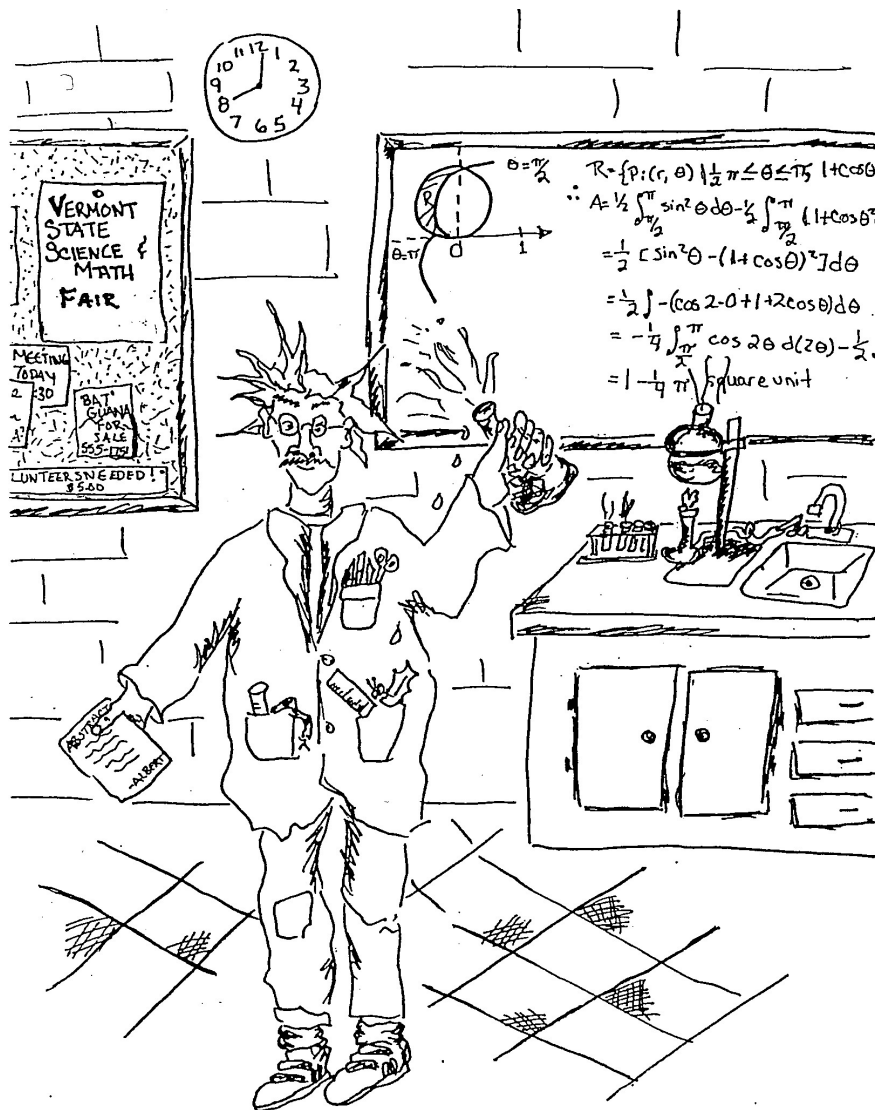


# 2014 Vermont State Science & Math Fair

*"Inspire and reward Vermont middle and high school students doing high quality research"*



Saturday March 29, 2014

Norwich University, Northfield, Vermont

# Map of Norwich University



## Schedule

7:45 - 9:00	<b>Registration</b> , Lobby of Science Building & project set up in assigned rooms
9:00 - 12:30	<b>Judging of projects</b> - Projects open to public
10:00 - 10:30	<b>Mid-morning break</b> - Students may visit exhibits
12:30 - 2:00	<b>Lunch</b> , Wise Campus Center Food Court & Take down projects
2:00 - 4:00	<b>Program &amp; Awards</b> , Dole Auditorium, Webb Hall
10:00 - 1:30	Exhibits of STEM Resources, registration lobby and the Sullivan Museum and History Center



**Floor Plan**  
**Rooms in the**  
**Engineering-Math-Science Complex**  
**Used in the VSSMF**

**First Floor**



**Floor Plan**  
**Rooms in the**  
**Engineering-Math-Science Complex**  
**Used in the VSSMF**

**Second Floor**

## Room Assignments

Room 267	B01-B19 B20-B32	General Biology Microbiology/Genetics
Room 243	B33-B45 GP01-GP07	Physiology/zoology Biology Groups
Room 235	C01-C25 GP08-GP09	General Chemistry Chemistry Groups
Room 195	G01-G09 GP10-GP11	Geology Geology Groups
Room 165	P01-P20	Physics part 1
Room 171	P21-P24 M01-M03 GP12-GP17	Physics part 2 Math Math and Physics Groups
Room 151	S01-S25	Social Sciences
Room 145	GP18-GP25	Social Sciences Groups

## **Awards Program, March 29<sup>th</sup>, 2014**

### **VSSMF Awards**

VSSMF Silver Medalists  
VSSMF Gold Medalists  
Vermont Principals' Association  
VSSMF Middle School Computer Science

### **Next Generation Scholarships**

St Michael's College  
Vermont Technical College  
Announcement about Green Mountain College  
& Norwich University's NG Scholarship winners  
Norwich University- top five juniors

### **VSSMF Local Awards**

AllEarth Renewables  
American Chemical Society, Green Mountain  
Local Section  
Biophysical Society  
Cabot Creamery Cooperative  
Dufresne Group  
Eagle Hill Institute  
Efficiency Vermont  
Entergy Vermont Yankee  
Ethical Science and Education Coalition  
Green Mountain Water Environment  
Association  
& Stockholm Jr Water Prize  
GroSolar  
Haematologic Technologies  
Logic Supply  
Nathaniel Group  
Northeast Branch, American Society of  
Microbiology  
Northeast Section Institute of Food  
Technologists  
Polhemus  
Renewable NRG Systems  
Resource Systems Group  
Society of Women Engineers  
Superior Technical Ceramics Corporation  
Tau Beta Pi  
Tcorp

### **VSSMF Local Awards, Contd.**

Ted Marsden Memorial Award  
Vermont Academy of Arts and Sciences  
Vermont Chapter, Sigma Xi  
Vermont Energy Education Program  
Vermont Organization of Nurse Leaders

### **National Awards**

#### **Grades 5-8**

Broadcom Masters

#### **Grades 9-12**

1-SWEEEP  
Genius Olympiad

### **ISEF Affiliation Awards**

#### **Grades 5-8**

U.S. Marines

#### **Grades 9-12**

### **National & Professional Society Awards**

American Meteorological Society  
American Psychological Association  
American Society of Materials  
Association of Women Geoscientists  
Intel Excellence in Computer Science  
Mu Alpha Theta  
Ricoh Sustainable Development  
Society for In Vitro Biology  
United States Metric Association  
Yale Science and Engineering Association

### **U.S. Government Non-Military Awards**

National Oceanographic and Atmospheric  
Association  
U.S. Public Health Service

### **U.S. Military Awards**

U.S. Army  
U.S. Navy  
  
ISEF Finalists

## **Vision & Mission:**

The Vermont State Science & Math Fair (VSSMF) envisions Vermont as a state where an increasing proportion of our secondary students continue their post-secondary education or training in STEM (Science, Technology, Engineering and Math), and our youth see a vibrant STEM culture and the promising future in STEM related careers and occupations in Vermont.

Our mission is to inspire and reward Vermont middle and high school students for high quality STEM inquiry by providing free access to competitions for independent student research, STEM scholarships to Vermont Colleges, and cash and recognition awards and opportunities worth almost a million dollars through participation in the VSSMF.

## **Introduction**

We believe conducting and presenting independent research prepares secondary students for post secondary education or training, and lifelong learning in STEM. The Scientific Methods empower students to innovate, solve problems and make discoveries that will impact the future. A crucial part of this process is the evaluation of their work by established scientists in the field using standards-based scoring rubrics. In this way the VSSMF contributes to the overall educational experience of the student.

The VSSMF annual inquiry based poster-presentation competition is an exciting opportunity for aspiring scientists and engineers (grades 5-12), and their teachers to showcase the results of their independent research. Each year 200 student projects, (selected from over 2000 projects statewide) address questions and solve problems in all possible areas of STEM.

Students compete for more than \$9000 in cash and \$16,000 in trip prizes donated by local organizations, and \$900,000 in scholarships to Vermont colleges. The fair is also affiliated with the International Science and Engineering Fair, and five other national and international competitions, which awards additional prizes

Projects are judged by at least three judges, separately over the course of the morning to determine winners for medals, cash, trips and scholarships. Our approximately 150 judges include scientists, secondary education faculty, dentists, physicians, nurses, military personnel and retirees, and other science related professionals from across Vermont. .

The VSSMF, sponsored by the VPA, is an all volunteer, non-profit [501(c)(3)] organization supported by Norwich University and over 100 other Vermont organizations, colleges and industry partners that share our vision and mission. We offer free outreach and professional development opportunities related to inquiry education to all public and private middle and high school science and math teachers.

The VSSMF is an all-volunteer organization. Over 80% of the \$34,000 raised annually goes to students and their teachers. The remainder goes to operating costs. The money raised comes from 53 sponsoring partners in Vermont who provide gifts or grants from \$50-\$1000. This year, these partners provided nearly \$16,800 for student and teacher trips to competitions beyond Vermont and expenses. Money also comes from 32 award sponsors (up from 27 last year) in Vermont that provide over \$8000 in prizes. In addition to the above money raised by VSSMF, four Vermont colleges provide Next Generation Scholarships totaling nearly \$900,000. Finally, our affiliation with competitions beyond Vermont provides over \$9,000 to Vermont students and their teachers. We also have judges from STEM partners in academia, industry, and professional organizations. In short, we have over 100 Vermont-based partners that share our vision joining us to make the VSSMF a huge success.

The following lists the above Vermont stakeholders who as partners and sponsors, consider investing in YOU NOW to be a wise move so they can employ you in the future when you finish your education!

#### VERMONT SPONSORING PARTNERS

Applied Research Associates Randolph	Environmental Compliance Services Brattleboro	Lyndon State College Lyndonville
ATC Associates Williston	Fairbanks Scales St Johnsbury	Med-Associates St. Albans
Bourne's Energy Morrisville	FairPoint Communications South Burlington	Mylan Technologies St Albans
Cabot Cooperative Creamery Cabot	First Wind Sheffield	New England Research White River Junction
Capital Connections Montpelier	Goodrich Corporation: United Technologies Corporation Aerospace Systems Vergennes	Northfield Savings Bank Northfield
Castleton State College Castleton	Green Mountain Antibodies Burlington	Norwich University Northfield
Catamount Research & Development St. Albans	Haematologic Technologies Essex Junction	Norwich University Applied Research Institute Northfield
Chroma Technology Corp Rockingham	Hallam, ICS South Burlington	Omya, Inc. Proctor
Concepts NREC White River Junction	Husky Injection Molding Milton	Phoenix Chemistry Services North Ferrisburg
Dufresne Group Windsor	IVEK Corporation North Springfield	Physician's Computer Company Winooski
EF Wall Barre	Johnson State College Johnson	Plasan Carbon Composites Bennington
Engleberth Construction Colchester	LORD Corporation-Microstrain Williston	Resource Systems Group White River Junction
Entergy Vermont Yankee Vernon		Rock of Ages Graniteville



Saint Michael's College Colchester	University of Vermont Burlington	Vermont Technical College Randolph Center
Stantec South Burlington	Vermont EPSCoR Colchester	Vermont Technology Council Burlington
TestAmerica Burlington Burlington	Vermont Gas Systems, Inc. Burlington	Washington Electric Co-op East Montpelier
Trumbell-Nelson Construction Montpelier	Vermont Principals' Association Montpelier	Weston & Sampson Waterbury
	Vermont Systems, Inc Essex Junction	Wright & Morrissey South Burlington

### VERMONT AWARD SPONSORS (Professional societies have Vermont members)

Vermont Principals' Association Montpelier	Green Mountain Water Environment Association & Stockholm Junior Water Prize Montpelier	Society of Women Engineers, North Country Section South Burlington
AllEarth Renewables Williston		Superior Technical Ceramics St. Albans
American Chemical Society, Green Mountain Local Section Burlington	groSolar White River Junction	Tau Beta Pi, Norwich University Chapter Northfield
Biophysical Society Rockville, MD	Haematologic Technologies, Inc. Essex Junction	TCORP Colchester
Cabot Creamery Cooperative Cabot	Nathaniel Group Inc. Vergennes	Vermont Academy of Arts and Sciences Northfield
Dufresne Group, Consulting Engineers Windsor	Northeast Branch, American Society for Microbiology Northfield	Vermont Chapter, Sigma Xi Northfield
Eagle Hill Institute Steuben, ME	Northeast Section, Institute of Food Technologists Natick, MA	Vermont Energy Education Program Burlington
Entergy Vermont Yankee, WIN Vernon	Polhemus Colchester	Vermont Organization of Nurse Leaders Montpelier
Ethical Science and Education Coalition Boston, MA	Renewable NRG Systems Hinesburg	Vermont State Science & Mathematics Fair (four separate monetary awards and travel awards to five national sites.) Northfield
	Resource Systems Group White River Junction	

### NEXT GENERATION SCHOLARSHIPS TO VERMONT COLLEGES AND UNIVERSITIES

Green Mountain College Poultney	Saint Michael's College Colchester
Norwich University Northfield	Vermont Technical College Randolph Center

## VERMONT PARTNERS PROVIDING JUDGES

### Vermont Post-Secondary STEM School Partners

Middlebury College Middlebury	University of Vermont Medical School Burlington	Saint Michael's College Colchester
Norwich University Northfield	Burlington Vermont Technical College East Randolph	Dartmouth College Hanover, New Hampshire
University of Vermont, College of Engineering and Mathematical Sciences		

### Vermont STEM Professional Partners

American Chemical Society, Green Mountain Local Section	Society of Women Engineers, North Country Section	Vermont Organization of Nurse Leaders
Vermont Entergy Women in Nuclear	Tau Beta Pi, Engineering Honor Society, Norwich University Chapter	Vermont Academy of Science and Engineering
Green Mountain Water Environment Association	Vermont Academy of Arts and Sciences Vermont Chapter of Sigma Xi	Vermont Astronomical Society
Northeast Branch, American Society for Microbiology		Vermont Genetics Network Outreach

### Vermont STEM State & Federal Government Partners

Fish & Wildlife/Agency of Natural Resources Waterbury	U.S. Army Northfield	US Navy White River Junction	US Air Force Burlington
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### Vermont STEM Industry Partners

AllEarth Renewables Williston	Island Innovations Grand Isle	Precision Bioassay Burlington
Blue Cross, Blue Shield of Vermont Berlin	LORD Corporation-Microstrain Williston	Resource Systems Group White River Junction
Carbon Catalyst Burlington	Nathaniel Group Vergennes	UTC-AS, Goodrich, Vergennes
Central Vermont Medical Center Berlin	Northfield Dental Group Northfield	VELCO Rutland
D.E.W. Construction Corporation	Northfield Elite Dental Northfield	Vermont Energy Education Program, Burlington
Hughlett Technical Services Waterbury	Phoenix Chemical Services North Ferrisburg	Weston and Sampson Engineers, Inc. Waterbury
IBM (International Business Machines) Essex Junction	Polhemus Colchester	

NAME(s)	<b>Hannah Choiniere</b>	PROJECT NUMBER	<b>G09</b>
SCHOOL	<b>Missisquoi Valley Union HS</b>	GRADE	<b>12</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>Can buffer strips reduce the effects of nutrient runoff from fields on water quality in Vermont?</b>		

### ABSTRACT

In this experiment, I compared the data of river sites in Vermont that were next to fields. I compared the values of phosphorus, and nitrogen at Hungerford Brook in St. Albans, VT and Rock River in Highgate, VT. I hypothesized that the buffer strips would reduce the effects of nutrients on the water quality in Vermont. The experiment was conducted continuously between August 13, 2013 and September 11, 2013. I performed five water collection trials and each trial involved 3 water samples for both total phosphorus and nitrogen. I analysed all the values from both rivers to see if there was a difference in the values of the two nutrients. I found that the nitrogen levels in Hungerford Brook was much higher than the nitrogen levels in Rock River. This is because while both streams are next to a farm field, there is no buffer strip to separate Hungerford Brook and the field. This means that the run off from the field can go straight into the water. This raises the nutrient levels because the runoff carries the nutrients from the field and straight into the water. When there is a buffer strip in place, the nutrients get absorbed by the grass and not as much goes into the stream. My hypothesis was confirmed by the data analyzed: buffer strips can reduce the effects of nutrient runoff from fields on water quality in Vermont.

NAME(s)	<b>Trenton Allen, Tate Hurd</b>	PROJECT NUMBER	<b>GP08</b>
SCHOOL	<b>Windsor Jr/Sr High School</b>	GRADE	<b>8</b>
TEACHER	<b>Owen Campbell</b>		
PROJECT TITLE	<b>Hydrolysis: Fueling The Future</b>		

### ABSTRACT

The purpose of this experiment is to show how we can use less or even stop the use of fossil fuels; one example is gasoline. Our testing was showing how much hydrogen we could create with such little resources and practice. Our question was, how much hydrogen and oxygen can be created with varying amounts of salt in the water. We put salt in water to speed up the process to get the hydrogen out of the battery faster. We hypothesised that there was going to be more hydrogen produced then oxygen. We did eight ten minute trials with controlled amounts of salts also with tap water. Part of our background information is that we can use hydrogen in the future for powering things that are powered by gas today. Hydrogen can be a substitute for the fossil fuels or even completely replace them if they run out. There are kind of cars that can run strictly on hydrogen are called fuel cell cars. In a time around 2015 to 2020 the auto industry is planning to be mass producing these kinds of cars. These cars will have 90% less parts.

NAME(s)	<b>Josh Baker</b>	PROJECT NUMBER	<b>P01</b>
SCHOOL	Albert D. Lawton Intermediate School	GRADE	<b>7</b>
TEACHER	Jennifer Aither		
PROJECT TITLE	<b>The Better Snowboard Binding</b>		

## ABSTRACT

My science fair project is an electromagnetic snowboard binding. I believe this invention is innovative, safer, and quicker than the present alternative. The project involves changing from click-in bindings to a self-activated magnet, in which a metal frame is around the boot, and a battery switch is wired through the coat and up, over the heart area. This means that when the button is pressed, the magnet is activated, holding the boot on. This also means that, if you fall onto your chest, the button will be pressed, setting the board free from your feet, preventing leg injury. The magnet is being created from a transformer I took from an old microwave. If this device were to be created and actually used, something like a nozzle latch like the kind on a gas pump would have to be installed onto the battery switch to hold down the magnetism. A potential problem would be that if you fell, the board would be set free and roll down the hill, but a restraint device would be built in, though they are required today anyway. This idea was generated from a conversation between me and my father after a day of skiing, where I practically spent more time clicking in to my bindings than actually snowboarding.

NAME(s)	<b>Sarah Baker</b>	PROJECT NUMBER	<b>B20</b>
SCHOOL	Green Mountain Union High School	GRADE	<b>10</b>
TEACHER	Jonathan Rice		
PROJECT TITLE	<b>Effects of Antioxidants on <i>Drosophila melanogaster</i></b>		

## ABSTRACT

The purpose of this investigation was to determine whether antioxidants have a beneficial effect on living organisms. Because they are believed to be able to fight free-radicals, it was predicted that antioxidants would have a positive effect on the lifespan of *Drosophila melanogaster*. To test this, *D. melanogaster* were exposed to a variety of antioxidants, as well as an oxidant, which were added to their food medium. The antioxidant substances tested included cranberry, blueberry, pomegranate, green tea, and vitamin C supplement. Three concentrations of the oxidant, hydrogen peroxide were also tested. The control was a standard *Drosophila* medium mixed with distilled water. Three trials were conducted for each substance using approximately 50 flies for each trial. The vials were kept at a consistent temperature between 24 and 26 degrees Celsius using a Pfizer model no. 698E incubator. The tests were run for eleven days, with the number of dead flies recorded daily. The flies exposed to antioxidants had a far lower mortality than did the flies exposed to oxidants. The one exception to this trend is vitamin C, which had a mortality midway between the antioxidants and oxidants. In addition, cranberry appeared to be the antioxidant that was most effective at reducing the mortality of *D. melanogaster*.

