with making sure that the shooting area is in a safe spot. The test requires that the gun's barrel to be cleaned out every time so the bullet starts out in the same manner. There were 15 trials with five bullets shot in each trial. The targets were set at 22.86 meters and the gun was placed on a rest so it would not move as much while firing. After the trials are conducted then the targets will be measured and recorded. The results were with Mini Mag with the best distance of 0.16 cm from the center and 1.6 cm for the furthest bullet. The Winchester round was within two quarters of a centimeter from the Mini Mag in the distance for the furthest bullet for the center and the size of the group. The distance from the center was 2.73 cm and the size of the group was 2.1 cm. The control was third and it was average by not having the worst size of the grouping and the bullets were fairly in the center. The stinger bullet was fourth and it was one half a centimeter from the control. The fifth and sixth place did not do so well. The cartridge was the Remington Subsonic for fifth and the Fed champion in last place. In conclusion to this research the soft point head with copper coating shot the best and the most accurately.

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☐ non-human vertebrate animals ☐ controlled substances ☐ human/animal tissue
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Sean T. Dudek 2/3/06
Finalist or Team Leader Signature Date

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The Relationship of Density to Sound Buffering
Connor J. Forman
Broad Run High School, 21670 Ashburn Road, Ashburn, VA USA

This experiment relates to the field of Physics. The goal of the experiment is to determine if an object's density has an effect on its ability to buffer sound.

The objects would each be measured for density, and then tested for their ability to buffer sound. The control for the experiment was the reading of the test tone with no material blocking the sound source. The independent variable was the material placed over the sound source, while the dependent variable was the decibel level perceived by the decibel meter. The material was placed in front of the sound source, acting as a barrier. Then a test tone was played for ten seconds and the decibel level was recorded by the decibel meter. The researcher's hypothesis was that the higher the density of the material, the lower the decibel level would be.

This test was then conducted four times to produce a mean. The materials tested had density and the dB level means as follows: Tile-3.722, 65.5dB; Drywall-2.1988, 70.25dB; Cardboard (corrugated)-0.1501, 72.25dB; Duraceramic™-1.8106, 58.75dB; Styrofoam-0.0136, 71.25dB; Insulation-0.0263, 69.75dB; Foam Egg Crate (folded in half)-0.02301, 69.25dB; Corkboard-0.2943, 66.25dB. The material with the third highest density buffered the most sound, but on average the objects with the higher density significantly reduced the decibel level more so than the others.

Other factors of the material could affect its ability to buffer sound, such as if it's layered, or the frequency of the test tone. To fairly test the materials' properties for buffering sound, multiple test should be conducted at varying frequencies. Further studies could be conducted on how the above factors affect a material's buffering capabilities.

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Finalist or Team Leader Signature Date

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The Relationship Between Humidity and the Distance an Electric Arc Can Be Conducted by a Tesla Coil
Philip T. Hawthorne
Briar Woods High School, Ashburn, Virginia

This experiment is used to determine whether different humidity levels affect the size of an electric arc from a Tesla coil. The original idea was to measure the volts of the electric arc in different humidity levels, but further research led to this final experiment. The Tesla coil creates a brilliant electric spark that appears to be a miniature lightning bolt. The Tesla coil was tested to see, if different humidity levels, would produce different size electric arcs.

The data for this experiment was taken at two different humidity levels, one at thirty-percent, which was the room's natural level and another at sixty-percent. In the different humidity levels the Tesla coil was turned on and the maximum size bolt was created, measured and recorded. The independent variable was the humidity level while the dependent variable was the electric bolts size.

Fifteen trials were taken at each humidity level; their means were used to determine the results. The mean of the electric bolt from the thirty percent humidity level was eight and eighty-three hundredths. The sixty percent humidity levels mean was significantly less at eight and two tenths. This showed that with a higher humidity level the electric arc is limited and not as large as in dry conditions.

The results therefore refute the hypothesis which stated higher humidity would create a larger electric arc, but the results were significant and the null hypothesis was rejected with (degrees of freedom)=30, \( t = 0.05, x^2 = 2.042 \) for significance; the T-value of-5.213<2.042 and is significant.