NAME(s)	<b>Rachael Barney</b>	PROJECT NUMBER	<b>C01</b>
SCHOOL	Northfield Middle and High School	GRADE	<b>11</b>
TEACHER	Amy Urling		
PROJECT TITLE	<b>The Effect of Different Types of Plant Material on the Amount of Heat Energy Produced (in</b>		

### ABSTRACT

With the decreasing resource of fossil fuels in the world people have turned to renewable resources to supply the energy need. The types of renewable energy are: biomass, solar, wind, hydro-power, and geothermal. My experiment tested which plant material (corn, sunflower seeds, almonds, and walnuts) would produce the most amount of heat energy for biomass. I burned one gram of each plant substance and lit it to determine which substance had the most change in mass (produces the most amount of energy) and then I took that substance for the next experiment, which was the almond. The almond had the most change in mass with .48 gram average, the sunflower seeds had a .377 gram average, the peanuts had .33 gram average, and the corn had .047 gram average. For the second test, I burned the almond at different masses (one gram, two grams, three grams, and four grams) to determine which produced the most amount of heat energy. The correlation between the amount of grams and the heat energy produced was direct with 4 grams having an average of 1.99 difference in mass, 1 gram had a .47 gram average, 2 gram had a 1.01 average, and 3 gram had 1.5 average. For the third experiment, I used one gram of almond as the control to burn and measured the time it takes for the almond to combust with an average of 82.56 seconds. My hypothesis was not supported by the data, as I thought the peanuts would burn the best when in reality the almonds burned the best. This experiment shows that different types of plant material can be used to produce energy, but some might not be the most efficient option. It also shows how mass affects burning and time, which are important in choosing biomass.

NAME(s)	<b>Nicole Barone, Alana Bigos</b>	PROJECT NUMBER	<b>GP01</b>
SCHOOL	Milton Middle School	GRADE	<b>7</b>
TEACHER	Greer Krembs Janet Smith		
PROJECT TITLE	<b>Can Common Plants Kill Bacteria?</b>		

### ABSTRACT

We were interested in plants and wanted to determine if they could be used as natural antibacterial agents. We thought that the best antibacterial would be oils from plants such as rosemary, sage, and tea tree. From our research, we learned that rosemary is used to treat skin irritation which can sometimes be caused by bacteria. Research also showed that sage and tea tree are types of disinfectants. We thought the best bacteria for our project would be from the human mouth because it is easy to obtain and will grow in warm, moist areas such as an incubator. With a fish tank filled with insulation as our incubator, we grew the bacteria on 12 petri dishes (four petri dishes per plant oil).

The average number of colonies on the four petri dishes to be treated with rosemary was 44 colonies; for sage it was 47 colonies; and the average for tea tree oil was 39 colonies. We let the bacteria grow for six days and then put two drops of oil into the center of the dishes. After five days we observed the petri dishes to see if a small ring had formed around where we placed the oils, indicating the bacterial colonies had been eliminated.

Our results indicate that there was no visible decrease in the bacterial colonies. We concluded that either the oils were not strong enough to destroy the bacteria or the bacteria was too resistant to any antibacterial effects of the oil. This was surprising to us since we had predicted that the oils would eliminate some of the bacteria. If we were to redo this experiment, we would count the actual number of colonies before and after the oils were placed in the dishes to get a more accurate measurement of any antibacterial effects.

NAME(s)	<b>Roger Barraby</b>	PROJECT NUMBER	<b>S01</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>12</b>
TEACHER	<b>Andy Marquis</b>		
PROJECT TITLE	<b>The Effect of Legislation on Marijuana Usage</b>		

## ABSTRACT

This project was about the impact of legislation on drug use, focusing on marijuana since it is a current issue and the effects that legalizing it or banning it has on teenage use. The hypothesis was that states with more severe laws against marijuana would have less teens smoking it. This may be because most teens are afraid of and abide by the laws.

Data was found about marijuana use from the Youth Risk Behavior Survey, given to high school teens around the United States every two years by the CDC. The four survey questions used were: 1. Have you ever used marijuana in your life. 2. Have you used marijuana before age 13? 3. Have you used marijuana in the past 30 days? and 4. Have you used marijuana in the past 30 days on school grounds? Information about current state legislation was found at NORML.org. The states were then split into three categories: lenient, moderate and severe, based on their legislation. Lastly, each state's usage was compared with their current legislation.

The hypothesis was supported, but not fully. States with lenient laws had the most usage. However, states with moderate laws showed less usage than states with severe laws. So, for the future states must search for that elusive happy medium.

NAME(s)	<b>Nacole Barrett, Sara Bostok</b>	PROJECT NUMBER	<b>GP07</b>
SCHOOL	<b>Chriast the King School</b>	GRADE	<b>8</b>
TEACHER	<b>Vidula Srivastava</b>		
PROJECT TITLE	<b>Stretch those muscles</b>		

## ABSTRACT

enhancing flexibility of muscles

NAME(s)	<b>Ethan Behr</b>	PROJECT NUMBER	<b>S02</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>6</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>Score = Score?</b>		

## ABSTRACT

This science fair project tested whether music would affect people's video game performance. A game was created in Scratch, and music was composed on a clavichord (piano) and recorded in GarageBand. Three identical versions of the game were created: one with no music, one with slow music, and one with fast music. The test involved the participant playing each version of the game once, and the scores were recorded for each version. The hypothesis stated that participants would perform better with the fast music version of the game than the no music or slow music versions. Research shows that music intensifies the video game experience. Research also shows that if the rhythm of the music is fast, then participants will feel rushed and nervous. The ten participants each played the no, slow, and fast music versions of the game. Their scores were recorded on the data table and the averages were calculated and illustrated on a graph. On average, the scores for the slow music version of the game were the highest. This shows that the hypothesis was incorrect. Participants scored higher on the fast music version than the no music version, but on average, participants scored highest on the slow music version out of all three games.

NAME(s)	<b>Jessica Beliveau, Olivia Miller-Johnson, Syd Frolik</b>	PROJECT NUMBER	<b>GP11</b>
SCHOOL	<b>Albert D. Lawton Intermediate School</b>	GRADE	<b>7</b>
TEACHER	<b>Jennifer Aither</b>		
PROJECT TITLE	<b>To Brine or Not to Brine</b>		

## ABSTRACT

Brine salt, which is used to melt ice stormy winter days, could be posing a threat to cars, wildlife, and plants. Classic road salt, which is still used on smaller roads, could be endangering these same things. We did 3 experiments regarding these materials: we observed the effectiveness of both materials on ice, packed snow, and fluffy snow. Then we soaked a piece of car metal in diluted brine and diluted road salt to judge the impact of the two salts on the rusting of cars. Third, we observed the effects of both materials on a chia plant to see how roadside plants would fare with both of the materials. Lastly, we conducted some research about other effects of the salts, and possible alternatives for these potentially harmful materials. This project could have lasting implication for the Agency of Transportation in Vermont, as well as for the environment. It is important to look at the aspects of this product to make educated decisions, not just decisions based on cost.

NAME(s)	<u>Emily Benz, Olivia Morana</u>	PROJECT NUMBER	<u>GP18</u>
SCHOOL	<u>Christ the King School</u>	GRADE	<u>7</u>
TEACHER	<u>Vidula Strivastava</u>		
PROJECT TITLE	<u>A Stroll Down Memory Lane</u>		

## ABSTRACT

Abstract:

Children often find learning and retaining information difficult because they are not learning in a way is effective for the way their brain has developed. Our project teaches people how to figure out which learning style helps them remember information best. Using the correct learning style for you, not only has you remember the information, but helps you store it in a way that you will remember it for a longer period of time.

Many people wonder how children are able to remember so much information in such little time. We wondered this too. The question we asked was: what is the most effective learning style for children; auditory, visual, or kinesthetic. Next, we did a series of three tests on the age group of six to seven.

To conduct the tests we took a child individually, had them look, touch, and play with a group of various objects for one minute. This is the kinesthetic test. After the minute was up, we read an age appropriate book for a minute as well. Once the reading was finished, we had the child recall what he/she could remember. This system was repeated with the visual and auditory test.

After the testing was completed, we analyzed the results. Although our hypothesis stated that we thought the kinesthetic test would have the best outcome, but our data showed that the visual test proved the best.

We hope that our project has had a positive effect on the students and teachers in our school and other schools. We are very impressed that we were able to test thirty children, and we hope we gave a better understanding on how you can determine the ways you learn best.

NAME(s)	<u>Sparsh Bhardwaj</u>	PROJECT NUMBER	<u>B21</u>
SCHOOL	<u>South Burlington High School</u>	GRADE	<u>10</u>
TEACHER	<u>Curtis Belton</u>		
PROJECT TITLE	<u>The Effect of Stimulant Drugs on Plant Growth</u>		

## ABSTRACT

The purpose of this experiment was to identify the effect various stimulant drugs had on *Pisum sativum*. South Burlington High School student Sparsh Bhardwaj, with the guidance of a mentor, highlights the usage of common drugs for humans and the effect they have on plants. It is hypothesized that the caffeine will accelerate the growth while the nicotine will hamper the growth of the plants.

The control group in this experiment consisted of two pots, filled with soil and containing *Pisum sativum* seeds. These plants will receive daily watering of five hundred milliliters, with no additional treatment. The experimental group consisted of four pots, also with soil and seed. They would get the same treatment, however, in one day of the week, they would receive one hundred milligrams of one drug, either nicotine or caffeine. The plants will be measured both qualitatively and quantitatively. Quantitatively, they will be measured in height, average leaf length, and length of pods. Qualitatively, plant color, pod color, pod shape, pod texture, and plant health will be observed.

Once the data is collected, it will be used to determine whether these substances are safe to be received by plants from external sources or not. It has many practical applications in the world of agriculture, and can determine whether these drugs provide for a viable, and safe long-term solution.



NAME(s)	<u>Olivia Bombardier</u>	PROJECT NUMBER	<u>S03</u>
SCHOOL	<u>St. Francis Xavier School</u>	GRADE	<u>7</u>
TEACHER	<u>Mary Ellen Varhue</u>		
PROJECT TITLE	<u>Can You Do Two?</u>		

### ABSTRACT

The reason I did this experiment was so I could find out how the brain copes with challenges like multitasking. Multitasking is a very important part of life today but it can cause many accidents. For instance texting and driving is one of the worst ways to multitask.

My hypothesis was if the amount of distraction increases than the time to complete a task increases. My experiment generally proved that my hypothesis was correct. Many students cannot multitask very well. There was one group that did seem to multitask successfully but there were problems with the testing.

To complete my experiment I had middle schoolers take a math test twice. The first time they had three minutes to complete fifteen problems. The second time they took a different test with the same difficulty but with a Spongebob video playing. I observed the second time they were either taking the test and looking up or they were not taking the test and just out of control laughing and singing the theme song.

My results were a little mixed for the sixth graders. One group did better with the distraction, but I believed this happened because the two tests were in different formats. They also had a period of silent reading so they were calmer than most classes. The second group of sixth graders and the seventh and eighth graders took longer when distracted.

In conclusion, I believe I demonstrated that multitasking does affect how we complete a task.

NAME(s)	<u>Kendrick Brayman</u>	PROJECT NUMBER	<u>B22</u>
SCHOOL	<u>South Burlington High School</u>	GRADE	<u>10</u>
TEACHER	<u>Curtis Belton</u>		
PROJECT TITLE	<u>Electricity and bacteria growth</u>		

### ABSTRACT

The purpose of this experiment was to determine whether small amounts of electricity can change the rate that a colony of rhizobium bacteria can grow. During this experiment it was hypothesized that the small amounts of electricity will increase the rate that colonies grow in the experimental group.

The control group in this experiment consisted of one broth of bacteria in a sterilized petri dish. The dependent variable is the bacteria in the petri dishes while the independent variable is the electricity that is added to the bacterial broth. Before experimentation begins colony size will be measured and after the experimentation process if complete the colony size will be measured again.

Data collection is incomplete as of now, but it is expected that the small amounts of electricity will increase the growth rate of the bacteria.

Some applications for this experimentation are whether it is safe to lay power lines in the ground near places that organisms live underground.

NAME(s)	<b>Keegan Brown</b>	PROJECT NUMBER	<b>B01</b>
SCHOOL	<b>Northfield Middle High School</b>	GRADE	<b>11</b>
TEACHER	<b>Amy Urling</b>		
PROJECT TITLE	<b>The Effect of Water Quality On Dog River</b>		

### ABSTRACT

○The purpose of this experiment is to show what dangers farm runoff can present to the water quality of our rivers. My hypothesis was that the farm runoff would affect the water quality of the Dog River in a negative way because of increased fertilizers. More fertilizers in water increase the amount of phosphates and nitrates in the water. This experiment involved going to the Dog River, directly next to the Dog River Farm, and running various tests including a habitat assessment, macro invertebrate analysis, and chemical analysis. The chemical analysis data was compared to the acceptable water quality levels for Vermont. The macro invertebrate analysis indicated the water quality by seeing different macro invertebrates. Lastly, the habitat assessment gave a rating of 0-20 in categories such as sediment deposition, channel alteration, and bank stability to give a total water quality rating. The habitat assessment data averages showed that two of the three sites had a good rating, while the last site had a fair rating. Site 1 had an average of .405, which is fair condition, site 2 averaged .670, which is good condition, and site 3 averaged .54, which is a fair condition. The macro invertebrate analysis indicated that two of the sites had a good rating and the last had a fair rating. Site 1 averaged 2.5, which is good condition, site 2 averaged 2.33, which is good condition, and site 3 averaged 3, which is fair condition. All data met the acceptable chemical levels for Vermont in the chemical analysis, except the pH, which was low. For all three sites, the phosphate category was far less than the acceptable level in Vermont. In conclusion, my hypothesis was not supported by the data; the Dog River farm doesn't affect the water quality of the Dog River.

NAME(s)	<b>Miya Brown</b>	PROJECT NUMBER	<b>B33</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effects of Drinking Water on Internal Body Temperature</b>		

### ABSTRACT

The purpose of this experiment is to determine whether drinking water consistently throughout the day accounts for changes in internal body temperature. According to the University of Rochester Medical Center, water helps to regulate the body temperature by absorbing heat generated by your metabolism and eliminating excess heat through perspiration. In conducting this experiment, it is hypothesized that the consistent drinking water groups body temperature will be slightly lower and more stable than the group that is not drinking water consistently throughout the day. The control group will be the group assigned to drinking water throughout the day at a consistent rate using the equation of dividing their weight in half to see how many ounces of water they should be consuming in a day. The dependent variable is body temperature as it should rely on number of ounces consumed throughout the day, while the independent variable is the amount of water consumed. Prior to testing each day, the participants will be instructed to take their body temperature and record it and at the end of the day they will do the same thing. Data collection is incomplete at this time, however, for more accurate results I want to be fully prepared before finishing up my final testing. The data will be analyzed thoroughly at the end of the five days, determining if drinking water actually does account for fluctuations in body temperature. Furthermore, my final data analysis will hopefully show if body temperature might be influenced by how much water you consume and could possibly prevent dehydration and or overheating.

NAME(s)	<b>Amanda Burke</b>	PROJECT NUMBER	<b>G01</b>
SCHOOL	<b>Missisquoi Valley Union</b>	GRADE	<b>11</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>Turning Coffee Grinds into Fertilizer</b>		

## ABSTRACT

Abstract  
Turning Coffee Grinds Into Fertilizer

○In many restaurants, stores, and other convenient places pounds of coffee grounds is wasted everyday and it goes to the landfill. After I interviewed several restaurant managers coffee grounds is a waste. Americans use 7,658,780 pounds of coffee per year. In my project I grew dill seeds in six different mixtures of coffee, fertilizer, soil, and dill seeds. In group number one I grew one half coffee and one half natural soil. In the second group I grew one half coffee and one half fertilizer. In the third group I grew one third coffee, one third fertilizer, and one third soil. In the fourth group I had all coffee. In the fifth group I had one half coffee and one half fertilizer, and in the last group I had one half dirt and one half fertilizer. I watered these plants every other day and recorded how much they grew once a week for five weeks. After growing my plants for five weeks I discovered that the plants that I grew with only coffee grew the tallest. The second tallest plants were the ones that consisted of one half coffee and the other half of either soil or fertilizer.

NAME(s)	<b>Jonathan Burke</b>	PROJECT NUMBER	<b>C02</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>8</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Energy Content</b>		

## ABSTRACT

The purpose of my science fair project is to determine the gross energy in an almond and a marshmallow. I wanted to do this project to see if the gross energy in a nut (almond) is greater than the gross energy in a marshmallow. I have always enjoyed learning facts about nutrition, and wanted to test food energy content.

My project hypothesis was: The marshmallow will have more energy content because there is energy in sugar and sugar is in marshmallows. Almonds do not have as much energy content as marshmallows do.

To investigate the energy content of the almond and the marshmallow I measured the mass of the food items in grams, measured water temperature in degrees Fahrenheit that was in a test tube, then burned each of the food items under the test tube until they were completely burned and after stirring the water twice, measured the water temperature again and recorded the results. I completed this test using five test runs for each food item to analyze my results.

The data and observations proved to me that there is a significantly higher energy content in almonds versus marshmallows because after burning the food objects the water in the test tube was much higher for the almond, meaning more energy content. The average water temperature after five tests for the almond was 185 degrees and the average water temperature after five tests for the marshmallow was 74. My experiment proves that if you want a type of food with high energy content, almonds would be a good source.

Based on my data and observations my hypothesis was found to be incorrect. I believed the marshmallow would have a higher energy content than an almond because of the significant amount of sugar that I believed would give energy.

NAME(s)	<b>Molly Burke</b>	PROJECT NUMBER	<b>B23</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Methane and DNA</b>		

## ABSTRACT

The purpose of this experiment was to determine whether, at high concentrations of methane, fibroblast lung cells would mutate. According to NASA, methane only makes up 0.00017 percent of the earth's atmosphere. The hypothesis of this experiment is that high doses of methane affect the mitosis and DNA sequence of the cells.

In this experiment, the control group and the experimental group each consisted of two samples of a fibroblast lung cell line in T25 flasks. Both of the control samples were placed in a non CO2 cultured medium in a dessicator for 6.5 hours. The two experimental samples were placed in a dessicator flushed with 43 percent methane for 6.5 hours. One sample, each from the control and experimental groups were karyotyped. The remaining samples were washed, frozen, put through a Polymerase Chain Reaction, purified, and sequenced for one DNA repair gene. The dependent variable is the culture in both flasks and the time the samples were exposed. The independent variable is the cell division and the DNA sequence.

Because the data collection is not complete at this time, speculations about the data are made. It is expected there will be no change in the mitosis of the cells, because the cell line doubles every 24 to 28 hours, meaning the cells are not highly mitotic. Because of this, not many of the cells in the samples would have been captured at metaphase. On initial microscopic examination it appeared that most of the methane exposed cells survived, therefore it is also expected that there will not be a change in the DNA repair gene.

The results can lead to the speculation that chronic exposure to methane will either affect or not affect cells.