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The Comparison Between The Compressive Strengths Of Different Concrete Mixes and Sizes
Cured In Different Conditions
Steven Zilong Hu
Loudoun County High School, Leesburg, Virginia

The purpose of the experiment was to test the compressive strength of two types of concrete and sizes in different curing conditions. Experimentation was done to gain information for specific situations where the question is asked, what type of concrete should be used, how much concrete, and how the concrete should be cured. A 3x6 inch capsule and a 4x8 inch capsule were used to show a relationship in the type of mix and curing environment. A fast set concrete mix was used and a regular set concrete mix was used. The curing conditions consisted of a field and lab environment. The field condition was tested to show the effects of natural curing conditions and the lab condition was to show the effects of concentrated curing conditions. The results of the experiment showed the compressive strength of each variable tested. The compressive strengths indicated that the primary factor was curing environment, followed by capsule size, and the weakest factor was the type of mix used. The concrete cured in the lab showed the best curing rate, followed by the 4x8 inch capsule, and the preferred type of mix was the fast set concrete mix. Analysis of the data also showed that the fast set mix, regardless of size, had a better initial curing rate in both conditions when compared to the normal set mix, but its compressive strength peaked earlier than the normal set mix and as a result, the curing rate of concrete tapered off. The ANOVA test showed that on Day 8, the P value was greater than 0.1, on Day 15, the P value was less than 0.1, on Day 22, the P value was less than 0.1, on Day 29, the P value was less than 0.1. The P value greater than 0.1 showed no difference in the environment, the P value that showed less than 0.1 showed that there was a difference in size.

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Date: 02/17/06

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The Relationship Between the Tonal Characteristics of an Acoustic Guitar to its String Type and Body Type
Bethany Janka
Heritage High School, Leesburg, Virginia USA

A guitar is an instrument whose sound is very difficult to define through words or mathematically. Different guitars have different sounds due to their material, size and shape. It can be even more difficult to describe what is different in the tonal characteristics from one guitar to another. So how do you take something such as a sound and turn it being purely subjective into something that is objective? That is what this experiment tried to do to see what the bigger influence was on a guitar's overall sound between string type and body geometry.

Two different shaped guitars were used—a dreadnought and a jumbo guitar and two different sets of strings were used—steel and nylon. The string vibration of each guitar's low E string was recorded once with the steel strings and once with the nylon strings. Using software, the frequency spectrum of each recording was able to be viewed and analyzed. Using the software, the experiment measured the energy of the primary overtones relative to the fundamental tone.

The energy in each guitar's fundamental tone, when compared to the three primary overtones, showed that there was little change from one guitar's data to the next. The results showed when the spectrums were compared there was no difference in the data significant enough to prove that any one factor was more influential than the rest. The results did not support my hypothesis since no factor (string or body type) was more influential than the other.

Category
Pick one only—mark an “X” in box at right
Behavioral and Social Science □
Biochemistry □
Botany □
Chemistry □
Computers □
Earth Sciences □
Engineering □
Environmental Sciences □
Mathematics □
Medicine and Health □
Microbiology □
Space Science □
Physics X
Zoology □

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   □ non-human vertebrate animals □ controlled substances □ human/animal tissue

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   □ Yes X No

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Bethany Janka 2/23/06
Finalist or Team Leader Signature Date

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Slowing Disasters: Changing Hurricane Winds via Acoustics
Emmy-Maria Joseph
Dominion High School, Sterling, Virginia

The 2005 hurricane season was an especially vicious one. Thousands of people were affected and uprooted from their homes because of hurricanes such as Katrina. Hurricanes are able to continue along their destructive path because of the constant high wind speeds that spur them forward. Disrupting the wind flow in a hurricane may cause the hurricane to lessen in intensity and help to minimize effects.

The purpose of this research was to determine whether energy provided in the form of acoustics would disrupt airflow. An amplifier linked to a bass guitar was placed perpendicularly to a fan. The wind speed of the air flowing from the fan was then recorded using an anemometer. Energy produced by the guitar’s sound waves interfered with the airflow and changed the wind speed. Three levels of frequency were tested: 41.3 Hz, 55 Hz, and 73.42 Hz. It was discovered that the lowest frequency level produced energy via acoustics that consistently decreased the wind speed. Hence the null hypothesis, that there would be no change in wind speed when airflow is interfered by acoustics, was refuted. Theoretically it is possible to decrease wind speed using acoustics.

Further research in constructing a device that produces enough energy to decrease the actual wind speed in a hurricane would be beneficial in applying this concept.

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Emmy Joseph 2/17/06

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The Effect of Center of Mass on the Final Velocity of a Pinewood Derby Car
Darby H. Kidwell
Park View High School, Sterling VA, USA

The purpose of this project was to determine whether placing the center of gravity further back on a Pinewood Derby car would increase the final velocity.

This was accomplished by placing weights in different positions along the Pinewood Derby car and recording how long the car took to travel down the track. The weights on the car were positioned in the front, in the back, and were distributed evenly along the car. Then by comparing the final velocity of the cars, it could be seen how the placement of the center of gravity effected the final velocity of the car.

This experiment demonstrated that the weight placement had an impact on the speed of the Pinewood Derby car. By placing the weights further back on the car, the time it took to travel down the track decreased. Placing the weights closer to the front of the car increased the time it took the car to travel down the track.

The results, which were collected, supported the hypothesis. These results could also be seen if you were to calculate how long that the Pinewood Derby car was supposed to travel down the track. In the theoretical calculation, there was a smaller benefit to moving the weights towards the back of the car than what was demonstrated by the test results.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check ALL that apply):  
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   - [] non-human vertebrate animals  
   - [] controlled substances  
   - [] human/animal tissue

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

3. This project was conducted at a Registered Research Institution.  [ ] Yes  [X] No

4. Is this project a continuation?  [ ] Yes  [X] No

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Darby Kidwell
Finalist or Team Leader Signature
2/22/00

Date

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There is No Flaw in Bernoulli's Law  
Natalie B. Liberty  
Freedom High School, South Riding, VA, United States

The objective of this project was to determine the effect that surface irregularities, i.e. dimples or raised seams, have on a ball in flight. Specifically, the purpose was to establish whether the introduction of these irregularities would contribute to the effects of drag or lift, thereby making the ball curve more in flight, or stay aloft longer. The experiment was conducted by "launching" balls from a machine designed to impact spin. Launch conditions were kept constant, and the projectiles were identical except for their surface characteristics; one was smooth, one had dimples, and one had raised seams. Flight patterns of each were measured to determine amount of curvature and/or time of flight.

The ball with dimples was observed to curve significantly more than the smooth ball when launched with side-spin and to stay aloft longer when launched with backspin. Similarly, the ball with raised seams displayed greater lift and drag characteristics than the smooth ball, although less than the dimpled ball.

It can be inferred from the results of the experiment that the introduction of surface irregularities does enhance the effects of drag and lift on a ball in flight.

Further research could certainly be done on this topic by introducing and investigating different variables into the experiment. Specifically, the size and/or weight of the spheres, number, size, depth and pattern of dimples, and height of seams could be adjusted to see how flight patterns would be affected. In addition, launch velocity, launch angle, and spin rate could be varied to observe further affects on ball flights.

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   [ ] non-human vertebrate animals  [ ] controlled substances  [ ] human/animal tissue  

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Natalie B. Liberty  2/21/06

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Sound Absorption of Home Construction Material  
Kevin S. McIntire  
Potomac Falls High School, Potomac Falls, Virginia

This experiment relates to the study of physics. Have you ever had to concentrate, but the sound of nearby outdoor or indoor activities distracts you? This experiment was performed to determine which home construction materials absorb the most sound. Several home construction materials were tested at single and double thicknesses. The independent variable was the type of home construction material (drywall, fiberglass insulation, ceiling tile, carpet, carpet pad, glass pane, ceramic tile, and styrofoam board) and the dependent variable was the amount of sound absorbed. A test box was constructed out of plywood. A sound level meter was placed at one end, and a speaker at the other. Each material was tested at five standard frequencies. The sound coefficient (the percentage of sound absorbed) and noise reduction coefficient (the average of the sound coefficients for some of the test frequencies) was computed to determine which material absorbed the most sound. The results found that dense materials, like drywall and glass pane, performed better than porous materials, like ceiling tile and fiberglass insulation. This may be because the dense materials reflected more sound during the tests. The hypothesis, which stated that the most porous material will absorb the most sound, was not supported by the data. Further research can be performed to study combinations of materials together, like drywall and fiberglass insulation, and which material should be closest to the sound source for the combination to be the most effective.

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Kevin S. McIntire  
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Archery has become a popular sport for all ages. With its popularity, an experiment regarding accuracy would be beneficial not only to the science community, but to the whole public. Screw-on field tips are used on arrows for target practice, and they come in different grains, or weights. The experiment tests four different grains for the best accuracy. The initial hypothesis before the start was that the 125-grained field tip would be most accurate from the 90, 100, and 145 other grained tips. This experiment was performed with a target on flatland with a backdrop. The archer was 12.5m from the target and each of the different grained-tips were shot and marked so that they could be measured from the bull’s-eye. This was repeated five times so that there was a total of 20 shots for each testing day. After the testing, the data was collected and conclusions were reached. The 90-grained field tipped arrow had an average of 7.6cm from the bull’s-eye. The 100-grained field tipped arrow was averaged around 8.3cm away from the bull’s-eye. The 125-grained field tipped arrow had an over-all average of 8.4cm from the bull’s-eye and the 145-grained field tipped arrow was averaged at 7cm away from the bull’s-eye. This experiment did not support the hypothesis and the 145-grained field tip yielded the most accuracy. Also, the experiment could also be changed to have more accurate results. A more experienced archer would certainly improve the data, along with a more constant setting.