NAME(s)	<b>Morgan Bushey</b>	PROJECT NUMBER	<b>C03</b>
SCHOOL	<b>Milton Middle School</b>	GRADE	<b>7</b>
TEACHER	<b>Janet Smith</b>		
PROJECT TITLE	<b>The Effect of Nail Products on Fingernails</b>		

## ABSTRACT

I use different fingernail products to help my hands look their best. Knowing that these are made of chemicals, I was interested in the effects of nail polish, nail polish remover with acetone, non-acetone nail polish remover, and artificial nail glue on fingernail structure and chemistry.

○Fingernails are made of a protein called keratin. I learned that many nail products are made with acetone and other solvents which are used to dissolve materials. I predicted that the products made with these solvents would break down the keratin protein in fingernails. I predicted that artificial nail glue would strip the most protein and non-acetone polish remover would strip the least.

○I used seagull feathers in this experiment since the solid ends are made of keratin and provide more material to test than fingernails. To see if the keratin breaks down over time, I found the mass of the feather samples before and after soaking them in clear nail polish, artificial nail glue, nail polish remover with acetone, and non-acetone nail polish remover. I used protein indicator strips to test for the presence of protein in the products before soaking the feathers and in the days afterward. I used egg whites as a positive control for the protein test strips and water as a negative control.

I could not test the samples in nail glue since the sample containers became glued shut. The remaining tests showed that protein was present only in the nail polish remover with acetone. The mass of feathers increased in all nail products and in water. The greatest difference in mass was from feathers in both types of nail polish removers.

○This shows that fingernails may absorb harsh chemicals from nail products, therefore making them less natural and healthy. We should consider using nail products with fewer chemicals.

NAME(s)	<b>Daniel Chang</b>	PROJECT NUMBER	<b>B02</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effect of the Environment on the Rate a Banana Peel Turns Brown</b>		

## ABSTRACT

Have you ever wondered why banana peels turn black if you leave them alone for too long? The environment plays a big role in the speed at which a banana peel blackens. An article on The Hindu, a newspaper, brings forth the point that the peel blackens due to an enzyme that is oxygen dependent.

It is hypothesized that colder temperatures and exposure to air will cause a faster time for a banana to turn brown, as tissues in the banana are broken down and the contents oxidize causing the skin to turn brown. The control group of this experiment was a group of bananas sitting on a counter in room temperature away from windows. The dependent variable was how long it would take for the bananas to turn brown. The independent variable was the environment the bananas were placed in. At the start of experimentation, the bananas were placed in their different environments, and were checked daily until the insides turned brown. After data collection, the results were compared for the bananas. Data collection has not been completed yet, but expected results are that the bananas placed in a colder environment with more exposure to oxygen will turn brown quicker than those placed in a warmer temperature in a sealed location. The data was analyzed to compare how the environment affected the rate at which the bananas blackened. The analysis will also prove how different environments can affect how well bananas are stored.

This experiment can show how people can store bananas and foods similar the best way to preserve the freshness.

NAME(s)	<b>Kylee Charest</b>	PROJECT NUMBER	<b>B24</b>
SCHOOL	<b>Weathersfield School</b>	GRADE	<b>8</b>
TEACHER	<b>David E. Lambert</b>		
PROJECT TITLE	<b>Should You Really Give Your Pooch A Smooch?</b>		

## ABSTRACT

The problem I studied was who's mouth is cleaner, a dog's or human's? I studied this question because I wanted to know if the myth that a dog's mouth is cleaner than a human's is true.

Before I started my project I found many different answers from different scientists. I also found that there could be many different types of bacteria in a dog's mouth and in a human's mouth. My hypothesis was that a human's mouth would be cleaner than a dog's mouth because we practice good oral hygiene.

I swabbed the mouths of five people. I swabbed their mouth twice. I swabbed the mouth of five dogs twice as well. I then wiped the swab covered in spit on the nutrient agar in my Petri dish. After I closed and taped shut the Petri dish I put them in the incubator for ninety-six hours. The most growth I grew was in the first twenty-four hours.

My hypothesis was not supported. Human's mouths are not cleaner than dog's mouths! Human first swab average was 294.2 colonies and the second swab was 35 colonies. The dog's first swab was 88.4 colonies and the second was 232.4 colonies. The average number of colonies found in human mouths was 164.6. The average number of colonies found in dog mouths was 160.4.

Some other questions that occurred during my experiment were that if things like age, breed, gender, type of tooth paste, having braces, or even the brand of floss you use would affect the amount of growth or the types of bacteria in your mouth. If I continued working in this field I would like to investigate if a tiger's mouth is cleaner than a lion's or a cheetah's?

NAME(s)	<b>Alexandre Chaulot</b>	PROJECT NUMBER	<b>B34</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>9</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Does Color Affect Taste</b>		

## ABSTRACT

The purpose of this experiment is to explore the effects of visual interference with the perception of taste. Coca-Cola came out with a clear coke nicknamed Coca-Cola Crystal, it failed as a product. Many consumers said it was not as good as original, even though only the tasteless caramel-colored dye was removed. My hypothesis is that color affects the perceived taste.

To conduct this test, I took a child from age 3-5 and gave them two cups of milk. One was artificially colored, and the other was normally colored. The subjects tasted both, and told me which tasted better. Then I blindfolded the child, gave them two cups of milk, one artificially colored and one normally colored, and had them taste them. They told me if the first or second cup they tasted was best.

The data I found was interesting. All but one of the children preferred the colored milk, maybe because they thought it was cooler. However, 78.57 percent of the children reached for the normal colored milk first, particularly in the class with younger children. When blindfolded, only 38.4 percent of the children said they preferred the colored milk, 52.8 percent of the children preferred normal milk, and 7.80 percent said that they tasted the same. This proves that color has a profound effect on taste.

NAME(s)	<b>Alan Chiang</b>	PROJECT NUMBER	<b>B03</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Acid Rain: The Effects of Different Types of Bedrock on Buffering Capacity</b>		

## ABSTRACT

The purpose of the experiment was to determine whether different kinds of bedrock, simulated with granite and limestone powder, would affect both the buffering capacity of the soil in the presence of acid rain and the height of the bean plants. Sulfuric acid and nitrogen oxides are introduced to rain from fossil-fuel combustion, leading to numerous environmental consequences. It was expected that the bean sprout with the granite powder would sustain more damage, making the soil pH more acidic, while the bean sprout with the limestone powder would sustain less damage, and the soil pH would be neutral.

The bean plants with granite and limestone powder was the experimental groups, while the bean plants with plain soil was the control group. The independent variable was the inclusion and type of mineral powder and whether acid rain was added, and the dependent variable was plant growth and soil acidity. Grouping five beans within one pot, after germination, half of the plants switched from regular water to acid water with pH level of four. Data was recorded each day, keeping note of germination time, changes to the seedling, and plant height.

More experimentation is needed for sufficient data, but it is predicted that the bean sprouts with the limestone bedrock would fare better than the bean sprouts with the granite bedrock in terms of height and condition. After conducting the experiment, the state of the sprouts, like color and height, would be examined and noted in the analysis portion of the experiment.

NAME(s)	<b>Katie Cleary</b>	PROJECT NUMBER	<b>C04</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>12</b>
TEACHER	Dania Marie Dezotell		
PROJECT TITLE	<b>Turning Milk into plastic</b>		

### ABSTRACT

I chose to turn milk into plastic because I thought it was an interesting thing to experiment with. I also thought that it was very neat that in the 20th century milk that was turned into plastic was used to make jewelry and ornaments. When I decided to do this experiment I wanted to see how well the plastic would hold up and see how long it would take for the plastic to form.

NAME(s)	<b>Isaac Cohen</b>	PROJECT NUMBER	<b>G02</b>
SCHOOL	South Burlington Highschool	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>The Effects of NaCl Road Dusting on the Environment</b>		

### ABSTRACT

The Effects of NaCl Road Dusting on the Environment  
by Isaac Cohen

The purpose of this lab is to determine if NaCl road dusting, or salting, has a negative effect on the environment. I hypothesized that the NaCl dusting in the winter will have a negative effect on the environment and wildlife over time. This hypothesis partially comes from research from previous studies, that state that road salt contains several harmful chemicals such as urea. Also, road salt has been proven to cause dogs and other animals to vomit and have bodily abnormalities.

The effects of salt on the environment will be tested through water samples. The salt naturally runs off from streets into ponds, rivers, and lakes, and diffuses into a solution. Water samples have been taken in bottles, during different times throughout the winter. The water will then be tested using Vernier probes to compare electrical currents, and the data will be processed and recorded until it can be compared as a percentage of salt content. Then, the research of what salt content is safe for the environment will be compared with the salt content recorded, and a conclusion will be derived. Materials will include bottles, Vernier probes, water, and a computer.

The data will be collected through bottles filled with various different water from different water sources. The data, as mentioned, will be tested for the electrical current with Vernier probes, and the higher the electricity, the higher the salt content. This data will then be analyzed as percentages, and parts per quantity of water. They will be compared with known numbers of salt tolerance for organisms, to see if the road salting is harming organisms and environments.

NAME(s)	<b>Lily Cohen</b>	PROJECT NUMBER	<b>B04</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE			

### ABSTRACT

The purpose of this experiment is to find out how gender, age, and handedness impact brain hemisphere dominance. M. Habib, D. Gayraud, A. Oliva, J. Regis, G. Salamon, and R. Khalil did a study on how handedness and gender affected the corpus callosum which connects the two hemispheres. They found connections between hemisphere dominance, gender, and handedness.

Subjects will watch a Power Point with two test slides and fill out a test sheet during the presentation. Each test page has a numbered list of ten names of colors. For each word, the color of the font does not match color named. The PowerPoint is in presentation mode. Each slide appears for 30 seconds with a 10 second transition. The data will be recorded and graphed according to gender, age, and handedness.

Data collection is currently in process. The hypothesis is that the responses of older people will be more accurate on both tests because they have had a longer time to grow and use both sides of their brains. Females will be more accurate on the test of writing down written color because they usually have better language skills. Right handed people will do better writing down the written word than the color because language is primarily a function of the left hemisphere. Left handed people will have the opposite result because the right brain is more visual.

NAME(s)	<b>Veronica Cook-Vilbrin</b>	PROJECT NUMBER	<b>S04</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>9</b>
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	<b>Evaluating Music's Affect on Short Term Memory</b>		

### ABSTRACT

Students always get yelled at by their teachers when they, the students, are listening to music while the teacher is giving a lecture because they believe it is distracting. Although I believe that music actually will help you remember the notes better when you take the test. Music is used for helping regain lost memories of people with dementia, so why wouldn't the same principle apply here? However, there are some places where my variable could change. For instance, each person obtains information differently. So one person may not do well with music, and another may do very well. Even though I can not control the outcome, I am in control of the level and questions in the tests. Each person will be asked to look at a paragraph of words that has been altered for questions. They will do this for five minutes. Then they will have another five minutes to complete a ten-question quiz on the words. They will then look at a different set of words for five minutes while listening to music. Following this, they will answer the same ten questions while listening to the same song that they were listening to while looking over the words. At this moment the only successful data collection of similar tests is for people with long term memory loss. After the conclusion of my experiment I discovered that music does affect short term memory in a positive manner; music can help improve your chance of remembering things for a test.



NAME(s)	<b>Elizabeth Croll</b>	PROJECT NUMBER	<b>S05</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effects of Television Audio on Short Term Memory</b>		

## ABSTRACT

The purpose of this experiment is to determine whether audio from a television show with constant dialogue will affect short term memory test scores. Previous experiments have investigated whether listening to music while studying would affect test scores and the subjects who studied in silence usually recalled more information. It is hypothesized that background audio from a television show with constant dialogue will prove detrimental to short term memory, causing the scores from the test taken with audio to be an average of two points lower than the scores of the tests taken in silence.

The control group in this experiment is a group of students who will watch a slideshow with simple words in silence and then directly afterwards write down as many words as they can recall. The experimental group will watch the same slideshow and record words recalled with television audio playing in the background. The dependent variable is the two sets of test scores. The independent variable is television audio playing in the background during both the slideshow and the recall period.

Data collection is incomplete at this time, however it is expected that the experimental group will remember one to two words less than the control group. The analysis will look at the average scores of both groups as well as the individual scores. The analysis will also observe any correlation between gender and test scores.

New information may show students how listening to music and television while studying can have negative effects.

NAME(s)	<b>Jasmine Crowe</b>	PROJECT NUMBER	<b>S06</b>
SCHOOL	<b>The Renaissance School</b>	GRADE	<b>5</b>
TEACHER	<b>Caryn Shield</b>		
PROJECT TITLE	<b>Look and Remember</b>		

## ABSTRACT

My experiment explored how age affects memory among kindergarten through middle school students. My hypothesis was that the middle school students (fifth, sixth, and seventh grade) would score better on a visual memory test than younger elementary students. I thought that the older volunteers would remember more of the pictures on the memory test because their brain is more developed. For my experiment, I gathered a picture of 20 random objects, and gave volunteers 30 seconds to look at the objects on the paper. Some images of the objects included everyday items such as food, people, and animals. When the 30 seconds were finished, I asked the volunteers to list as many objects as they could remember. Answers varied from grade to grade. The average score was 40% for the kindergarten through first graders, 45% for the third graders, and 65% for the fifth, sixth, and seventh graders. Therefore, the data supported my hypothesis. Some reasons for the data are that the brains of middle school students are more developed in the areas associated with memory, and they might have more practice with methods of memorization to use.

NAME(s)	<b>Tyler Daniels</b>	PROJECT NUMBER	<b>C05</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Hot N Cold</b>		

## ABSTRACT

People are always trying to save money on wood for heating their homes in the winter, and those cold nights where your wood just isn't burning are very annoying. My research question asked: Do different types of wood generate more heat (or BTUs) when burned? A BTU stands for British Thermal Unit, which is the amount of energy needed to heat one pound of water by one degree Fahrenheit. This is an important thing to know because people with wood stoves want to get the most heat for their money. My hypothesis was that White Oak was going to generate the most heat (or BTUs) when burned. I chose White Oak from four other types of wood; Walnut, Pine, Cedar, and Maple.

My hypothesis needed to be proven with an experiment, I had to use a calorimeter, which is a device that measures the heat content in different chemical reactions. First I put a small cube of wood in the bottom of the large can that I used as a calorimeter. Then I filled a smaller can with one pound of water and put that above the cube of wood. I took the water temperature and set the cube of wood on fire. When the water temperature hit its peak and I recorded that temperature. I took the difference in temperatures and plugged it into an equation that included the difference in weights from before and after I burned the cubes.

I found that White Oak did end up having the highest BTU count, it burned the slowest and got the hottest quicker than the others. Other types, like cedar, burned too quickly and didn't heat the water as much. In conclusion my hypothesis was correct, Oak did generate more heat.

NAME(s)	<b>Alexander Davis</b>	PROJECT NUMBER	<b>B05</b>
SCHOOL	<b>Missisquoi Valley Union</b>	GRADE	<b>11</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>Plastic Alternative For The Environment</b>		

## ABSTRACT

The purpose of this science fair project is to find a suitable substitute to plastic bottles. Plastic bottles is one of the highest polluting things on earth and cause many deaths of animal life each year. While they are fantastic for relief efforts they should never be used for just everyday life. Plastic is just too punishing to the environment. The planet is slowly dying to pollution and this is a great step forward to combat that. This project will be testing different alternatives to the plastic water bottle. These alternatives are a glass bottle, a wax coated carton, and an animal bladder. These were tested on their durability and mobility level. Also, their decomposition rates were taken into account. The plastic water bottle proved to be superior to the other alternatives but when the decomposition rate is taken into account then the animal bladder is the superior choice. It was incredibly durable and had the highest level of mobility without water. But, with water it was not the best choice. That's okay though because the fact that it decomposes makes it better. The glass bottle and milk carton were horrible for durability and scored medium for mobility.

NAME(s)	<b>Victoria Deatherage</b>	PROJECT NUMBER	<b>B06</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>11</b>
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	<b>The Benefits and Dangers of Blue-green Algae</b>		

## ABSTRACT

Blue-green algae has become a potential threat to our environment for: it's affecting our environment, animals, and selves. This threat matters for it will affect future generations with human/animal health, nutrient intake, the aquatic life, and environmental surroundings. This experiment will provide an explanation of what blue-green algae is, including the dangers of it. Also, the health benefits of blue-green algae will be included. Following with an opinion or observation on how the environment could be saved from blue-green algae, with an extra hypothesis on how people could create safe blue-green algae so the health benefits could be used.

My hypothesis to the outcome to my experiment and research are that finding a cure to removing blue-green algae from lakes will be extremely complex and difficult. Scientists now have not found a cure to remove blue-green algae yet for blue-green algae can be extremely toxic when handled wrong.

Now, college students from UVM and people from my EPSCoR group are currently researching how blue-green algae affect the fatty acids in fish. We will be researching how the fatty acids of fish are being affected by blue-green algae? Followed with how blue - green algae affect humans and aquatic life? After explaining the concerns of blue-green algae, I will be explaining the benefits of blue green algae. Then I will be offering an opinion on how to possibly protect the environment from blue-green algae. Furthermore, I would be doing more research, and tests on the blue-green algae to find a cure to getting rid of blue-green algae from lakes infested with blue-green algae blooms.

NAME(s)	<b>Chengzhi (Clark) Deng</b>	PROJECT NUMBER	<b>B25</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Does Physarum Polycephalum Turn on Genes to Code for Different Proteins When Exposed to Va</b>		

## ABSTRACT

The purpose of this experiment was to determine if Physarum polycephalum encased in different concentrations of glucose would turn on new genes and code for new proteins. South Burlington High School student Chengzhi (Clark) Deng and Dr. Brian Ballif of the University of Vermont highlight the usage of SDS-PAGE and mass spectrometry to determine the new proteins created by the encasement of glucose on Physarum polycephalum. The hypothesis is that the organisms regulates movement by changing the proteins that are produced.

The control group in this experiment consisted of 3 slides set-up with a sample of Physarum polycephalum placed in the center and encased in 50 milliliters of water. The experimental groups each consisted of 4 slides with a sample of Physarum polycephalum encased in 50 milliliter solutions of glucose at the concentrations of 2 percent, 1.5 percent, 1 percent, 0.5 percent weight per volume. Prior to experimentation, the bases of the slides were created using the Luria formulas and placed in an autoclave and the glucose solution was sanitized using a syringe filter, all materials used were sanitized in some way. The slides were then placed in an incubator at 25 degrees C and a bucket of water was added to simulate humidity. The slides were left in the incubator for four days before being put in separate 1.5 ml micro centrifuge tubes and put in a freezer at -80 degrees C to await further analysis.

The soluble proteins will be extracted from the organism and the soluble proteins will be subjected to SDS-PAGE to separate them by molecular weight and then stain them with coomassie blue. Bands showing major differences in intensity will be subjected to identification by mass spectrometry. The analysis will expose the new proteins created by the exposure of Physarum polycephalum to glucose.

NAME(s)	<b>Nevil Desai</b>	PROJECT NUMBER	<b>B07</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Bioremediation: Using Strains of Pseudomonas on Oil Spills</b>		

### ABSTRACT

Oil spills can drastically affect environments of both humans and animals. Estimated by the U.S. Environmental Protection Agency, there are a reported 13,000 uncontained spills every year which can kill millions of organisms and harm the future of their offspring. To keep these spills from affecting such a large population of species, mechanical containment equipment is used to contain the oil. In conjunction with mechanical means of containment, biological agents would be dispersed over the widespread oil to keep it from reaching shorelines and other sensitive habitats. A type of bacteria capable of degrading oil, mainly composed of polymers of hydrocarbons, is *Pseudomonas*. *Pseudomonas* is a genus of gamma proteobacteria, belonging to the larger family of pseudomonads. Since it can acclimate to a wide range of environments, the application of this bacteria is ideal for bioremediation. In this experiment, 4 strains of *Pseudomonas* will come in contact with 10 different oils, both refined and unrefined, as its only carbon source. The objective of this study is to find out which strain is most efficient on every oil and to see its reaction to unrefined hydrocarbons such as crude oil. The data already collected is inconclusive but further testing will quantitatively prove that a certain strain will do better on a specific type of oil. The experimentation will be through an OD detector, where one can see the performance of each strain of bacteria. The significance of the data collected in my research could be implemented when a real oil spill occurs, thus effectively remediating the most amount of oil through the strain of bacteria. New discoveries about bioremediation can pave way for ground breaking research on microorganisms, mainly bacteria, which can be used to destroy a wide variety of hazardous contaminants.

NAME(s)	<b>Nirali Desai</b>	PROJECT NUMBER	<b>B26</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Natural Antimicrobials against Antibiotic Resistant Bacteria</b>		

### ABSTRACT

The purpose of this experiment was to test natural antimicrobials from the essential oils obtained from cloves, thyme and basil against two strands of antibiotic resistant bacteria to determine if they decrease the resistance of the strands. A collaboration of many graduates from Jilin University in Changchun, China highlights the success of eugenol, an essential oil, against antibiotic resistant bacteria. In this experiment, it is predicted that the clove's essential oil will result in the greatest decrease in resistance, as it contains the highest concentration of eugenol that is proven to be effective repressing transcription of many bacteria.

This experiment consisted of two strands of *Staphylococcus aureus*: Methicillin-Resistant *S. aureus* and Methicillin-Susceptible *S. aureus*. The bacteria will be grown with e-test strips of penicillin and oxacillin to determine the difference in resistance between the groups and antibiotics. The control groups grew both strands of bacteria in favorable conditions in petri dishes. The experimental groups consisted of the bacteria being cultured separately with the essential oil from each herb. After twenty-four hours, the petri dishes' e-test strips were read to determine the change in antibiotic resistance.

Data collection is incomplete at the moment; however, it is expected that the cloves will have a greater impact in reducing antibiotic resistance in both strands of *S. aureus*. The control group's data of resistance will be compared against the experimental groups' to discover any significant changes. Furthermore, the analysis will include clinical significance compared to experimental significance post-experimentation.

New discoveries about significant decreases in antibiotic resistance through natural antimicrobials can provide essential new information to treat patients that are plagued with these diseases.

NAME(s)	<b>Richard (Tre) Diemer</b>	PROJECT NUMBER	<b>S07</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>7</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>Burning Calories With Video Games: The Truth</b>		

### ABSTRACT

○This science fair project is called "Burning Calories with Video Games". The Hypothesis was, "If a person plays a video game then the genre will increase or decrease the number of Calories Burned and the Diastolic Blood Pressure." This project designed to help understand whether a video game can burn calories by increasing heart-rate and diastolic blood pressure. Several terms and mathematical equations were learned to prepare for testing. One of which was an equation to find how many calories a person burns within two minutes. Also, 5 terms were learned including, Calorie, Heart-Rate, Pulse, Video Game and Body Weight. To set up this test a necessary element is an Xbox 360 or similar game console and an object that can measure a Diastolic Blood Pressure and Pulse. Once 4-5 games prepared for testing are picked choose one and then check the pulse three minutes into the game along with the diastolic, this would be best measuring both at the same time. When collecting data make sure to also collect the weight, age and time playing the video game, all of which are necessary in doing the math problem. The data analysis proved not only can one burn calories but different genres effect the amount of calories burned. The Hypothesis, "If a person plays a video game then the genre will increase or decrease the number of Calories Burned and the Diastolic Blood Pressure." was correct because in each case a different amount of calories burned for each genre.

NAME(s)	<b>Kylee DiMaggio</b>	PROJECT NUMBER	<b>G03</b>
SCHOOL	<b>Missisquoi Valley Union High School</b>	GRADE	<b>11</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>Evaluating the Effect of Greywater on Plant Growth</b>		

### ABSTRACT

An average two person household uses 300 gallons of water each week, or 15,600 gallons per year and almost all of this comes back as greywater. The focus question is, how does greywater affect plants and their growth? It is important to test how waste water affects plant growth because we are able to determine how the pollution of our water could affect plants and their growth. My hypothesis is: if the plants die faster or show stunted growth then the greywater negatively affects the plants. To find the results six of the same plant will be used, Five of these plants will be the controlled variable, and will be watered with clean water, and the other five will be watered with greywater. The water condition will serve as the dependent variable, and the plant will be the independent variable. All the plants were watered every day for twenty days. All six plants were also in the same environment throughout the twenty days, and checked each day. The plants will be monitored with pictures, and data will be kept with a journal that records the number of leaves, flowers, and condition of the leaves. My results proved my hypothesis wrong. At the end of the twenty days the controlled, and variable plants both showed signs of death, this observation proves that the greywater and the distilled water had very similar effects. My results show that we will be able to conserve water by using greywater to water crops, plants and as irrigation. Using greywater will conserve clean water that is used for drinking. Using greywater will also provide us with water for crops during droughts and to undeveloped countries where water is scarce.

NAME(s)	<b>Carrie Drescher</b>	PROJECT NUMBER	<b>S08</b>
SCHOOL	<b>Hinesburg Community School</b>	GRADE	<b>8</b>
TEACHER	<b>Stephanie Konowitz</b>		
PROJECT TITLE	<b>Pop Culture vs. Our Planet</b>		

## ABSTRACT

Some parts of our country's education system are strong, and some parts are weak. One of the weaker areas is social studies. I was wondering what areas of social studies are least understood, and what younger grades need to be taught more. My question was, are children in younger grades able to better identify physical features and landmarks of the world or are they able to better identify famous people or company logos? To conduct my experiment, I tested 20 first graders by showing them pictures (five pictures representing two topics: physical features/landmarks and famous people/logos) and asking them to identify the photo. My results were that famous people and logos were more easily identified. This shows that children in early grades need to be taught more about the world, such as geography, because many of them couldn't even identify simple geography such as states and continents.

NAME(s)	<b>Madison Duffy</b>	PROJECT NUMBER	<b>S09</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Facial Symmetry: Effects on perceived attractiveness</b>		

## ABSTRACT

The purpose of this experiment was to find whether symmetrical or asymmetrical faces plays a role in how attractive a person is considered to be. A study done by Mehrabian and Blum in 1997 showed that the changeable features of a person's face such as their haircut plays a bigger role in how attractive that person is thought to be than their facial symmetry. While carrying out this experiment it is hypothesized that facial symmetry is not going to play a role in how attractive a person is perceived to be.

In this experiment the students will take a 13 question multiple choice quiz that will have both symmetrical and asymmetrical faces. They will be asked of their gender and then just what pictures they find the most attractive to them. The data will be collected and then analyzed to see whether there are any relationships between gender and the type of symmetry they are attracted to.

When data collection is complete it is expected that the symmetry of faces will not play a role in how attractive a person is thought to be. The data will be analyzed first to see whether there is a differentiation between what the male and females preferred. Also the data will be analyzed as a whole to see if there was an overall agreement to whether symmetrical or asymmetrical faces are considered more attractive. This experiment can help to better understand why people are attracted to who they are attracted to especially between different genders.

NAME(s)	<b>Shea Dunlop</b>	PROJECT NUMBER	<b>C06</b>
SCHOOL	<b>Hinesburg Community School</b>	GRADE	<b>8</b>
TEACHER	<b>Stephanie Konowitz</b>		
PROJECT TITLE	<b>Udderly Earth-Saving Acids</b>		

### ABSTRACT

I was curious about which natural acid used to make casein plastic would produce the most plastic. IÆm interested in the prevention of global warming, so I chose to conduct this experiment to explore an alternative to making plastic with oil. The acids I tested were lemon juice, orange juice, and tomato juice. Lemon juice has a pH level of 2, while orange juice has pH 3 and tomato juice has pH 4. I conducted the experiment by heating three mugs of milk to 49 degrees celsius, and mixing in one tablespoon of one type of acid into each mug. I then strained the mixture, and caught what plastic each mug held in a cloth and weighed it. While making the plastic, it was interesting to think about why the acid and milk were creating plastic: When combined with acid, the polymers in the milk unfolded into long plastic chains. The lower the pH level of the fruit juice, the higher the acid content, and the more polymers unfolded to create plastic. Because lemon juice has the lowest pH level, it unfolded the most polymers to create the most casein plastic, just as I predicted.

NAME(s)	<b>Siobhan Eagan</b>	PROJECT NUMBER	<b>B27</b>
SCHOOL	<b>Saint Mary's School, Middlebury, Vermont</b>	GRADE	<b>6</b>
TEACHER	<b>Michelle Eagan</b>		
PROJECT TITLE	<b>Put bacteria in the penalty box!</b>		

### ABSTRACT

The problem I investigated was how to prevent infections from sports equipment. This is an important experiment because 2 out of 5 people get MRSA (Methicillin-resistant Staphylococcus aureus), a difficult to treat infection. MRSA is sometimes spread among athletes in locker rooms. I am trying to determine ways to decrease the number of athletes getting infections. If I cultivate bacteria from hockey equipment three ways; immediately after use, after 24 hours in the bag, and after 24 hours on a drying rack, then the most bacteria will be found on the equipment left in the bag for 24 hours. My materials were Petri dishes, hockey shin pads, microscope, sterile swabs, tape to seal Petrie dishes, helmet and towel used during hockey practice. First, I swabbed the helmet, pads, and towel within 5 minutes after use and smeared the swabs on Petri dishes. I labeled and sealed each Petri dish. I repeated this procedure, swabbing and culturing the same items after they had been stored in a zipped equipment bag for 24 hours. I allowed each set of Petri dishes to culture in a darkened space for 3 days at 64 degrees. Lastly, I compared the microbial growth between the 3 study arms. My main approach was to determine what is the best way not to get an infection from sports gear. My answer is that the best way to have fewer bacteria on the gear is to air out your equipment after practice. I agree with my hypothesis that the most bacteria grew on the equipment left in the bag. My results are important because this can reduce the number of people getting infections by airing out equipment.

NAME(s)	<b>Jared Forsythe</b>	PROJECT NUMBER	<b>C07</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Glow Temperature</b>		

### ABSTRACT

Forensic investigators use luminol to detect trace amounts of blood left at a crime scene. Luminol reacts with the iron in the blood, the iron is found in a hemoglobin. Hemoglobin is responsible for transporting oxygen in the blood of vertebrates. This project looks at how the temperature affects the blue glow in luminol. My hypothesis was that the coldest temperature would have the greatest effect, because of the theory when you put a glow stick in the freezer it is reusable. This experiment was tested in a dark storage room using a piece of graph paper, and see through cups, using a pencil to trace lines however far the glow was visible. This procedure was done again as a second trial. A time trial was set-up and done to time how long it took each different temperature to die out.

My results for trial 1 were that the hot temperature glow distance was 25 mm. ,the room temperature glow distance was 46 mm. ,and the cold temperature glow distance was 30 mm. My results for trial 2 were that the hot temperature glow distance was 29 mm. ,the room temperature glow distance was 41 mm. and the cold temperature glow distance was 32 mm. The results did not support my hypothesis. The results showed that the room temperature had the greatest effect on the blue glow in luminol. The reason that this happened was because the hot temperature had melted the crystals in the luminol faster than the other temperatures allowing it to die out quick, the cold temperature was long lasting, however it had the dimmest glow.

NAME(s)	<b>Emily Fortier, Jessica Smith, Gabrielle Williams</b>	PROJECT NUMBER	<b>GP02</b>
SCHOOL	<b>Hartford High School</b>	GRADE	<b>10</b>
TEACHER	<b>Meghan Wilson</b>		
PROJECT TITLE	<b>Dry weight vs. Mercury</b>		

### ABSTRACT

Mercury contamination in our ecosystems is becoming a big problem in todayÆs world. Half of the mercury put into the ecosystem is human caused and half of that is caused by burning coal. Fish are beginning to get mercury contamination as more people burn coal and other contaminants. When other animals and humans eat those fish they are consuming more mercury. Mercury contamination is potentially deadly to humans if they consume too much. This is the study of the effect of mercury in living organisms. This study will help us to see how much mercury is in certain areas of the country and the world. It can also help us monitor the amount of mercury in the environment in the future.If we see how much mercury content is in a dragonfly imagine how much is in a large fish that eats the dragonfly and so forth. The hypothesis of this experiment is the heavier the dragonfly the higher the mercury content.



NAME(s)	<b>Alexander Freeman</b>	PROJECT NUMBER	<b>P02</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>11</b>
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	<b>Simulation of Earthquakes Using Different Sized Lego Structures</b>		

## ABSTRACT

### Simulation of Earthquakes Using Different Sized Lego Structures

○The project I will be testing and conducting is to investigate the properties of Lego blocks by creating different height buildings and testing using a shake table. The shake table will consist of a Lego board and binder board underneath, and four rubber balls set in each corner of the boards. This test will help imitate an earthquake that can help scientists be more prepared for natural disasters. The top board will cause there to be a table on which a Lego building can be set up above. If the two corners are pulled away from each other, simulating the plate tectonics, then there will be a shaking motion which will replicate an earthquake from the Lego board when let go. The name of the distance between the two corners when pulled is called the table displacement. Models like these can help scientists or civil engineers test to see how to create more reliable infrastructures to prepare against earthquakes or tsunamis. When the trials finished, my hypothesis was that the larger the distance between any two corners the more likely the building is to fall no matter what the height is. I proved this to be correct. The dependent variable is the height of the building which is affected by the independent which is the shake table. This shows that test models are an effective way to figure out how to make infrastructures stable against destructive forces. However the materials that help buildings be ready for some of these events. Some of the materials used in a building are conglomerate rock, steel, or concrete. Over time scientists can use these materials to have controlled buildings that can withstand harmful forces.

NAME(s)	<b>Alyson Gadue</b>	PROJECT NUMBER	<b>C08</b>
SCHOOL	Milton Middle School	GRADE	<b>8</b>
TEACHER	Janet Smith		
PROJECT TITLE	<b>From Kale to Kiwi - Which Foods are Higher in Iron?</b>		

## ABSTRACT

○Minerals are important in diet to help our bodies function properly. Seventy percent of the iron in our body is found with red blood cells and is essential for oxygen transport. Some effects of low iron levels can include fatigue, anemia, dizziness, and decreased mental well-being. I decided to test different food for iron content since it is such an important dietary mineral. I tested kale, cheddar cheese, whole wheat bread, and kiwi. I know that kale is filled with many types of minerals so I predicted it would have the highest iron content.

○ I found a method that separates dissolved iron when it reacts with tannic acid in tea to form a solid precipitate. I liquified each food in a powerful blender, filtered out any solids using filter paper, and collected the liquid food extract. I made a strong tea solution boiling 3 teabags in 300 milliliters of water. A precipitate formed in some of the test tubes after adding tea solution to each food extract. I collected this precipitate on preweighed filter paper, measured the mass of the dried filter paper with precipitate and calculated the mass of the residue. These values were compared for the four foods and an iron supplement control sample.

○Cheddar cheese had the greatest residue mass and not kale as I had predicted. Kiwi had the least amount. I was not surprised by these results since I realized there were sources of error in the procedure as used. I am redoing this investigation and using finer filter paper to separate more food solids initially; testing the tea, water, and residue for iron presence; using the same mass of each food; and calculating what percent of the food extract tested is iron. It will be interesting to compare the results from both of these investigations.

NAME(s)	<b>Derek Gagnon</b>	PROJECT NUMBER	<b>B35</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effect of Sound on Tenebrio molitor Reproduction</b>		

## ABSTRACT

The purpose of this experiment was to determine whether a certain decibel level of noise changes the reproductive/growth rate of the population of Tenebrio molitor. Tenebrio molitor don't have any (yet discovered) organs that allow them to hear but they do rely on ground vibrations to navigate themselves. Sound waves are waves of vibrations that flow through the air, water and earth materials. Mealworms bred in lab scenarios like this rely on some form of vegetable, placed into their containers, as their source of water. When subjected to 80 dB of sound the population of Tenebrio molitor is expected to shrink due to increased mortality rate and decreased birth rate. The control group in this experiment is three sets of 100 mealworms in containers filled with a bedding mixture. The experimental group consists of the same number of mealworms, same volume and mass of bedding, all within the same type of containers except this group is submitted to an 80 dB level recording of a windmill. Mealworms were weighed and counted before being placed in their containers, and will be weighed and counted again after one full reproductive cycle has been completed. Along the way carrots are weighed, then placed into the tins. When taken out they are weighed again. This is to monitor the fluid intake of the mealworms along the way. If the hypothesis is supported by the data, this project will help support the argument that noise pollution due industrial windmills effects the environment.

NAME(s)	<b>Jacob Garnjost</b>	PROJECT NUMBER	<b>P03</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>10</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Shoe Horns: A Sneaker Ventilation System</b>		

## ABSTRACT

The question was posed as to how to effectively eliminate the odor from a pair of athletic sneakers without direct application from a liquid solvent or solution that way leave a residue or damage the inside of the shoe. Bacteria that appear in the shoe because of the sweat glands in the human foot cause sneaker odor. The most effective way to eliminate the odor is to attack the bacteria. By filtering in the solution into the ventilation system, the odor is attacked via the airflow. This attacks the bacteria without leaving any residue thanks to airborne antibacterial spray. The chemical used to fight the bacteria is Benzalkonium Chloride. As the air cycles through, the shoe is also aired out. This cuts down on the odor, although it does not affect the bacteria levels. In order to conduct test to see the effectiveness of the ventilation system, 25 people were gathered and asked to compare the odor of 3 pairs of shoes where one shoe was vented in each pair. In all cases the majority of the of the test subjects found the vented shoe to be less odorous. Oddly the average odor ratings of the vented shoe in pair 1 were higher. They compared at 3.56 to 3.34 out of 5. In all the other shoes the vented was rated as less odorous, especially pair 2, which had the largest difference in rating in all categories of all the pairs. The evidence and data suggests that the ventilation system worked to eliminate odor, which supports the hypothesis. The system however could use some adjustments to increase the effectiveness, such as a better housing in for the anti bacterial solution. Further testing is required in order to see the effectiveness at killing bacteria.

NAME(s)	<b>Katrina Garrow</b>	PROJECT NUMBER	<b>C09</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>8</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>This Fabric's On Fire</b>		

## ABSTRACT

The law for clothing to be fire retardant came out in 1975. I read that kids were being burned when they got close to fire because their pajamas weren't flame resistant. This summer companies may be able to make clothes without fire resistant products, therefore it will be easier to catch on fire. The purpose of my project was to see if fabric softener affects the flammability of fabric. I wanted to see what effect fabric softener has on flame resistance.

My hypothesis was I think the fabric washed in fabric softener will burn the most. I had to go to a store and find children's pajamas that had flame resistance in them. I cut them into strips and washed them in plain water, fabric softener, fabric softener and a dryer sheet, and just a plain dryer sheet. I burned them for a total of ten seconds then dunked them in water and set them on a table to dry. I measured the strips and recorded my data. My results supported my hypothesis. The fabric softener burnt off an average of 1.2 inches. The dryer sheet burnt off an average of 1 inch. The fabric softener and dryer sheet only burnt off an average of .8 inches, possibly because when the fabric softener and dryer sheet and put together they cancel each other out. If you don't wash your clothing with anything special you're safe because it only burnt any average of .6 inches.

This will contribute to people because it suggests that using fabric softener might reduce flame resistance and they will either eliminate or reduce its use. In conclusion I think I have met my objectives in this experiment.

NAME(s)	<b>Angelica Gaulin</b>	PROJECT NUMBER	<b>B36</b>
SCHOOL	<b>Randolph Educational Resource Center</b>	GRADE	<b>6</b>
TEACHER	<b>Gina Sweet</b>		
PROJECT TITLE	<b>Fingerprints</b>		

## ABSTRACT

### The Basics

Fingerprints are made up of ridges on our fingertips that can create many different patterns. There are three main types of fingerprint patterns: arches, loops, and whorls. In addition to that, two different fingerprint patterns can mix, creating a whole new pattern.