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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

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

[Signature]
Finalist or Team Leader Signature
Date

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The Effects Of Color On Heat Absorption
Alex Testere
Broad Run High School, 21670 Ashburn Rd., Ashburn, VA 20147

The goal of this experiment was to understand whether colors could have any effects on the rate of thermal energy being absorbed into a substance.

In order to complete this task, water was placed into seven different jars, each jar painted a different color; red, yellow, green, blue, purple, black, and the clear control. The temperature of the water was taken and recorded before they were set for experimentation. After recording this temperature, their lids were closed and they were each placed an equal distance away from a suspended light bulb, to heat their contents. They were left to warm for 100 minutes. After the 100 minute period had passed, their temperatures were recorded again and the rate of temperature increase was calculated.

The results of this experiment showed that the control jar, simply clear glass with no color, had the highest rate of heat absorption at 0.16 degrees Fahrenheit per minute. After the control, a pattern was noticed, as the colors with the highest rate of absorption were those with the lowest wavelengths such as purple and blue. Those with the lowest heat absorption rate were those colors such as yellow and red with higher wavelengths. This leads to the conclusion that colors with lower wavelengths and higher frequencies are more energetic and able to absorb, and probably emit, more thermal radiation that those colors of lower frequencies. This may help to explain why ultraviolet rays, with relatively high frequencies can be so harmful, because they are able to maintain a high level of energy.

Further research was conducted to note of a color's wavelength could have any molecular effect on the transfer of light energy into heat energy, and the rate of energy conversion, in relation to my corresponding results.

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Alex Testere
Finalist or Team Leader Signature

2/3/06
Date

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The experimental design called for each of the five guitars to go through ten tests. Each of the five guitars was assigned to its own environment. After the ten tests were completed, average graphs were used to show overall what happens to a guitar in a specific climate. It was originally thought that guitars when exposed to low temperature or low humidity would experience a higher frequency as an end result, but this was shown to be untrue. Throughout the experimental process, nearly every single test, the strings decreased in frequency, or became flat. It was only thought that guitar strings would go flat due to a warmer climate because high temperature and high humidity cause wood to swell therefore creating a flat tone on an instrument. When a guitar was placed in environments containing high temperatures paired with high humidity levels, the tuning changed so dramatically that some of the strings did not register anywhere near their target frequency, or the frequency at which a string is considered to be in tune. For example, the string normally tuned to "B", or a frequency of 246.94 Hertz, measured up to only 196.44 Hertz, almost to the exact frequency used to tell if the string known as "G" is in tune. While testing a guitar in environments with low humidity and low temperatures, there was only a slight difference in the frequency of each individual string. One guitar that was exposed to low temperature with high humidity, did experience slight damage to its front. This was long, dark cracks, or scratches. Although some guitars did enter the experimental process with previous damage, there was no increase. In conclusion, humidity and temperature can have certain affects on guitars all by themselves, however, when working together, the results exist on a much greater scale, creating not only a fluctuation in the sound a stringed instrument can make, but creating visible damage as well. Overall, the experiment supported the hypothesis and created a way for musicians to view what can happen when an instrument isn't cared for. This was something that through previous research was not found. By completing these tests, an example has been set and hopefully many will learn how to treat their guitars.

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[Signature]  [Date]

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Cheating in Baseball
Wellington, Tom C.
Park View High School, Sterling, VA, USA

This project presents the results of four baseball bats filled with different substances (cork, sawdust, and rubber balls). The goal was to find out which bat would hit a baseball farther and with the most velocity. Each bat was tested with the same power with a batting device. This experiment was done to find the interesting results.

The test was done with each bat being swung with the same power for 25 trials for distance and velocity. The four bats were the independent variables used with the control being the bat with no substance added. The dependent variables were how far the baseball was hit and with how much velocity.

The findings of this experiment indicated that bats added with different substances did not have a positive effect on the distance a baseball was hit, but with the corked bat, it had an effect with the velocity.

The conclusions made were that corking a bat had no increased effect on the distance it could hit a baseball. However, corking a bat did have an effect on the velocity it could hit a baseball. The reason the distance was less then the control bat for the corked bat was because there was less kinetic energy in the corked bat than the control bat. The velocity was greater for the corked bat because it was lighter and could be swung slightly faster in turn allowing it to hit the baseball with greater speed.

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[Signature] Wellington 2-21-06
Finalist or Team Leader Signature Date

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<td>Rotational Transfer Dynamics of a Combined Momentum eXchange/Electro-dynamic Reboost (MXER) Space Tether System</td>
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<td>Hayden Katherine</td>
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<td>Measuring the Period of Rotation of the Sun at Different Latitudes by the Motion of Sunspots</td>
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</table>
Rotational Transfer Dynamics of a Combined Momentum eXchange/Electro-dynamic Reboost (MXER) Space Tether System
Adam Matthew Fuhrmann
Heritage High School, Leesburg VA, USA

Could space tether technology be used to send satellites into higher orbits like a large game of crack the whip? The purpose of this experiment was to determine if a momentum-transfer space tether system is capable of sending a satellite from a lower-earth orbit (LEO) to geo-transfer orbit (GTO). This transfer of momentum was determined based on tests conducted with a model tether on a low friction, 2-Dimensional, ice surface. The tests, which focused on simulating the system's angular operation, were captured on video and imported onto the computer where (x,y) coordinates of the system for each frame were determined and used to calculate changes in the angular velocity of the tether and linear velocity of the satellite over time.

Based on these calculations, a graph of the angular momentum of the tether over time was determined, using the length, weight, and angular velocity. This graph showed that, at capture, the rotating tether system transferred 16.8% of its angular momentum to the payload causing its linear velocity to increase in the orbital direction. Based upon the conceptual data, being the control, the system needs a minimum transfer of 10% of its angular momentum to the satellite for it to reach GTO. The experimental system exceeded the necessary transfer of momentum resulting in a correct hypothesis, which was verified by the error analysis showing that even with a possible 14% test error, the system still exceeds the necessary percent of momentum transfer. This conclusion illustrates the possibility of this system being applied to current space objectives.

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Measuring the Period of Rotation of the Sun at Different Latitudes by the Motion of Sunspots.
Hayden, Katherine E.
Broad Run High School, Ashburn, VA.

This experiment relates to space science, more specifically the study of the Sun, and its properties. Life upon Earth is extremely dependent on the Sun. The Sun is the source of energy for plants and eventually this energy gets transferred to us. Variations in the Sun’s output of energy can affect the Earth's climate, as well as disrupt electronic communications, which are very important in modern society. Sunspots are associated with intense magnetic fields, which affect energy output. Thus studying the motion of sunspots gives us insight on rotation of the Sun and how variations in energy may affect the Earth.

Using images of the Sun captured by the SoHo satellite, the time taken for thirty sunspots to cross the Sun's disk was measured. A grid with markings for both latitude and longitude was used to determine the sunspots absolute location. Using the time taken for the sun to appear and disappear on the sun’s disk the time taken for the sunspot to appear and disappear was calculated at different latitudes.

The analysis showed faster rotation near the equator, although statistical analysis showed low confidence in the significance of this conclusion.

The period of rotation of the sun measured at the equator measured closely with published scientific data. However, significant variations in period of rotation with latitude were not seen, but this may have been due to lack of data available showing sun spots nearer to the extremities.

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<td>Cooper Pearce</td>
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<td>The Effect of Environment on Frequency of Cricket Chirps</td>
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<td>Thomas Jennifer</td>
<td>10H1412</td>
<td>Light's Effect on Planarian Regeneration Rate</td>
</tr>
</tbody>
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Environmental Effects on Crayfish Mortality
Naeem Ashraf
Potomac Falls High School, Potomac Falls, VA

This project was designed to test the effects of environmental design on crayfish mortality. This experiment was designed as a model for possible use in blue crab (Callinectes sapidus) aquaculture. Blue crabs, during the early stages of their lifecycle, are cannibalistic. Currently, each crab has to be moved into its own compartment, to continue the maturation process. This method is labor intensive and costly due to individual tank requirements.

In an effort to solve this problem crayfish, which molt and are then subject to cannibalism, were tested in three different artificial environments to determine if the design of the tank would increase survival during molting. PVC pipes and screen were used to construct the different environmental plans.

The data collected from trial #1 supported the hypothesis that creating hiding places allowed the crayfish to elude predators and have a greater chance of surviving. Later trials did not support this finding, which may have been due to poor general health.