No two fingerprints are alike allowing crime scene investigators to track down criminals by using the fingerprints that were left behind. They collect fingerprints from suspects and compare them to the fingerprint found at the crime scene. Once they have found eleven similarities in one fingerprint, they then know who to arrest.

### Question

Can certain fingerprint patterns be inherited?

### Hypothesis

I believe certain fingerprint patterns can be inherited.

### Procedure

When beginning the procedure, I first fingerprinted friends and family. To fingerprint someone, you must ink one fingertip at a time. Press each fingertip onto the paper after you ink it, repeating for all ten fingers.

Once I had collected many fingerprints, I began comparing them to one another. When I had finished, I found that my hypothesis was correct: fingerprint patterns can be inherited.

NAME(s)	<b>Shelbie Gebert, Valerie Koch</b>	PROJECT NUMBER	<b>GP12</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Jennifer Townsend</b>		
PROJECT TITLE	<b>Can We Influence You?</b>		

## ABSTRACT

Being exposed to advertisements is inevitable. Advertising is found in many different forms such as newspapers, magazines, billboards, television, and clothing. This project aimed to test the effect of advertising on children, in grades third through twelfth, by asking the children to pick a number between 1 and 20, while the questioner was wearing a number. Our hypothesis stated, if a child is asked a question concerning choices, then the child will make their decision based on surrounding influences because children are impressionable. Given the null hypothesis that 5% of the children would randomly pick the advertised number, our experiment set out to see if it was statistically likely that a child would pick the advertised number more often than a random number.

In this experiment a child was randomly selected, and called into a room, with no other advertisements. The child was asked to pick a number between 1 and 20, while the questioner was wearing a jersey with the number 13 on it. No one else was in the room when the child was being questioned. This was repeated with all of the children.

We found that the null hypothesis was not supported. The number 13 came up more often than one would expect through random choices. This was especially seen in the 8th grade; they were more susceptible to advertising as evidence implied. However, we noticed 13 wasn't the only statistically significant number.

Through our experiment, we found that people are not capable of choosing a truly random number. Noticing 9 out of the 20 numbers were chosen statistically less, or more, than a random set of numbers. Showing that people often have a preconceived bias toward a certain number.

NAME(s)	<b>Kay Gilman</b>	PROJECT NUMBER	<b>S10</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Music Preference Based on Appearance or Vocal Ability</b>		

## ABSTRACT

The purpose of this project was to find out if a person chooses a music artist based on their appearance or their actual vocal ability. Females and males were asked to watch, listen, and then watch and listen to the opposite sex perform one chorus of a song. A total of five female artist and five male artist were chosen at random. The people asked to watch the random musical artist were to pick their top three artist after each test. After all data was collected, the results of each person that was tested was put into the category of appearance, vocals, or both. This was decided by which test, the vocal and video only ones, matched the closest to the text which both video and audio was being played for the person. The results showed that, for both male and females, that appearance played little role in choosing a musical artist, but still played some role in the decision process, and that vocal ability was actually the key decider.

NAME(s)	<b>Hunter Grela, Maggie Gilman</b>	PROJECT NUMBER	<b>GP14</b>
SCHOOL	<b>Windsor Jr/Sr High School</b>	GRADE	<b>7</b>
TEACHER	<b>Owen Campbell</b>		
PROJECT TITLE	<b>Bristlebots</b>		

### ABSTRACT

The purpose of this experiment with the bristlebots is to find if the length of the bristles on a bristlebot affects the speed of the Bristlebots. The track length used with each trial was the same length each time. Also, the length of the bristles on the three different Bristlebots were made proportionally smaller. Plus, each toothbrush head, vibration motor, and battery were all the same brand and size. The slant of the track was always at the same angle. The five trials for each Bristlebots were averaged out to find the average time of each Bristlebot. one of the interesting things we found after the tests were how the shorter the bristles, the stiffer, which of course affects the times and time averages. after all the tests were finished, the Bristlebot with the longest bristles won with the smallest average time, 4.37 seconds, while the one with the shortest bristles lost with the average of a pretty big 10.35 seconds. To find each average, we added up all five trial times, and divided them by 5. In the end our hypothesis was correct, the Bristlebot with the longest bristle would be the fastest. One of the reasons we said this hypothesis was because we put it into real life, such as when your dad, who has really long legs takes one step, and you as a kid, with shorter legs, might have to take two steps to keep up. Finally testing the Bristlebots was fun and new, and the results were exciting.

NAME(s)	<b>Christopher Gurney</b>	PROJECT NUMBER	<b>C10</b>
SCHOOL	<b>Weathersfield School</b>	GRADE	<b>8</b>
TEACHER	<b>David E. Lambert</b>		
PROJECT TITLE	<b>Temperature vs. Ice Melter</b>		

### ABSTRACT

I studied what effects various ice melting products have on ice and how efficiently they melt ice. My family business handles snow and ice removal as part of our income, so I thought it would be interesting to find out what products worked the best.

First, I researched what types of ice melting products are used for ice melting and the science behind melting ice in freezing temperatures. The various melting products absorb heat to melt the ice. These products use salts, additives or chlorides to melt the ice. I formed my hypothesis based on the product that I thought would be the best to work with.

My hypothesis is that Premier Ice Melter will be the most efficient at melting ice.

I froze three cups of water in aluminum pans. Then placed a quarter cup of each of the following in the pans: rock salt, rock salt with Liquid Magic, potassium chloride, Premier Ice Melter, and one plain aluminum pan of ice. I observed the temperature change in the ice every thirty minutes for three hours.

The most noticeable difference was that Premier Ice Melter made the largest drop in temperature and remained that way throughout the experiment. My hypothesis was supported. I discovered that I had to change my original hypothesis because calcium chloride is no longer available due to the damage it causes to sidewalks, pavement, grasses, etc.

If I were to investigate this project further, I would like to find out how safe Premier Ice Melter is for the environment or if there are other safer products available that work as efficiently or better, but still environmentally safe.

NAME(s)	<b>Louis Hallstrom</b>	PROJECT NUMBER	<b>P04</b>
SCHOOL	<b>Northfield Middle High school</b>	GRADE	<b>10</b>
TEACHER	<b>Amy Urling</b>		
PROJECT TITLE	<b>The Effects of different Angles, Wattage of CFL Light Bulbs, and the Color of the Polar Pa</b>		

## ABSTRACT

○This experiment was to see under which variables a solar panel could be most efficient. The variables were solar panel surface color, angles, and bulb wattage. The data for this lab was all obtained the same way, and that is through the digital multimeter that was attached to the small solar panel. For my first results the data showed that the 90 degree angle produced a significantly higher voltage, compared to the other angles (25, 45, 60, 180). The 90 degree angle produced .403 volts. The trend for this experiment with angles was as the angles got larger, the volts produced did as well, but once it gets to 90 degrees it plateaus and then declines.

○Results two included changing the wattages of CFL light bulbs (9-26 watts). My hypothesis states that the wattage and the volts produced are a direct correlation. The solar panel was placed one foot away from the light, the light was left on for only 20 seconds and then volts were recorded. The data found did support my hypothesis with the average of the 9 watt bulb was .243 volts, and the wattage of a 26 watt bulb was .308 volts.

○Results three used the solar panel at the optimum angle at 90 degrees and the panel was covered in colored cellophane (red, yellow, green, blue). My hypothesis was as the colors had a lower wave length, the amount of light that was allowed to pass through, because the darker colors absorbed more of the E.M color spectrum because it only reflects the color that it was. The colors that were darker such as green and yellow did not allow the light to access the solar panel, both produced only .0003 volts.

NAME(s)	<b>Braelin Hanbridge</b>	PROJECT NUMBER	<b>B37</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Biology of Music</b>		

## ABSTRACT

The purpose of this experiment was to determine whether listening to music while studying turns out to be helpful, or a distraction. In 1933 the scientist Rauscher claimed that after listening to Mozart for ten minutes subjects had spatial IQ scores eight and nine points higher than those who listened to relaxation instructions designed to lower blood pressure. In this experiment it is hypothesized that listening to Mozart music while studying will improve test scores.○

The control group in this experiment will be the group that reads a short story in silence and proceeds to take a short test with questions based on the story. The dependent variable is the Mozart music playing in the background while the experimental group reads the short story.

Data collection is incomplete at the moment; however it is expected that listening to Mozart music while reading the story will improve the test scores. The data will be analyzed to show which group did best, the group with the music, or the group without.

With more research like this learning methods could be improved in classrooms all around the world.

NAME(s)	<b>Xander Harrison</b>	PROJECT NUMBER	<b>P05</b>
SCHOOL	<b>The Renaissance School</b>	GRADE	<b>5</b>
TEACHER	<b>Caryn Shield</b>		
PROJECT TITLE	<b>The Piezoelectric Effect</b>		

### ABSTRACT

My experiment explored how piezoelectric crystals make electricity, and how the mass of the crystal affects how much electricity they produce. Piezoelectric crystals work by creating electricity as a result of applying mechanical pressure. My hypothesis was that crystals of larger mass would produce a greater voltage when hit with the same force as crystals of smaller mass. To test this, I made and measured the mass of several crystals and classified them based on size and shape. The crystals were made from water, cream of tartar, and soda ash. I placed each crystal in a vice to hold it steady, applied a consistent pressure by dropping the padded handle of a knife from a constant height, and used a multimeter to measure how many volts each crystal emitted when a mechanical force was applied. My data did support my hypothesis because the larger crystals did create more voltage. Also, the direction the crystal was put into the vice affected the amount of voltage it produced. Piezoelectric crystals generate a small amount of electricity. With interest in green and renewable energy and with a good imagination, it may be able to be much more useful than we thought, such as in walkways that generate electricity when people walk over them.

NAME(s)	<b>Grace Hasselbach, Alison Rouleau</b>	PROJECT NUMBER	<b>GP25</b>
SCHOOL	<b>Christ the King School</b>	GRADE	<b>7</b>
TEACHER	<b>Vidula Srivastava</b>		
PROJECT TITLE	<b>Two Birds- One Stone?</b>		

### ABSTRACT

Multitasking is a big part of modern life. People are busy, and they try to do two things at once, thinking they are doing themselves a favor. One major way students multitask is texting or listening to music while doing schoolwork.

We asked ourselves, Can people multitask successfully, or are they wasting time? We thought that the results of the activity, such as homework, would have better results without a distraction, such as texting.

For our procedure, we asked ten volunteers to read two short passages and answer questions about each passage. For the first test, there were no distractions. For the second test, our subjects had to receive and send out text messages while reading the passage and while answering questions.

We hypothesized that most our volunteers would do better on the first test. The volunteers said that they had a hard time concentrating and focusing while texting, making the second test more distracting. Most people scored higher on the first test.

We concluded that doing schoolwork with a distraction is counterproductive. Our science fair project can contribute to the lives of students because it gives them evidence that texting while doing schoolwork can lower the scores of most people.

NAME(s)	<b>Devin Hebert</b>	PROJECT NUMBER	<b>B08</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Water Bound Escherichia coli Survival in Phosphorous Filled Lake Champlain Water</b>		

## ABSTRACT

The purpose of this experiment is to determine whether the ability of E. coli to grow or reproduce at various levels Escherichia coli (E. coli) is able grow or reproduce at certain levels of phosphorus. E. coli is a bacteria that is the intestines of most organisms. Outside of the intestines E. coli can be found mainly in feces. That feces can travel into streams, rivers, and lakes which may have harmful consequences in those environments. In conducting this experiment, it is hypothesized that the E. coli will be unable to survive in the higher concentrations of phosphorous, and thrive in the lower concentrations of phosphorous.

The control group in this experiment consists of a water sample from both Lake Champlain and the Winooski River, and both E. coli and phosphorous will be added to the environment. The E. coli will be given nourishment so that it may grow and reproduce. The dependent variable is the amount of phosphorous that will be added to each container. Once phosphorous levels are stable E. coli will be entered in to each container. The E. coli in all samples will be monitored daily, and checked to see if any growth or decay has occurred.

Data collection is incomplete at this time; however, it is expected that the E. coli will not be able to survive with large concentrations of phosphorous in the environment, and will die off before experimentation is finished. An analysis will show how much each colony of E. coli grew or shrank after each day.

New discoveries around phosphorous levels and E. coli will allow the public to see whether whither high phosphorous levels promote or obstruct the growth of E. coli.

NAME(s)	<b>Mahntra Hennessey, Emily Rachek</b>	PROJECT NUMBER	<b>GP06</b>
SCHOOL	<b>Christ the King School</b>	GRADE	<b>7</b>
TEACHER	<b>Mrs. Srivastava</b>		
PROJECT TITLE	<b>Radiation and the Beanstalk</b>		

## ABSTRACT

We wanted to learn about the effects of ionizing radiation, specifically gamma and x rays, on the germination of seeds. We chose this topic because radiation in food has been debated recently, especially since the nuclear power plant explosion in Japan; the radiation went into the food and plants surrounding the area.

We went to the Rowell Building at UVM and worked with Mr. Tom Kellogg. Using the RadSource 2000, we introduced six groups of ten lima bean seeds to varying amounts of radiation from our Control Group (0 REMs) and Group One (5 REMs) to Group Five (20,000 REMs). We hypothesized that the beans introduced to a smaller amount of radiation would grow the healthiest looking while the beans with more radiation would do the opposite and either grow abnormally or not even grow at all. During our procedure, we kept the groups in separate beakers under cheesecloth and watered them twice a day until they began germinating. They were then moved into soil and seed starters under a grow lamp and were watered once a day while notes were taken.

At the end of the experiment, we recorded the plants' heights. We concluded that our hypothesis was correct. The groups with less radiation grew the fullest and most consistently while the rest of the groups had only two to three sprouts. Surprisingly, one bean in Group Four grew extremely tall. Group Five's beans did not sprout at all; when one of the beans was dug up, it resembled white mush.

There were no variables in our experiment except for the different amounts of radiation introduced to the seeds. If this topic was to be explored further, we would recommend having larger groups and having the experiment go on for longer than our twenty five days.



NAME(s)	<b>Elisha Herring</b>	PROJECT NUMBER	<b>S11</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Memory and Bilingualism</b>		

## ABSTRACT

The purpose of this experiment was to compare the working memories of monolingual people and bilingual people and to determine which is stronger. A pair of studies done at the University of Granada and the University of York with a total number of 181 subjects between 5 and 7 years old resulted in bilingual subjects having stronger scores in various memory tests. It is hypothesized that bilingual subjects will have stronger working memories than monolingual subjects.

Both bilingual and monolingual subjects were given an intelligence test and the Automated Operation Span task. Bilingual subjects also completed an English proficiency test and a survey about their language background. The Automated Operation Span task is a computer program in which subjects had to memorize letters that were shown to them between simple math problems. They would later have to state the sequence of letters in the correct order after each session.

Experimentation is not yet finished. 10 bilingual subjects have been tested so far, and testing on monolingual subjects will begin starting the week of March 10. The Automated Operation Span task keeps the data of each subject. Once testing is complete, this data will be analyzed and compared. After analysis, a conclusion will be reached as to whether monolingual people or bilingual people have better working memories.

This study could promote bilingualism and encourage more people to learn languages other than their native one.

NAME(s)	<b>Ethan Hill</b>	PROJECT NUMBER	<b>M01</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>12</b>
TEACHER	<b>Andy Marquis</b>		
PROJECT TITLE	<b>The Effect of Distance on Home Court Advantage</b>		

## ABSTRACT

This experiment focused on the distance between basketball teams in the NBA and its effect on the home teams' home court advantage. To do this, 861 points of data were recorded, each one representing a game that was played. These points compared the distance between two team's arenas to the win/loss point margin of the home team. Seven teams from all around the country were selected, and their home games from the 1990, 2000, and 2010 seasons were recorded. The hypothesis was that as the distance between two teams increased, the point margin for the home team would also increase. However, when these points were plotted and a trend line was calculated, the slope of the line was too close to zero to declare a relationship. The line showed that as distance changed, the point margin stayed constant. The trend line did have a significantly positive y-intercept, though, which means that the home team won more games on average. This means that there is a home court advantage, distance between arenas just isn't the deciding factor. There is a hole in the research that was done. What wasn't taken into account was the distance the teams actually traveled. The way the schedules work in the NBA, the away team could have been playing in a different city the night before, and rather than traveling from their home court, they go right from another city to the game. The home team could also be in a different place the day or two before the game, so they would also have a travel distance. If the experiment was done over again, taking in those factors would decide for sure whether distance effects the home court advantage in basketball.

NAME(s)	<b>Trevor Houchens</b>	PROJECT NUMBER	<b>B09</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>9</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Ability of Grasses to Remove Fertilizer from Percolating Water and the Effect of Root</b>		

## ABSTRACT

The purpose of this experiment is to find which type of grass best removes the elements nitrogen, potassium, and phosphorus from water that is dissolved into the ground. These elements are found in fertilizer that is used in massive quantities on farms. Much of this fertilizer is dissolved and seeps into lakes and ponds where it causes large, unwanted, algal blooms. I hypothesize that in this experiment the type of grass that has the longest root system will most effectively remove these nutrients.

Three species of grass and a mix of the three were grown in the same conditions for the same period of time. Water was mixed with fertilizer and measured for the three previously mentioned nutrients using LaMotte testing kits. The solution was then poured into each of the aluminum grass trays and allowed time to flow into a catching basin. The solution was then tested again for the same nutrients and the roots of the grasses were measured.

Currently data collection is incomplete and in progress. Analysis will include comparing root length to post-testing nutrient levels and comparing post-testing nutrient levels between species. I expect that the grass species with the longest root system will remove the most nutrients from the fertilizer solution.

Many private lawns stand in the way of nutrients percolating towards lakes. Having a grass that is more effective at absorbing nutrients in these lawns could decrease the percentage of nutrients that reach lakes and ponds.

NAME(s)	<b>Jacob Hubbard</b>	PROJECT NUMBER	<b>G04</b>
SCHOOL	<b>Missisquoi Valley Union High School</b>	GRADE	<b>10</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>The Effect Fertilizer Has on Crop Growth</b>		

## ABSTRACT

I am doing a science fair project on how crop growth is affected by different types of fertilizers during its growth period. The dependant variable is the corn the independent variable is the water, pesticides, liquid, and pellet fertilizers. First, I planted 4 sets of 6 corn seeds in fresh soil. I then took the first group and fertilized it with liquid manure and weed killer, the second with pellets of fertilizer and weed killer, third with only weed killer, and finally group four I left as control. (all natural without any pesticides or fertilizers.) My next step is to monitor all groups over the next few weeks and water all with the same amount of water and record the growth. The last step will be to look at the finalized products see which grew both the fastest and which was the best quality. Overall, my goal in this project is to share my results not only with my family farm but with more farmers across the state to help strengthen Vermont agriculture.

The results I ended up with showed that the two groups that used the liquid or dry fertilizer were the best because they not only grew the tallest but they were the healthiest looking plants. The groups that did not use any type of fertilizer did not grow nearly as tall and they were unhealthy. In the end the group that had the dry fertilizer had a slight advantage, being two centimeters taller than the liquid fertilizer group.