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Naeem Ashraf
3-21-15
Finalist or Team Leader Signature Date

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The Effects of Electromagnetic Fields on Planarian Life Processes
Veronica Butka
Briar Woods High School
Ashburn, VA

This project tested the effects of electromagnetic fields on planaria, specifically their death rate. Since planaria are often compared to humans, this experiment is designed to model a human's exposure to electromagnetic fields. The groups of planaria were exposed to different levels of electromagnetic fields while regenerating.

Groups of fifteen planaria were cut in half horizontally and then were exposed to electromagnetic field levels of zero, five, ten, and fifteen coils of 22 gauge copper wire, each powered by a AA battery. They were observed to see if the regeneration of the missing half was affected and if so, how much, compared to the planaria regenerating without exposure to an electromagnetic field. The deaths of planaria exposed were counted.

The planaria were largely affected by the electromagnetic fields, in that the majority exposed died. The Planaria not exposed regenerated healthily with only a few deaths. Planaria exposed to electromagnetic fields did not regenerate to full size, while those not exposed did. Exposed planaria seemed to be more lethargic than those not exposed. The chi-square table value was 3.841 and the calculated chi-square values were 19.2 for the control, 19.2 for 5 coils, 23.53 for 10 coils and 26.13 for 15 coils. This means the results were significant and the null hypothesis was rejected.

The Planaria were affected by the electromagnetic fields. The results supported the hypothesis. The electromagnetic fields adversely affected the planaria's life processes. Consequently these results suggest that humans may be adversely affected by exposure to electromagnetic fields.

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Veronica Butka
Finalist or Team Leader Signature 2-17-06

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RE-ESTABLISHMENT OF NATIVE VIRGINIAN SOUTHERN FLYING SQUIRREL POPULATION AT NATURE SANCTUARY
FRANK J. CHILLI
POTOMAC FALSS HIGH SCHOOL, STERLING, VIRGINIA

This project tests whether providing a safe habitat designed to the needs of a specific specie will encourage their return to a local nature sanctuary. At this sanctuary, the Southern Flying (Glaucomys volans) is being edge out by the non-native Eastern Gray Squirrel (Sciurus carolinensis).

Nesting boxes were designed and built to accommodate the smaller Glaucomys volans with entrance holes too small for competing squirrels. Boxes were placed at various distances from the feeding station. Approximately every 2 weeks boxes were checked by tapping on the tree to see if a squirrel was present. The ground was checked for hollow nuts, an indicator for these squirrels.

My study was inconclusive during the testing period. Warm weather into the winter did not encourage the use of the nesting boxes and abundant food competed with the feeding station. When there was cold weather, I found as many as 4 to 5 squirrels sharing one nesting box. Cold weather encourages the sharing of housing for the Southern Flying Squirrel, but warm weather offers more flexibility for squirrel living conditions.

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Frances Chilli 2/16/06
Finalist or Team Leader Signature Date

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Population and Diversity of Aquatic Organisms within Inflow and Outflow Cave Streams
Pearce Cooper
Harmony Intermediate School, Hamilton, VA

Because of the lacking of organic material in caves it is difficult for cave-dwelling aquatic organisms to obtain energy. Streams that flow into caves from the outside contain greater concentrations of organic material than streams that originate in the cave and flow out. Do streams that flow into the cave from the outside contain a greater diversity and number of aquatic organisms in the cave stream inside the cave than streams that originate in the cave and flow out of the cave?

I hypothesize that caves with inflowing streams will have a greater diversity and population size of aquatic organisms living in the cave stream inside the cave than caves with streams originating in the cave and flowing out of the cave. The independent variable in this experiment is whether the cave stream flows into the cave from the outside or the cave stream originates in the cave and flows out of the cave. The dependent variable in the diversity and amount of aquatic organisms collected inside the cave. As a control, organisms will be collected in the cave stream outside of where it enters or exits the cave. Water quality data will also be collected at each sampling station.

The data collected has shown that the stream that flows into Moore Cave from the outside contains a much greater number and a greater diversity of aquatic organisms in the cave stream inside the cave than the stream that originates in and flows out of Confluence Cave. Therefore the results support my hypothesis.

It can be concluded that streams that flow into the cave from the outside are better habitats for aquatic cave-dwelling organisms than streams that originate inside the cave and flow out of the cave.

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Pearce Cooper 2/15/06
Finalist or Team Leader Signature Date

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Brittany Delong  
The Effect of Temperature on the Frequency of Cricket Chirps  
Park View High School, Sterling, VA, USA  

This project in its present form is the result of experimentation on the effects of various environments on the frequency of a cricket's chirp. The independent variable is temperature and the dependent variable is frequency of cricket chirps. The hypothesis is the colder the environment, the less the cricket will chirp. The warmer the environment, the more the cricket will chirp. The initial idea was to observe which environment crickets tend to prefer and function best in.  

In the experiment crickets were tested multiple times for one minute in various different environments such as in extreme heat (80 degrees F), extreme cold (20 degrees F), and neutral (50 degrees F) temperatures. The error of the project occurs in the type of crickets purchased. Though the results were inconclusive, it is shown that genetically mutated crickets don't possess the same abilities as crickets from nature. The conclusion came to be an extreme opposite to that of my hypothesis. As it turns out, store bought crickets are genetically altered and therefore do not chirp. Therefore, all results showed no chirping and the experiment wasn't able to determine the initial goal of the project. Testing will resume with crickets purchased from Sargent Welch Company and data will be collected to determine the effects of various environments.  

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   - [ ] pathogenic agents  
   - [ ] non-human vertebrate animals  
   - [ ] controlled substances  
   - [ ] recombinant DNA  
   - [ ] human/animal tissue  

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

3. This project was conducted at a Registered Research Institution.  
   - [ ] Yes  
   - [x] No  

4. Is this project a continuation?  
   - [ ] Yes  
   - [x] No  

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   - [x] No  

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Brittany Delong  
Finalist or Team Leader Signature:  
Date: 2/20/05  

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 eyespots on a moth or butterfly's wings are a type of trickery that enables it to escape unharmed from a predator. However, not all species of Lepidoptera have these defense mechanisms. The purpose of this research was to determine whether there was a correlation between adult and larval butterflies' and moths' markings and the food they consumed. If so, then perhaps there could be genetic correlation between the markings and food source chosen which allow them to escape predation in addition to exploiting a food source better than competitors. Twenty-two butterfly and moth species' markings on adult and larval forms were analyzed. It was determined that there was a correlation in some species. For example, the Io moth and the One-eyed Sphinx moth both had one eyespot on each forewing and both feed on nothing as adults. Thus the null hypothesis that there would be no correlation between markings and food choice was partially refuted depending on the species. This research is useful in helping to determine the evolutionary history of the occurrence of certain traits and the history of feeding choices. Further research would entail field studies to determine how often these organisms were consumed as a food source for predators if allowed to feed on different food plants, such as those with which they didn't blend in.
Finding the Weight of Equus Caballus  
Virginia Horne  
Loudoun Valley High School, Purcellville, VA

Today's most popular method of weighing horses is the weight tape, but how accurate is the tape? The focus of the experiment is to look into this popular device and its inaccuracy. A little over twenty horses of different breeds, disciplines, and sizes were measured. The weight tape was wrapped around the horses' chests, and then the horses were weighed on an equine specific weight scale. The two weights were compared, the scale being the more accurate weight. It was found that the tape was severely inaccurate in many cases, 86.9% of the time the difference in the weight was over twenty pounds. According to a paired t-test, the differences in weight between the two groups is statistically significant using a 95% confidence interval. For medication doses and deworming doses this is a concern for veterinarians, who, if given a wrong weight, could underdose or overdose a horse.

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   □ human subjects  
   □ pathogenic agents  
   ☑️ non-human vertebrate animals  
   □ controlled substances  
   □ recombinant DNA  
   □ 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

5. My display board includes photographs/visual depictions of humans (other than myself or my family):  
   □ 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.

Virginia Horne  
Finalist or Team Leader Signature  
2-15-06  
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.
Effects of Different Substrates on Coral
Albert A. Huggins
Loudoun Valley High School, Purcellville, Virginia

The coral growing on the piece of metal will grow more than the coral growing on the piece of Live Rock. The experiment was done in a saltwater aquarium. After setting up the aquarium the coral started to grow and its growth was measured weekly. During the Eight weeks of experimentation the coral grew rapidly. The coral on a Live Rock substrate grew the fastest and most. The coral on a sand substrate grew slowest and second most. Finally the coral on the metal substrate at first it began to wither looking as if it were sure to die. As it slowly withered the small coral organisms spread out to populate the metal and it slowly began to grow and it grew second fastest, but had the least net growth; thus not supporting the hypothesis. The results of my experiment prove that it is possible to grow coral on metal. This means that as governments and other groups have been sinking airplanes trains and such to make up for coral growth loss they actually will be able to subsidize a coral community.