NAME(s)	<b>Casey Husband</b>	PROJECT NUMBER	<b>P06</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>10</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Maglev and the Environment</b>		

## ABSTRACT

Maglev technology is capable of revolutionizing the modern world if used correctly in correspondence to certain countries' economical structure and transportation infrastructure. Technology involving magnetic levitation isn't a new idea, it has been available to society since the early 1900s. The reason why it has not been implemented into the modern world isn't because of the cost or availability, but because it has not been properly planned or assessed for construction projects. Maglev projects outside their countries of origin (Germany, Japan, etc.) have not been planned accordingly, thus preventing environmental breakthroughs in modern civilization. The Japanese maglev model of the L0 Series Shinkansen will most likely be the most efficient in energy usage, Co2 emissions, as well as top speed since it is the most modern maglev design. However, the German Transrapid will most likely offer a better price since it has already been rigorously tested and in service for decades. All data was recorded by analyzing the specifications (of the trains) from the train companies' official websites, along with studies from multiple universities. As a result to this data being compared, and then comparing the top two most competitive (which were both trains that used magnetic levitation), It was quite noticeable that the Japanese L0 Series Shinkansen was the most efficient in wattage per person per km/h, velocity, and emissions. However, the German Transrapid was not too far off from it's energy efficiency at cruise speed, and cost far less. Thus proving that the German maglev model would be much more suited for the United States' system (due to the U.S.'s low railway budget), and that the Japanese maglev would be more efficient in European/Asian markets (considering the wide-spread railway usage, and higher budget for such projects).

NAME(s)	<b>Brett Johnson, Andrew Hubbard</b>	PROJECT NUMBER	<b>GP17</b>
SCHOOL	<b>Missisquoi Valley Union High</b>	GRADE	<b>11</b>
TEACHER	<b>Dada Maria Dezotell</b>		
PROJECT TITLE	<b>Fuel From Biomass...Is It possible?</b>		

## ABSTRACT

With the ever fluctuation in fuel prices, and the cost and expenses it takes to obtain different forms of fuel, are very costly by today's standards. The purpose of this project was to find a clean, effective, waste reducing form of biofuel, that produces the greatest energy output, from multiple different combinations of biomass. The combinations include some materials such as vegetable peelings, fruit, and cow manure. We suspect that the combination with the cow manure included will produce the most energy output because of the methane produced by the manure. The experiment was the measuring of the energy released by the different types of biofuel produced by the combinations of biomass. We found the the bottles the had both biomass and cow manure produced the greatest volume of gas, as well as the most flammable gas out of the trials. been collected thus far in the experiment. We conclude that although not every trial produced a flammable gas, our idea is possible and can provide energy for the future.

NAME(s)	Casey Keenan	PROJECT NUMBER	C11
SCHOOL	St. Francis Xavier School	GRADE	8
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	Salty Solutions		

## ABSTRACT

My project question was which material is better, salt or brine. I did this science fair project because I wanted to learn about the effects of salt vs. salt brine. I also did this project to learn why people would prefer to use one over the other and because people have been complaining about how brine has been sticking to their cars and rusting them.

○I ran three tests to try to determine which material worked better melting ice and which rusted metal faster. In my first experiment I tested which rusts metal faster by putting nails into salt, brine, and water. In my next experiment I tested which material melted ice faster, by putting brine and salt on separate pieces of ice and timing how long it took for each of them to melt. In my final experiment I tested which material could melt snow the fastest when traffic was being simulated. I simulated the traffic by riding over the snow with my bike. As I ran the experiments I learned it was hard to reach conclusions because of the differences in how the brine and salt are used. I had originally intended for there to be another experiment, but I did not count it because the results were badly affected by human error and the way the experiment was done.

In the end, I found my second experiment was inconclusive because the brine was not used the way it was supposed to be used. I was able to draw some conclusions from my first and third experiments but I would like to do further testing.

NAME(s)	Olivia Knudsen	PROJECT NUMBER	S12
SCHOOL	Randolph Educational Resource Center	GRADE	7
TEACHER	Gina Sweet		
PROJECT TITLE	Distractions		

## ABSTRACT

○The objective of this experiment was to determine if men or women were more likely to keep focus and complete my test more quickly and accurately. I also wanted to find if distractions would affect their results as opposed to the subject just blocking them out. I hypothesized that both men and women would be slower with distractions. I did some research, and I found that on average, women are better at multitasking and completing jobs with background noise.

○The experiment started with me bringing the test subject into a room with a table full of tests including picture and word puzzles. They were to complete the test without leaving the room and without talking. I timed them while they did one test with and one test without distractions. After completing the first one, I checked it for mistakes and had them sit in the other room while I changed the puzzles up. The second time after thirty seconds, I played a recording of distracting noises until they finished.

○The results show that women work faster with distractions; two to three minutes quicker. The results also showed that men work on average about one minute slower with distractions. Both men and women achieved about the same amount of minutes when it came to the test without any distractions.

○After testing many men and women, I found women are averagely more accurate and faster with distractions. I thought maybe this was so because generally most women are balancing housework, husband, pets, job, and children throughout their day.

NAME(s)	<b>Haley Koenig</b>	PROJECT NUMBER	<b>C12</b>
SCHOOL	<b>Northfield Middle High School</b>	GRADE	<b>11</b>
TEACHER	<b>Amy Urling</b>		
PROJECT TITLE	<b>The Effect of Normal Dish Detergents Compared to Eco-Friendly Detergents on the Growth Rat</b>		

### ABSTRACT

This experiment consisted of finding the effect of an eco-friendly detergent verses an average detergent on the growth of bean plants. The procedure was the same for each type of detergent and was as followed: I planted a starter tray with 32 bean plants, and placed them in the sun to germinate. I label each plant with the percentage and type of detergent, and made sure there were two plants per solution Next I made 6 solutions per detergent by measuring out 100mL of soap for the 100 percent detergent then another 100mL of soap to mix with 100mL of water, which was 50 percent detergent, then I continued to dilute the solutions with water in cups labeled 100 percent, 50 percent, 25 percent, 12.5 percent, 6 percent, and 3 percent. Once the solutions were mixed for each detergent I added them to the plants once they started to sprout. Then I measured the height of each plant once a week. The averages of the plants growth I received during the three weeks when watering the plants with 100 percent, 50 percent, 25 percent, 12.5 percent, 6 percent, 3 percent, and 0 percent solutions were: for the eco-friendly detergent, 19.25cm, 15.25cm, 19.17cm, 18.50cm, 17.50cm, 17.50cm, and 16.08cm. For the average detergent, 18.58cm, 21.08cm, 17.75cm, 20.17cm, 18.58cm, 18.50cm, and 16.58cm. The trend that I noticed for the eco-friendly detergent was that the higher the percentage of detergent in the solution the more it effected the bean plants growth. The trend that I noticed for the average detergent was similar to the eco-friendly detergent except the plants tended to be healthier and taller. The overall trend is that the eco-friendly detergent is more harmful to the height of bean plants than the average detergent when there is a high amount of detergent.

NAME(s)	<b>Sara Kunin</b>	PROJECT NUMBER	<b>B10</b>
SCHOOL	<b>South Burlington Highschool</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>How Air Temperature Affects the Transpiration Rate of Plants</b>		

### ABSTRACT

The purpose of this lab is to determine how air temperature affects the transpiration rate of plants. Transpiration is the process by which moisture is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere. High air temperatures causes the plant cells which control the stomata to open. It is hypothesized that air temperature will increase the transpiration rate of plants because the increase in air temperature allows the stomata to open up and allows the water from the plants to escape into the atmosphere. I have constructed a plant setup for measuring the rate of transpiration. I am placing each leaf of the plant in a 10 ml graduated cylinder filled up to 10 ml with water. I am sealing the top of the cylinder with Press and Seal and poking a hole through the Press and Seal to stick the plant through so the stem reaches the water. I am keeping 10 plants in a warm environment and 10 in a cooler environment in my house. My data collection is in progress at the moment. I will be recording the data every twelve hours for each plant. The data that is to be expected is that the warmer air temperature will have a faster rate of transpiration, meaning the water level will go down quicker. I will have six points of data for each plant, therefor my experiment will occur over a 3 day period.

NAME(s)	<b>Davis Lavoie</b>	PROJECT NUMBER	<b>P07</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>7</b>
TEACHER	<b>Mr. Mark Pendergrass</b>		
PROJECT TITLE	<b>enGAUGEing Magnetism</b>		

## ABSTRACT

○This project was intended to figure out if different gauge wire affects an electromagnet. It was predicted that the larger gauge wire produces a larger magnetic field as shown in the hypothesis: If a larger gauge wire is wrapped around an iron nail then it will create a stronger magnetic field than a smaller gauge wire. Some vocabulary terms that were learned were: induction, electromagnetic and enamel coating. One concept discovered is that the more coils an electromagnet has the more force it has. The procedure for this project involved wrapping two different gauge wires 110 times around an iron nail. Sandpaper was used to scratch the enamel coating off the larger and smaller wires. Then the bare wire was attached to a 1.5 volt battery by pinching the two wires to the positive and negative terminals. While the electromagnet was attached to the battery, the nail was touched to the force meter and pulled back. The meter was carefully observed and when the electromagnet disengaged with the meter, the number of ounces was recorded from the force meter. These steps were repeated for the different gauge wires. A meter was used to collect the data. One difficulty was seeing how many ounces the meter measured at the exact time it disengaged. The data showed that the hypothesis is correct because 3.95oz, the average force produced by the nail wrapped with the larger wire is greater than 2.25oz, the average force produced by the nail wrapped with the smaller gauge wire.

NAME(s)	<b>Nicholas LeBeau</b>	PROJECT NUMBER	<b>B38</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Color Recognition and Memory of a Goldfish</b>		

## ABSTRACT

The purpose of this experiment was to test the color recognition and memory abilities of goldfish by dispensing food in different-colored rings. In the evening, a red ring was placed on one side of the tank and a yellow ring was placed on the other side, both empty of food. The number of fish that went to the red or yellow ring based only on color was recorded for one minute. Then the yellow ring was removed and food was placed inside the red ring. For five days, the rings were kept in the same places; then variations of the placement were utilized, while keeping the food only in the red ring. It was found that 80% of the goldfish went to the red ring first. Based on the evidence, it can be concluded that goldfish can associate food with color and possess memory.

NAME(s)	<b>Brandon Lee, Finley Killeen</b>	PROJECT NUMBER	<b>GP19</b>
SCHOOL	Frederick H. Tuttle Middle School	GRADE	<b>8</b>
TEACHER	Amelia Lutz		
PROJECT TITLE	<b>Fear and the Human Response</b>		

### ABSTRACT

Fear is embedded in human nature and has kept us alive and away from danger, like tigers, but what are people scared of today and why are they scared of these things? This science project takes a look at the psychological factor of people who are scared of both non-dangerous and dangerous variables and how they react. By showing people pictures and loud sounds while asking them what they are scared of and why they are scared (independent variable), while measuring their pulse, blood pressure, and reaction (dependent variable) this experiment will determine what causes fear and different levels of physical and mental responses in different people. The hypothesis for the outcome is that the subject's blood pressure and heart rate will increase and they will cringe or jump back when displayed something they have a fear for. We anticipate that most of subjects will find some of the pictures scary because of obvious danger and others even though there is no obvious danger because of childhood events or for no reason at all. They might have no reason at all because of its vagueness and ambiguity. If this is so then it shows that people avoid creepy and scary things they don't understand because their brain is denying the ambiguity and the uncanny.

NAME(s)	<b>Ryan Liebegott</b>	PROJECT NUMBER	<b>B39</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Direct Impact of Soil pH on Darkling Beetle Development and Reproduction</b>		

### ABSTRACT

The purpose of this experiment was to determine whether the acidity of soil directly influences the performance of the beetle *Tenebrio molitor* in areas such as metamorphic and reproductive rates. Human disturbances alter soil composition, and animals such as insects and lizards have demonstrated an aversion or a negative reaction to pH extremes. It was hypothesized that mealworms raised in less extreme pH levels would develop sooner, reproduce faster, die in smaller number, and be slightly larger on average than those raised in more acidic or alkaline environments.

The experiment consisted of four groups of two containers, each housing substrate of a different pH level ranging from three and a half to five to six and a half to eight. This arrangement was repeated three times to house different metamorphic stages: larvae, pupae, and adults. The control group consisted of the two median pH levels. The dependent variables were population, number of births, number of deaths, total living biomass, and average individual mass, while the independent variable was soil pH. The animals were counted and weighed every three days for seventy-nine days.

The data showed that the higher pH levels performed poorly rather than the extremes, but soil acidity affected the populations nonetheless. Subjects raised in soil of pH five developed and reproduced the fastest, followed by the three and a half group, the six and a half group, and the eight group. Areas such as death rate and individual mass showed similar trends, but less conclusively due to the scale.

These insects serve as a representation of many like species which play important ecological roles and may be affected by soil composition in a similar way.

NAME(s)	<b>Molly Loucy</b>	PROJECT NUMBER	<b>C13</b>
SCHOOL	<b>Milton Middle School</b>	GRADE	<b>6</b>
TEACHER	<b>Janet Smith</b>		
PROJECT TITLE	<b>Digesting Milk - Does Fat Content Determine Lactose Levels?</b>		

### ABSTRACT

○ Lactose is a sugar present in milk which is digested naturally with the lactase enzyme. Approximately 70 percent of the population is lactose intolerant. Lactose intolerance is a condition where lactase is either not produced in the body or produced in insufficient amounts to break down lactose causing difficulties in digesting milk. People who are lactose intolerant and drink milk, often experience symptoms of indigestion.

○ I tested whether the fat content of milk had any effect on the lactose content in the same milk. I predicted that milk with a higher fat content would have a higher lactose content. When lactose is digested it is broken down into glucose and galactose in a 1 to 1 ratio. The method for testing lactose levels was by measuring glucose levels in milk. I tested milk with different amounts of milk fat: whole milk, heavy cream, skim milk, 1 percent milk, and 2 percent milk. Each was tested for glucose before and after lactase enzyme powder was added to digest lactose.

○ I determined what dilution was needed for the samples to get accurate glucose measurements within the testing range of the glucose strips. I tested a dilute glucose solution as a positive control. A lactose solution was tested as a negative control for the presence of glucose before lactase was added. Water was tested for glucose levels since it was used to dilute all of the samples.

○ The results were the opposite of my hypothesis. I found that heavy cream had the highest fat content but lowest lactose levels. Milk with no fat had the highest lactose levels. After analyzing all of my data I found that there was no obvious relationship between milk fat content and lactose levels. It may not help people with lactose intolerance to drink lower fat milk.

NAME(s)	<b>Emilie Manchester</b>	PROJECT NUMBER	<b>G05</b>
SCHOOL	<b>Missisquoi Valley Union High School</b>	GRADE	<b>10</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>Types of Rocks that Absorb the Most Oil</b>		

### ABSTRACT

Humans use oil for just about everything we do. It is in our clothes and we use it to run our cars. Oil is just about in everything we use. Oil drilling have been booming since the mid 1800s in the United States. But, over the recent years, there have been some very unfortunate oil spilled in North America. The BP oil spill that happened in the Gulf of Mexico. The oil from that ship contaminated the waters and killed thousands of animals. Since I don't live in the southern part of the U.S, I was never affected by it. But, I can find a way to help clean up the mess if another oil spill ever happens. Some rocks can absorb different types of liquid.

For my experiment, I will be using three different types of common sedimentary rocks to test if they can absorb any specific amount of oil. The stones that I am using are Limestone, Shale, and Sandstone. These types of rock will determine which will store the most amount of oil. My hypothesis is: If you can determine what types of sedimentary rocks that make the best storage for rock for petroleum, then, you will find out what types of rocks can store oil.



NAME(s)	<b>Katelyn Marcoux, Anika Miner</b>	PROJECT NUMBER	<b>GP09</b>
SCHOOL	<b>Christ the King</b>	GRADE	<b>7</b>
TEACHER	<b>Vidula Strivastava</b>		
PROJECT TITLE	<b>Store BOught Vs. Homemade</b>		

## ABSTRACT

The purpose for our science fair project was to figure out what laundry detergents are made out of and if a homemade laundry detergent would work just as well getting out stains as a store brand detergent. We figured out you can make a laundry detergent easily. The homemade detergent is made simply with ingredients found at your local grocery store. In the end, the homemade laundry detergent is less money than major brands.

The hypothesis for our project was that our homemade laundry detergent would work better or just as well as the store bought one. Our approach for solving the hypothesis was making a homemade laundry detergent and getting a store bought one. We stained both shirts with tomato sauce. We stirred the shirts in warm water for ten minutes. We put one stained shirt in the homemade detergent and another stained shirt in the store b then took both of the shirts out and studied the stains. On both shirts, the stain had not completely come out. We concluded the homemade detergent worked just as well as store brands.

In the end, we concluded that the homemade detergent is just as effective and cheaper than store brands. It also contains less chemicals than store brands. We learned that you can substitute store brands with simple ingredients found at your local store.

NAME(s)	<b>Elizah Markwood</b>	PROJECT NUMBER	<b>B40</b>
SCHOOL	<b>Randolph Educational Resource Center</b>	GRADE	<b>10</b>
TEACHER	<b>Gina Sweet</b>		
PROJECT TITLE	<b>PTC and Food Preferences</b>		

## ABSTRACT

The purpose of my experiment was to discover if there is a correlation between the ability to taste Phenol Thiorcabamide (PTC) and the dislike of certain foods. My hypothesis was that Tasters would be more likely to dislike a selection of foods and that there was a connection between tasting PTC and disliking foods in the Brassica family.

To do this experiment I had everyone taste a sample of the five different foods I selected, keeping track of what they liked and what they disliked, and then I tested them with the PTC paper and marked the appropriate box. (Taster or Non-taster)

The results seem to conclude that those who Taste have a wider variety of dislikes, however there was no difference in their preference for vegetables in the Brassica family.

NAME(s)	<b>Margaret Martell</b>	PROJECT NUMBER	<b>P08</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>8</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Glove Vs. Mittens</b>		

## ABSTRACT

For years people have wondered if gloves or mittens keep your hands warmer. My experiment was to prove which would increase the temperature of your hands; mittens or gloves. I thought it would be interesting to do this project because from my perspective, people buy more gloves because you have the ability to move your fingers around. But are gloves the best product to buy for warmth? To start my experiment I got some volunteers to measure the temperature of each of their hands. After temperatures were recorded, everyone had one glove and one mitten on their hands. No one could have both. They went outside and half the people would be doing an activity with their hands while the others would stay still. They stayed outside for 4 minutes, came back inside, and then recorded their hand temperature again.

The problem with my experiment was that I had too many variables. One problem was that we didn't have enough thermometers so people had to share. This might have caused their hands to get warmer while waiting to measure their temperatures after coming in from outside. Another problem was that people held the temperature probe either too long or not long enough. This would cause the thermometer to get the wrong temperature of their hands.

After my experiment I concluded that it depends on the material and how thick your mittens and gloves are. It also depends on the type of person and how much activity you will be doing outside. My data showed the average drops of no activity to activity. It said that activity had more of a drop which meant their hands were colder. I thought that was interesting because usually activity makes your blood circulate, but not in my project. My results were inconclusive.

NAME(s)	<b>Elizabeth Matthews, Mallory Curtis</b>	PROJECT NUMBER	<b>GP22</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Jennifer Townsend</b>		
PROJECT TITLE	<b>Sympathy by Gender</b>		

## ABSTRACT

The idea behind this experiment was to see whether or not people are more sympathetic to their own gender or the opposite gender. Before this experiment was done our hypothesis was that women really do get more sympathy when they get hurt compared to men getting hurt in the same way. We showed a videos to 40 females and 40 males all within 13 years old to 18 years old. First a video of a girl getting punched in the face, then a video of a girl getting kicked in the crotch, and lastly a girl getting hit by a car (and surviving). Then we showed the same people guys getting hurt in the same ways at similar angles. While they were watching the videos we had them rate the amount of pain they thought the person was in (1-10, 10 being the most pain ever imaginable) and then we had them rate how bad they really felt for them (sympathy) (1-10, 10 being they could almost cry for the person getting injured). We showed each video on a separate day to make sure they didn't think it was just funny videos. We do realize that all people have there own opinions on whether or not the person looked like they deserved it or not, that was the biggest bias that we could not avoid. After this experiment was done we found that males feel about equal for both females and males. Whereas the females felt much worse for the females then they did for the males. If we were to do this experiment again we would try much less extreme injuries, for example just a slap or a lighter kick.