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

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[Signature]
Finalist or Team Leader Signature 02/07/06
Date

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Canis sp. Identification via Forensic Odontology
Kathryn Maxwell
Dominion High School, Sterling, VA

Forensic odontology is the study of the use of teeth in identifying individuals. It is heavily used in the identification of humans. However, its practice has not been extended extensively to other organisms. The purpose of this research was to determine whether different dogs had different bites. If so, if every dog had an impression on file, the impression could be used to solve forensic cases in the future such as dog bite cases. The impressions of upper and lower teeth were taken of thirteen dogs. Pictures were taken of the molds and then duplicated. After examining the pictures of the teeth impressions it was determined that each dog did have its own specific teeth placement. When using one picture of an impression as an "unknown" it was readily matched in a “line up” of all the dog teeth impressions. The null hypothesis stating that canine teeth impressions will not help in the identification of a dog was refuted. This research is significant because it allows canine identification particularly in the case of dog mucings which result in human death. Further research would entail the exploration of the use of forensic odontology in the identification of other animals.

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   □ 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

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Kathryn Maxwell 2/16/06
Finalist or Team Leader Signature Date

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The effects of Replenishing beaches on the Nesting of Loggerhead Turtles
Dana Nachajski
Loudoun Valley High School

The project studied was the effect of renourishing the beaches of Bald Head Island on the nesting of Loggerhead turtles. Hypothesized was that if the beaches were renourished then the number of Loggerhead turtles nest would be lower. First, different nests already present were observed. Data was collected about the number of nests from the past four years. After analysing this data it was found that renourishing beaches has a negative affect on the nesting totals, the number of nests in renourished areas as compared to that of regular beach the number was significantly lower. In conclusion the hypothesis presented was correct, renourishing beaches is done because beaches are worn down by waves, overuse, and population increase. If beach front housing was eliminated the nesting numbers would slowly rise because beaches wouldn't have to be renourished as often. To further study this topic I could observe nests and collect data from different places on the east coast, such as a beach in Florida in South Carolina, where the sand used to renourish could be different in texture and sediment size.

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   ☐ 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

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Dana Nachajski  2/15/06
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 objective of this experiment is to determine if tall cows produce more milk than short cows. Before beginning this experiment the hypothesis was stated that taller cows would give more milk. After conducting this experiment, it was found that this hypothesis was supported and that of the tested cows, the taller cows did produce more milk. All cows are given a score on stature. The score is out of 50, so all cows that were 45-50 were considered "tall" cows, and all cows with a score below 30 were considered "short" cows.

This experiment was conducted using the official DHIA (Dairy Herd Improvement Association) records. An official DHIA representative comes to the dairy farm once a month and collects records on each individual cow. These records were used as the sources of the information for this project. During this experiment, there was no interaction with the actual cows used, only the records.

After conducting this experiment it was found that the hypothesis was supported by the following data. On average the tall cows produced 9,208,832.295 74 grams of milk on their first lactation. They also produced 10,311,061.754 84 grams on their second lactation. (A lactation is the time that a cow gives milk.) The short cows produced 9,114,485.082 78 grams of milk on their first lactation and 10,285,660.582 12 grams of milk on their second lactation.

After considering these results, it was found that tall cows did give more milk. Testing will have to be conducted with a larger sample size to prove this point in a stronger manner.

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☐ 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

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[Candidate's 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.
Light's Effect on Planarian Regeneration Rate
Jennifer Thomas
Heritage High School, Leesburg, VA 20175

Zoology can be an in-depth topic of study. The project being displayed here is specific to two general topics within the study of zoology, which are planarian, and their regeneration rate responding to the light they are exposed to. The focus of the experiment was to discover if light affected the regeneration rate of planarian.

The planarian were exposed to different light amounts and observed in those set conditions over the course of fourteen days. The results proved the present hypothesis to be wrong and the correct hypothesis would be stated as follows: if planarian is exposed to no light for a period of fourteen days, then it will regenerate at a faster rate than if the planarian was exposed to constant light.

The results showed the planarian exposed to no light to have the greatest growth over the set time, followed by the control of an uncontrolled environment, similar to one the planarians would experience if in the wild, and then, the planarians kept in the light at all times showed the least amount of growth.

This experiment is rather limited in the fact of light and darkness; however, this experiment could lead to several other experiments pertaining in the use and experimentation with chemicals such as caffeine or even insect repellent to show the harmful effects planarians might go through in a typical lifetime with pollution. Pollution can also bring up a whole other realm of experiments because pollution is a way of life in many rivers and streams in which zoology occurs in; quite possibly even in the river water used in this experiment.

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   □ 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

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Jennifer M. Thomas 7/22/06
Finalist or Team Leader Signature Date

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