NAME(s)	<b>Ethan McCabe</b>	PROJECT NUMBER	<b>P09</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>8</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>To move or not to move, that is the question</b>		

### ABSTRACT

Different batteries have different characteristics. Some batteries are designed for recharge and reuse. Disposable batteries vary in quality and are used until worn out. After building a model ski lift, three types of batteries were compared. The question was which battery moved a motor the fastest on a cord. It was assumed that if cheap standard batteries are the most commonly used, then they would move the chair lift the fastest on a cord and that they would work best also after two and four hours of use. Building the tiny chair lift was an important part of the science fair procedure. A Lego figure was placed on the chair lift for decoration and balance. Next, the batteries were placed into the power source for the chair lift. Then, testing was started. The chair lift was run along the cord and timed ten times for each battery type. Then the batteries were used to power a light and a motor for two, and then four hours. They were used to repeat the chair lift experiment 10 times after the two and four hours of use. Next, the collected data had some shocking, but really obvious results. Lithium batteries had the fastest time, premium brand-name batteries had the second fastest time, and the cheapest standard batteries came in dead last. While collecting the data, there were some problems. Sometimes the watch stopped or started way too early or too late. Once, the chair lift ran in the wrong direction. Last, that chair lift was stopped way too early. The data did not support the hypothesis. The hypothesis was probably wrong because standard batteries use cheaper components and wear out more easily.

NAME(s)	<b>Zachary McCormick,</b>	PROJECT NUMBER	<b>C14</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Salt and Battery</b>		

### ABSTRACT

My project was on the electrolysis of water. Electrolysis is the chemical reaction that occurs when an electric current passes through a liquid. I tested the effect that adding salt and changing battery voltage had on electrolysis. My hypotheses were increasing the salt content would increase the amount of hydrogen produced, and increasing battery voltage would increase hydrogen production. The salt variation portion of the experiment used a nine volt battery and the amount of salt used was five, ten, fifteen, and twenty grams of salt. A timer was used to measure the amount of time it took to produce 2 ml of hydrogen in an inverted test tube. The amount of current flowing through the water was measured with an ammeter. The voltage variation portion of the experiment used battery values of 3 , 4.5 and 6 volts. A solar panel producing 5 volts was also used. Once again the time to produce 2 ml of hydrogen gas was measured. The time for reaching the mark decreased as the amount of salt increased. This leads me to believe that my hypothesis was correct and increasing the amount of salt does increase hydrogen production. As predicted increasing battery voltage also increased hydrogen production. My project tells me that adding salt and increasing battery voltage would be a good way to collect hydrogen from the electrolysis of water.

NAME(s)	<b>Colin McKay</b>	PROJECT NUMBER	<b>P10</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Crackin' n' Snappin'</b>		

### ABSTRACT

My project tested three popsicle stick bridges to the point where they would break. I choose this project because every day we drive over bridges. I began to wonder how much weight can these bridges hold because they are holding big trucks and several cars at a time without breaking. These bridges we are driving over are saving our lives every day and we just take that for granted. My hypothesis was that the arch bridge will be able to hold more weight than the cable-stayed bridge and the beam bridge. The arch bridge has been used for thousands of years and is strong and reliable. I assumed from my research this was the best design. For my experiment I built these three bridge designs out of popsicle sticks and wood-glue. I looped a small rope over my bridges which I attached to a carabiner with a bucket. I then would add five lbs. at a time to the bucket until the bridge broke. If the bridge was under a lot of stress I would add only three lbs. to get a more accurate measure. Also when I did my experiment I noticed that the arch bridge's legs were uneven which made the bridge wobbly. This could have affected the outcome of the weight held. I also noticed that the wood-glue I used was stronger than the popsicle sticks. My results show that the cable-stayed bridge held 79 lbs. while the arch bridge held 53 lbs., and the beam bridge held 40 lbs.

I concluded that my hypothesis was incorrect because the cable-stayed bridge was able to hold more weight than the arch bridge. This leads me to believe that engineering today is better than it was thousands of years ago, but engineering thousands of years ago wasn't terrible.

NAME(s)	<b>Emily McMullen, Lysle Nelson</b>	PROJECT NUMBER	<b>GP23</b>
SCHOOL	<b>Windsor Jr/Sr High School</b>	GRADE	<b>8</b>
TEACHER	<b>Owen Campbell</b>		
PROJECT TITLE	<b>Text vs. Audio Comprehension</b>		

### ABSTRACT

In this experiment, we wanted to find out from which source--an ebook, an audiobook, or a hard copy book--do people comprehending the most details. We hypothesized that our test subjects, a sample size of ten eighth grade girls, would recall the most details from the text when reading from a traditionally printed book. We figured that if the girls read the same passage for each source, they would remember what they had read, and this would skew our data. Therefore we concluded that our subjects must read a different passage for each source. Next, we created corresponding tests for each passage with both easy and difficult questions. After our test subjects read the passages and took the tests, we scored them out of 100 percent. We found that the average comprehension level for the printed book, 57.5 percent, was considerably higher than either average for the ebook, 48 percent, or the audiobook, 52.5 percent. Though there were some outliers for each one, most scores fit into the status quo. In conclusion, we found that the majority of eighth grade girls were able to comprehend the most details for the originally printed source. We were shocked to see that the ebook had the lowest comprehension rate out of the three sources. The reason we were surprised is because the ebook and the printed book are very similar, their only difference being that the ebook is on technology. This may have been a result of experimental error on our part or perhaps technology is really not helping us at all.

NAME(s)	Emily Mead	PROJECT NUMBER	P11
SCHOOL	Missisquoi Valley Union High School	GRADE	10
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	Homemade Bubbles, More Enjoyment or Not		

## ABSTRACT

Abstract

Homemade Bubbles, More Enjoyment or Not

I decided to do this particular project because I enjoy playing with bubbles and my niece and nephews enjoy bubbles as well, so I wanted to create a new kind of bubble that kids will enjoy more than commercial bubbles. Bubbles are fun and an easy form of distraction used by parents and daycare providers to keep children from crying and keep them entertained. Bubbles don't last long enough and there is a small variety of bubbles to choose from, so I designed four different kinds of bubbles, Industrial strength, red colored, blue colored, and glow-in-the-dark, so that the children would have more of a selection of bubbles to play with. I presented each of these bubbles to eighteen 7th graders and four of my peers in my chemistry class. I tested which kind of bubbles the kids find most fun. I believe that if I let the children play with all four kinds of bubbles they will enjoy the Industrial strength bubbles the most. The results were that nineteen kids enjoyed the industrial strength bubbles the most, while the least favorite bubbles were the blue bubbles with twelve votes. The glowing bubbles were voted second place with ten votes and the red ones were voted third place with nine votes.

NAME(s)	Abigail Millard	PROJECT NUMBER	B28
SCHOOL	Windsor High School	GRADE	11
TEACHER	Catharine Engwall		
PROJECT TITLE	Lactobacillus vs. Amoxicillin: Beneficial Bacteria as Treatment for Sinus Infections		

## ABSTRACT

○The purpose of this experiment was to compare the effects of amoxicillin and lactobacillus on staphylococcus aureus. SA is a bacteria that causes sinus infections. Lactobacillus is a beneficial bacteria naturally occurring in the human digestive tract that kills harmful bacteria such as E. coli. Amoxicillin is an antibiotic prescribed for sinus infections. The hypothesis was that lactobacillus would be more effective than amoxicillin, because the staph would build up resistance to amoxicillin. In a six well plate, three wells contained established staph colonies, one lactobacillus, one a mixed culture of the two, and one an uninfected control. After 24 hours, one staph colony was treated with lactobacillus, the other amoxicillin. After 24 hours of treatment, the bacteria were counted. The amoxicillin decreased staph growth by 16.6 percent. The lactobacillus increased staph growth by 22 percent. The hypothesis was not supported. The most plausible explanation for this increase is the presence of leftover rich medium from the lactobacillus culture. When the lactobacillus was mixed with the staph, there may have been some media left from lactobacillus liquid culture that the staph fed off. Although the hypothesis was not supported, note that the decrease from amoxicillin was not as significant as might be expected. The 17 percent decrease demonstrates the function of biofilms, which cause antibiotic resistance. If the experiment was conducted over a longer trial period, the staph may have become more resistant to amoxicillin. This issue demonstrates the need for an alternative treatment. In the future, the procedure would include washing bacteria before creating the mixed culture. This step would reduce the bias of leftover media. In addition, the trial period would be extended to observe long term effects of the treatment. Finally, research would be done exploring the use of beneficial bacteria that naturally occurs in the sinuses.

NAME(s)	<b>Vincent Moeykens, Ben Meagher</b>	PROJECT NUMBER	<b>GP13</b>
SCHOOL	<b>Windsor Jr/Sr High School</b>	GRADE	<b>8</b>
TEACHER	<b>Owen Campbell</b>		
PROJECT TITLE	<b>Programming Language Efficiency</b>		

## ABSTRACT

The purpose for our experiment, Programming Language Efficiency, was to find the most efficient programming language to do simple, but important tasks. We tested three programming languages, Python, Ruby and Perl. We hypothesized that Python would be the most efficient programming language. Python is a fairly new and powerful language and the syntax is relatively easy to learn. To find out how well the languages process data we tested them in their ability to calculate the square root of 2 to 100,000 places and to sort a large chunk of text alphabetically. To find the simplicity and readability of the code we measured how many lines it took to write it. We also implemented a timer into our code to accurately time code chunks. During our first experiment, square root, we found that Python was the fastest, but not the most efficient. Ruby used significantly fewer lines of code than Python. Perl could not calculate the square root to the 100,000th place, instead of calling that an error, we considered it data. In the sorting category Perl was the fastest but used the most lines of code. Also, Ruby beat Python in speed and lines of code. We finally concluded that Ruby, although not the fastest for either categories, was the most efficient language. Ruby used fewer lines of code all around and was the second fastest for both categories. There are many ways we could, and plan to, continue this project, including applying our data to a program/website to try to improve efficiency, or narrowing many more languages down to find the best for one specific task.

NAME(s)	<b>Abigail Monahan</b>	PROJECT NUMBER	<b>B11</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Fertilizer Feud</b>		

## ABSTRACT

Fertilizer is a gardening expense that can impact a garden's success. My research question examined how fertilizer type affects plant germination. My hypothesis was that a mixture of half the recommended amount of chemical fertilizer and of organic fertilizer would produce the largest, deepest colored spinach.

I tested fertilizer by planting and fertilizing spinach plants. There were 4 sets of 12 plants. Set A had no fertilizer, set B had organic fertilizer, set C had chemical fertilizer and set D had half the recommended amount of chemical fertilizer and of organic fertilizer. They were planted in soil pods in a germinating greenhouse, watered, and observed for 28 days.

Data was collected based on percentage of plants grown, height, and health rate on a scale of 1 to 5. A plants (no fertilizer) grew 75 percent of the 12 plants, averaging a height of 2.44 inches, and an average health rate of 1.56. B plants (organic fertilizer) grew 25 percent, had an average height of 3.4 inches, and had an average health rate of 1.3. C plants didn't show any growth. D plants grew 25 percent, with an average height of 3.02 inches, and an average health rate of 1.5. The cost of organic fertilizer was the same as the chemical fertilizer at 11 cents per ounce. These results disproved my hypothesis showing that A plants grew the healthiest and the most plants, and B plants grew the tallest.

NAME(s)	<b>Grace Monteiro</b>	PROJECT NUMBER	<b>B12</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Decomposition of Biodegradable Materials</b>		

## ABSTRACT

The purpose of this experiment was to determine which biodegradable material out of cornstarch, Mater-Bi, and bagasse would decompose the quickest. Compostable materials including BioBags, World Centric Corn Starch Forks, and World Centric Straw Bowls were all used in this experiment. It was hypothesized that the BioBags would decompose the quickest because of their thickness (thin).

Two samples of each material were cut with a 10-centimeter radius and placed in a compost bin. The bin was set up prior to the experiment and it was filled with alternating brown and green layers. The data was taken once a week, which included observations, massing, testing the compost, and the temperature of the compost.

Data for this experiment has yet to conclude. Though the data collection has yet to cease, the material that seems to be decomposing the quickest is the bagasse bowls. This observation seems to conclude that the experiment's hypothesis is not how the experiment was expected to go.

The results of this experiment can give data about how well something decomposes and how quick.

NAME(s)	<b>Maizy Mooney</b>	PROJECT NUMBER	<b>B41</b>
SCHOOL	<b>Milton Middle School</b>	GRADE	<b>8</b>
TEACHER	<b>Nathan Caswell</b>	<b>Janet Smith</b>	
PROJECT TITLE	<b>Effects of Music on Heart Rate and Blood Pressure</b>		

## ABSTRACT

I sometimes listen to music to relax and wondered if heart rate and blood pressure were affected when listening to different types of instrumental music. My hypothesis was that hard rock music will cause blood pressure and heart rate to increase and that classical music will decrease heart rate and blood pressure since it is more calming. 4,500 hospitals currently use classical music as therapy to help regulate patient blood pressure and heart rate.

○ I measured the blood pressure of different subjects using a blood pressure monitor. It measures the systolic blood pressure which is the amount of pressure that the blood is putting vessels when the heart is beating. It also measures the diastolic blood pressure which is the pressure in your blood vessels between heart beats. I tested 1 boy and 2 girls by measuring heart rate and blood pressure with no music playing. The same subjects listened to classical music the next day and heart rate and blood pressure were measured again. The same was done another day when listening to hard rock music for the same amount of time .

○ The results indicate that classical and hard rock music both affected heart rate and blood pressure. Classical music had more of an effect on the subjects since the average heart rate decreased by 6 beats per minute from the average when listening to no music. Hard rock music did not significantly lower the average blood pressure compared to that with no music while heart rate average increased only minimally.

○ The data does support my hypothesis that listening to classical music will decrease the pressure of blood on vessels and will help people to relax. I wonder why more hospitals do not use music as therapy. Is silence the most calming for heart rate and blood pressure?

NAME(s)	<b>Sophia Moore-Smith</b>	PROJECT NUMBER	<b>P12</b>
SCHOOL	<b>Christ the King Rutland</b>	GRADE	<b>8</b>
TEACHER	<b>Tom Estill</b>		
PROJECT TITLE	<b>A New Spin on Wind Power</b>		

## ABSTRACT

My project studied vertical axis wind turbines (VAWTs), which are more lightweight than traditional horizontal axis turbines. VAWTs can be more efficient, can function well in lower wind speeds, and consist of several design types. Using scale models constructed from wire, paper, wood, foam, and plastic, I tested Giromill, Darrieus, Savonius, Gorlov and Turby type VAWTs.

My hypothesis was that the Darrieus turbine would perform best because it is the most popular style of VAWT currently used, is medium weight, and spins well even in relatively light winds.

Turbines were tested by placing them on a wooden dowel positioned in front of an 18 inch fan with a flow concentrator made from angled cardboard box to provide optimal airflow. Each turbine was tested at each of the fan's three speeds.

The number of full rotations recorded in one minute represented turbine power output.

Airflow speed, (typically wind, but for the purposes of my experiment was electric fan generated), represented power input.

Turbine efficiency can be best represented by maximum power output (rotations per minute) per various airflow speeds and power output per turbine weight.

I found that turbine efficiency was also affected by weight in several ways: weight could reduce the turbine's rotations due to friction or it could help sustain momentum resulting in more rotations.

The Gorlov model was found to be the most efficient overall with the Turby following closely. My hypothesis was incorrect as the Darrieus would not rotate until I attached additional paper wings to create more surface area. In conclusion, I found that the Gorlov and Turby, which were the two lightest weight turbines and also had the greatest surface area in relationship to their weight, performed best across all speeds.

NAME(s)	<b>Sha'Kylah Morris</b>	PROJECT NUMBER	<b>S13</b>
SCHOOL	<b>Burlington Technical Center</b>	GRADE	<b>12</b>
TEACHER	<b>Betsy McLane</b>		
PROJECT TITLE	<b>Facial Expressions Made By Young Children &amp; Adolescents (Do they correspond?)</b>		

## ABSTRACT

The hypothesis I would like to prove is that the facial expressions made by young children will correspond to the ones made in adolescents because facial muscles are developed before birth. Since facial muscles are developed so early they have been seen in newborns. The procedure I will use to conduct this experiment consists of the participant being blindfolded for each cup that contains an everyday item that I am asking them to smell. After they smell each of the 4 items I will record whether they have a positive or negative reaction and document the specifics. I will be testing vanilla, chocolate, pepper, and garlic.

I decided upon this experiment when I was doing research that involved similar experiments using both the age groups of newborns and adults. I considered how the results could be different if you actually tested two groups that were closer together. So I will be testing ages 16-18 and young children from ages 4 and up. I believe there will be two different types of feedback; negative and positive. I expect grins, smiles, and positive reactions to positive smells and grimaces, and frowns to the negative smells.

Considering I am still gathering data and conducting my experiment the results are inconclusive.

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NAME(s)	<b>Kevin Moynihan, Brandon Pratico</b>	PROJECT NUMBER	<b>GP15</b>
SCHOOL	<b>Christ the King, Burlington</b>	GRADE	<b>6</b>
TEACHER	<b>Mrs. Vidula Srivastava</b>		
PROJECT TITLE	<b>Helium Craft</b>		

## ABSTRACT

The physics of buoyancy and lighter-than-air aircraft are explored. In 2012, 2 percent (767 million tons) of world CO2 emissions resulted from air travel. To reduce airplane emissions helium can be used to create buoyancy and reduce the engine power needed. The first experiment explored helium lift at different temperatures since temperature is colder at higher elevations. The hypothesis was that if a balloon was exposed to cold temperatures helium would condense and not be able to lift as much mass as in warmer temperatures. After using balloons filled with helium to test mass lift at different temperatures the results showed that they were not affected after short exposure to cold but were affected after longer exposure. On an airplane helium may work well as long as additional helium is added for longer flights. The second experiment showed helium use in a hybrid aircraft to determine that a combination of helium and a propeller or motor would work as hybrid aircraft. A lighter- than- air aircraft was built using balloons filled with helium and a battery operated motor attached to a propeller. The plane worked at room temperature (68.0 F) and at the lower temperature of 40.5 F. The hybrid plane required lots of helium but did not require an increase in the propeller or motor size to carry the additional added weight. An aerodynamic hybrid design that could hold lots of helium would be required since helium has lifting power of one liter per gram. Lighter-than-air technology increases airplane buoyancy and reduces the motor size needs making it more environmentally friendly. A reduction of just 1 percent to world air travel CO2 emissions would be the equivalent of one year of the carbon footprint of 70 percent of Vermont's population.

NAME(s)	<b>Kendall Muzzy</b>	PROJECT NUMBER	<b>S14</b>
SCHOOL	<b>The Renaissance School</b>	GRADE	<b>5</b>
TEACHER	<b>Caryn Shield</b>		
PROJECT TITLE	<b>Do You Remember</b>		

## ABSTRACT

My experiment is called Do You Remember. In this experiment, I tested two different methods of learning on nine volunteers of the same age and then asked them comprehension questions on the topic. I did this experiment because I wanted to know what method of learning is more common: auditory learning or visual learning. My hypothesis was that most people would answer more of the comprehension questions correctly after reading silently than after listening to the reading. I thought this because when you are being read to, it seems easier to lose concentration. I individually tested nine volunteers from fifth and sixth grade by reading them an article about Bengal tigers and then asking five comprehension questions on the article. After that, I had them silently read an article on Siberian tigers and then asked five comprehension questions on that topic. After testing all nine of my volunteers, the results showed that the average number of questions answered correctly after reading silently was 2.67. After being read to, the average number of questions answered correctly was only 1.20, which suggests that visual learning is more common than auditory learning and that the data supported my hypothesis. When I tested the volunteers, it was hard to maintain consistency because students have various abilities to concentrate and do not all process information in their brain in the same way.

NAME(s)	<b>Ateev Nahar</b>	PROJECT NUMBER	<b>B13</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The effect of the length of the sand column on the effectiveness of Biosand Filters</b>		

## ABSTRACT

How does the length of the sand column affect the effectiveness of the water filtration in a bio sand filter? Also how does the amount of time given to the biofilm to grow effect the percent of filtration in bio sand filters? Biosand filters have been used for thousands of years, yet the effectiveness of the length of the column has never really been tested. By making several simple biosand filters of varying column lengths and also testing over a few weeks I carried out my lab. After doing some background research I formulated my hypothesis, If the sand column in the BioSand filter is longer, then the water will be cleaner, and also, Filtration levels will increase till a point over time and which after passing will start to decrease.

The filters were constructed by using, sand, gravel, PVC pipe, and small stones. Glue and also a saw was used to make the filters. Each filter was made with the same amount of gravel and small rocks, while the amount of sand changed. A biological nutrient broth was made to feed the bacteria used in this lab. By controlling the bacteria being filtered made it simple to figure out whether or not the biosand filter was effective by testing the water. The testing will be done with agar plates and an incubator.

The data will be found by counting the number of colonies of bacteria are left in the filter water. The amount of colonies before filtering will be counted, so it will be able to compare. By figuring out a length which is effective yet still easy to use can help communities around the world. This data can be used to make sure that sand filters long enough to purify water so that it is safe to drink.

NAME(s)	<b>Gabe Nelson</b>	PROJECT NUMBER	<b>S15</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Aloneness: Loneliness or Solitude</b>		

## ABSTRACT

The purpose of this experiment is to discover how people react to being in a state of aloneness for ten minutes. This test is based upon the idea that when a person is alone, they can either have a positive feeling of solitude or a negative feeling of loneliness, while they can also have positive and negative feelings in a social setting. When a person is stressed about by being lonely or while in a social situation, their behaviors and heart rate change.

Fifty-one subjects take several surveys, including one that reveals whether the person is an extrovert or an introvert. The subjects were divided into groups of three and were free to socialize with their heart rates monitored and activities video recorded for ten minutes. Those same subjects were then put into completely non-social situations in similar rooms, but alone. The main materials used to collect data were multiple rooms, EKG sensors, and video cameras.

Data has not yet been collected, but it is expected that the data will show that introverted people react negatively to the social setting and positively to the isolated setting, while extroverted people react reciprocally. A positive reaction would not include video evidence of nervous habits and would include a low heart rate.

This analysis of human behavioral psychology allows people to better understand themselves by helping them realize how much or how little human interaction they need.

NAME(s)	<b>Sydney Nguyen</b>	PROJECT NUMBER	<b>S16</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effects of Multitasking on Ones Activities</b>		

## ABSTRACT

The purpose of this project is to determine whether multitasking effects the speed it takes one to get multiple tasks done. Brain rules, 12 principles for surviving and thriving at work, home, and school by John Medina revealed that multitasking is a myth. Multitasking is the ability to quickly switch between tasks. It is hypothesized that it will take a subject longer to complete the tasks when they are trying to multitask than it will take for the subject who is not multitasking and doing them sequentially.

In the first part of the experiment students aged 14 through 18, will be asked to copy down a phrase while writing down corresponding numbers after they write down each letter of the phrase on a different line. In the second part the same student will be asked to write down the phrase and once they are done writing down the entire phrase they will be asked to write down the numbers. For both parts the subjects will be timed.

Experimentation is incomplete at the moment, but it is expected the hypothesis will be true. It will take the subject a longer time to complete tasks when they are trying to be done simultaneously as opposed to when they are being done one at a time. The results will show that multitasking or the ability to switch between tasks is poor and inefficient.

This experiment will help people improve their work efficiency and the way everyday tasks are completed.

NAME(s)	<b>Mike North</b>	PROJECT NUMBER	<b>C15</b>
SCHOOL	<b>Mater Christi</b>	GRADE	<b>6</b>
TEACHER	<b>Mr Mark Pendergrass</b>		
PROJECT TITLE	<b>The Bad Side of Oxyen</b>		

## ABSTRACT

The original question for this experiment is the following. Is there a way to preserve the fruit for lunches? The original hypothesis was an apple dipped in 100 percent lemon juice would shrink less then an apple without lemon juice. The project was about helping people preserve their fruit for lunches.

The background research shows how to apply the lemon juice whether the fruit is peeled or not. The project is done by peeling and cutting four apple slices 2.00 inches in length each. Two slices are dipped in 100 percent lemon juice for one minute. The other two slices are left alone. The samples are observed daily.

To summarize the procedure, first, cut an apple into four slices, make sure they are exactly 2.00 inches long. Dip two in 100 percent lemon juice for one minute. Place slices in a spot where they will be untouched for four days. Every 24 hours for the four days record the observations.

The size of the slices will be compared to the start day size of two inches to check for changes.

For example: In trial one day two

1.75 inches divided by 2.00 inches equals .875 inches

100 percent minus 87.5 percent equals 12.5 percent shrinkage

The apple with lemon juice started at 2.00 inches and ended with an average of 12.5 percent. The apple without lemon juice started at 2.00 inches and ended with an average of 30 percent. The apple without lemon juice shrunk more than twice as much.

By observing changes in the apples, the apple with lemon juice has almost no change while the unprotected apple was dark brown and dry. The hypothesis stated that an apple with lemon juice would shrink less then an apple without lemon juice. The hypothesis was correct.

NAME(s)	<b>Willy Noyes</b>	PROJECT NUMBER	<b>P13</b>
SCHOOL	<b>Northfield Middle High school</b>	GRADE	<b>10</b>
TEACHER	<b>Amy Urling</b>		
PROJECT TITLE	<b>Speed Traveled by A Vehicle Vs. Its Fuel Efficiency</b>		

### ABSTRACT

My project stemmed from an argument with my mother who constantly nags me to drive slower. Her claim is that slower driving means more money saved. I, however, with the need for speed, decided to try to prove her wrong. I decided to test if driving slower actually does consume less fuel. My hypothesis was that there is an optimal speed that differs from car to car, that when achieved, the car is able to obtain maximum fuel efficiency. This means that cars driving slower than this optimal range actually consume more fuel. My procedure consisted of long distance driving on a pre-determined course with two different vehicles, a light-weight hybrid car, and a larger, heavier car. When I graphed my findings, I found a parabolic shape that suggested that my hypothesis may have been true. As opposed to a steady slope, the parabolic shape found in the graph, suggested a range of good fuel efficiency followed by a drop-off at either end of the parabola, representing decreasing efficiency as the car goes either faster or slower than the optimal speed. In conclusion, it can be determined that driving slower doesn't necessarily save more gas than driving faster. That's good news for me.

NAME(s)	<b>Aster O'Leary</b>	PROJECT NUMBER	<b>B14</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Effects of Household Vitamins on Plants</b>		

### ABSTRACT

The purpose of this experiment was to determine which common, household vitamin promoted the greatest plant growth. According to Livestrong.com, the growth and development of plants is influenced greatly by the nutrients they are provided. It is hypothesized that plants administered vitamin D3 will experience greater growth than plants administered other vitamins.

The control group in this experiment consisted of two pots of wheatgrass administered water devoid of vitamins. The experimental group consisted of wheatgrass pots administered water rich in either vitamin D3, vitamin B12, vitamin C, or vitamin E. The dependent variable in this experiment is the amount of water each plant receives per day. The vitamins each set of two plants is given is the independent variable. During experimentation, the height of the tallest strand of wheatgrass (omitting outliers) is measured and recorded. After experimentation, the heights of the two pots given one vitamin will be averaged, yielding more accurate results.

In concluding experimentation, the hypothesis was supported. Vitamin D resulted in the most growth and highest stalk height, with the final stalk height being 13.45 cm. Vitamin B12 was the second most effective vitamin (final stalk height of 13.3 cm). The final stalk height of the control group (administered water) was 12.4 cm. Both plants given vitamins E and C grew less than the control, with final stalk heights of 12 cm and 10 cm, respectively.

In conclusion, vitamin D3 supplements promoted the greatest growth in wheatgrass plants. By determining which household vitamins promote the best plant growth, people are able to assist themselves in the process of growing popular, edible plants such as wheatgrass without the added cost of a specialty plant fertilizer.

NAME(s)	<b>Natalie Oberding</b>	PROJECT NUMBER	<b>B42</b>
SCHOOL	<b>Burlington Technical Center</b>	GRADE	<b>12</b>
TEACHER	<b>Betsy McLane</b>		
PROJECT TITLE	<b>The Effects of Environmental Enrichment on Gerbil Behavior</b>		

### ABSTRACT

Laboratory scientists discovered that environment does influence the physical and mental health of an animal, along with its behavior. Some laboratories provide their gerbils with environmental enrichment (EE), or items that allow them to perform instinctive behaviors. The effects of EE, in addition to the standard food, water, and bedding, are often unclear. The main goal of EE includes reducing stereotypic behavior, which adds stress to the animals. I hypothesized that gerbils living in EE would portray less stressed behavior. Two pairs of female gerbils were placed in separate cages. The experimental pair was placed in a cage with periodically increasing EE. The control group had no external stimuli. Each gerbil was placed into a stressful environment and her behavior was recorded to determine her level of stress. Behavior, such as where she explored, stood up, defecated or urinated, indicated her stress level in the testing environment. How the gerbils acted in their cages also demonstrated their stress levels. While testing and observations are not yet complete, the data thus far does indicate a lower stress level of the group in EE compared to the control group. However, because I have not yet completed analyzing my work and have more tests to do, the results are currently inconclusive.

NAME(s)	<b>Isaak Olson</b>	PROJECT NUMBER	<b>S17</b>
SCHOOL	<b>Albert D. Lawton Intermediate School</b>	GRADE	<b>7</b>
TEACHER	<b>Jennifer Aither</b>		
PROJECT TITLE	<b>Essential Emotions</b>		

### ABSTRACT

Essential oils are advertised as everything from mood enhancers, to cure-alls for certain disorders. Is this factual or just bogus advertising? Is it possible for essential oils to actually enhance or change people's moods? Many people believe it is and live by this belief. Using essential oils has become a way of life for many and for others is seen as a fad. This investigation has allowed me to look into the use of essential oils, but also how people respond to them.

NAME(s)	<b>Lucas Parascando, Eric Benner</b>	PROJECT NUMBER	<b>GP20</b>
SCHOOL	<b>Christ The KIng School</b>	GRADE	<b>6</b>
TEACHER	<b>Vidula Srivastava</b>		
PROJECT TITLE	<b>How Different Postures Affect Blood Pressure and Heart Rate While Playing a Computer Game</b>		

### ABSTRACT

We measured the blood pressure and heart rate of four subjects while they were playing the computer Incursion 2 in different postures. Incursion 2 is a strategic defense game. Video game playing is a popular pastime so it is important to be aware of how different postures can affect your health. We hypothesized that different postures while playing a computer game will affect blood pressure and heart rate. Blood pressure is the force of blood against the walls of arteries and heart rate is the number of times the heart beats in a minute. There are two measurements involved in blood pressure: systolic and diastolic. Systolic is when the heart contracts and diastolic is when the heart relaxes in between beats.

Our subjects were 10 to 12 year old boys. They played in three positions: sitting, standing, and laying on their stomach. The subjects played three trials in each position. Their blood pressure and heart rate were recorded directly before and immediately after playing each trial. Each trial was five minutes long. To measure the blood pressure and heart rate, we used a portable wrist blood pressure monitor.

Our data demonstrated that sitting and laying down were the two most relaxing positions with the lowest heart rates. Standing had the highest heart rate for all subjects. All subjects' blood pressure rose when they were laying down on their stomachs. Three out of four subjects' blood pressure was highest while in the laying down position. Different postures while playing a computer game affect heart rate and blood pressure.

NAME(s)	<b>Madeleine Parzyck</b>	PROJECT NUMBER	<b>S18</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>The Short Term Memory Test</b>		

### ABSTRACT

My project was to find the effects of gender identity using short term memory. I choose this project because last year I also has a gender experiment. I really enjoyed the topic and wanted to look further on that subject

For this experiment I created a page of pictures with twenty images on it. Ten of the images were prototypical boy images and the other ten were prototypical girl images. I tested fifty middle school students to see if they would remember their gender's images. I took each student, one at a time, into a quiet room. I had them study the twenty images for twenty seconds. Then they wrote down the images they remembered on a flash card.

I ran into one problem during my experiment. Half way though, I realized that both the boys and the girls were remembering a lot of the girl images. I released that most of the girly images were bright colors. It would draw you eye to them and would be easier to remember. The boys data was close between the girls and boy pictures because of the bright colors. Boys and girls do remember their gender's prototypical images.

NAME(s)	Amelia Payne	PROJECT NUMBER	B15
SCHOOL	South Burlitong High School	GRADE	9
TEACHER	curtis belton		
PROJECT TITLE	The Effect of Cellphone Radiation on yeast metabolism		

## ABSTRACT

The purpose of this investigation was to determine the effect of electromagnetic radiation from cell phones on the rate that yeast metabolize sugar. The World Health Organization lists cell phone radiation as a potential carcinogen. The effects of cell phone radiation on yeast may provide a basis for the claims that cell phones can have adverse health effects. The hypothesis was that the yeast that closer to the cell phone would metabolize sugar at a more rapid rate than the yeast that was farther away from the phone due to the heating effect of the cell phone radiation.

Test tubes of yeast were placed at varying distances from an operational cell phone - 0cm, 30cm, and 1m. Three trials were conducted in which CO<sub>2</sub> was collected in balloons that were placed over the neck of the test tubes and the diameter of the balloon was measured to determine CO<sub>2</sub> output, representing yeast metabolism. The control group for this experiment was a tube of yeast that was placed in a different room from the cell phone.

The data show that the hypothesis was correct. The test tube of yeast that was placed on top of the cell phone grew the most. Further experimentation will analyze the metabolism of yeast that is not exposed to any radio waves.

NAME(s)	Gailin Pease	PROJECT NUMBER	M02
SCHOOL	Burlington High School	GRADE	12
TEACHER	Mark Wagy		
PROJECT TITLE	Learning and Habituation in Evolutionary Robotics		

## ABSTRACT

Evolutionary robotics often addresses two timescales: the evolutionary scale, where thousands of robots are run in successive generations with mutations to develop a successful control plan, and the simulation step scale, where the conditions of the robot's body at the end of one simulation step determine the motion of the robot in the next simulation step. This research aims to investigate an intermediate timescale, namely the potential for learning and memory within a single simulation over multiple timesteps. Can habituation, a simple form of learning, for an individual robot be evolved? Can this be useful in adaptation to stimulus changes within an individual simulation? Additionally, will this adaptation come at the expense of efficiency in legged locomotion, a complex problem often solved with evolutionary algorithms? This research develops a simple legged robot with a neural network controller which, for test groups, includes a "memory bank" allowing the robot to store outputs from one simulation step to the next. The neural network controller and "memory bank" are evolved over 5000 simulations, and final genomes are tested. Within each simulation run, the robot will be subjected to physically meaningless simulation spikes which should be ignored, and this research aims to test if a robot can become habituated to these spikes with the "memory bank" described above. Initial data collection shows that "memory bank" robots have more mobility and smoother gaits than non-"memory bank," but analysis of effects on habituation ability has not yet been completed.

NAME(s)	<b>Adela Peco, Emily Harvey, Chantalle Nguyen</b>	PROJECT NUMBER	<b>GP10</b>
SCHOOL	<b>Albert D. Lawton Intermediate School</b>	GRADE	<b>8</b>
TEACHER	<b>Jennifer Aither</b>		
PROJECT TITLE	<b>Acid Rain, Rain, Go Away</b>		

### ABSTRACT

Acid Rain is a world-wide concern. Here in the Northeast, the environment is fragile and susceptible to changes in pH levels. The conditions created in the Midwestern United States from coal plant emissions directly affect Vermont and Upstate New York. Coniferous forests and lake ecosystems are murdered by the low pH rain, which creates hazardous conditions for wildlife native to the area.

Our investigation looked at how acid rain affects coniferous trees on a small scale. With the help of a UVM researcher, we were able to design an experiment to test acid rain over a two season change. We simulated a seasonal shift from winter to spring by moving our trees inside to a warmer area and continued testing. We found that trees subjected to low pH are impacted greatly very quickly.

We also attempted to mitigate acid rain by using a base product (baking soda) to neutralize the acid that was subjected to the trees. We found that worked well. In addition, the trees that were hit with the acid rain were given a baking soda solution in an attempt to bring them back to life.

Overall, the investigation shed light on the affects on acid rain on areas like Vermont and Upstate New York that have a large concentration of coniferous trees. However, that is only part of the problem. Acid rain is world-wide and affect much more than forests. We need to begin work to limit our sulfide production and reduce our emissions world-wide to protect our environment.

NAME(s)	<b>Gabriel Pena</b>	PROJECT NUMBER	<b>P14</b>
SCHOOL	<b>Missisquoi Valley Union High School</b>	GRADE	<b>11</b>
TEACHER	<b>Dana Maria Dezotell</b>		
PROJECT TITLE	<b>The Direct Current of Electrolytes in Beverages</b>		

### ABSTRACT

Sports drink companies such as Gatorade, Powerade, Aquarius, Herbalife, and many more spend millions of dollars advertising their products each and every year on T.V, radio, and newspapers. The benefits of these advertisements are that they show the large amount of Electrolytes, which is lost whenever a person sweats. Throughout this project, I will compare the amount of electrolytes in different sports drinks, orange juice and water to find out which beverage has the least and most amount of electrolytes to replenish the ones that people lose when they sweat.



NAME(s)	<b>Katelyn Perry</b>	PROJECT NUMBER	<b>S19</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>10</b>
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	<b>Evaluating Music's Ability to Distort an Individual's Emotions</b>		

### ABSTRACT

The purpose of this project is to detect which musical genre invokes certain emotions. It is known that certain types of music can cause you to feel happy or sad, but I would like to know what genres cause specific emotions. I feel that genres with more upbeat melodies will make people happier than genres with slow, mournful melodies. I will ask different people (with different musical preferences) to listen to a pre-made playlist full of 30 second clips from different songs of 15 genres. I will have them write down their thoughts and what they are feeling whilst listening to the playlist. The results I received corresponded with my hypothesis. The "happier" genres caused the people to feel more upbeat and the "angrier" genre made them feel negative emotions.

NAME(s)	<b>Isabelle Pertucci</b>	PROJECT NUMBER	<b>C16</b>
SCHOOL	Albert D. Lawton Intermediate School	GRADE	<b>7</b>
TEACHER	Jennifer Aither		
PROJECT TITLE	<b>Spicy Food and My Stomach</b>		

### ABSTRACT

Food is known to cause some people stomach problems, I wanted to figure out why, so I did my project on it. I bought assorted spicy and citrus foods. I discovered that your stomach is mostly made up of hydrochloric acid, and that the pH of your stomach is around 3 while you're eating, and around 5 when you're not eating. I tested each food with both pH's. My hypothesis was that no matter what the pH was, it would go lower, making it more acidic. My hypothesis was not completely correct. At the pH of 3, all of the citrus foods went down a little or stayed the same, but the rest of the spicy foods all went up or stayed the same. That disproved my hypothesis, so I just went on with the pH of 5. With the pH of 5 I found out that all of the citrus foods went down a big drop. The spicy foods also went down somewhat, at least to the pH of 4. Some even went lower. My theory about the experiment was that if a spicy or citrus food is the first thing you eat, the solution will be at the pH of 5, it would make a bigger impact on your stomach. That's why people tell you to eat something with your spicy food, so everything evens out. However, if you mix it around then your pH will be at 3, which doesn't change your pH level very much. With a little extra research I realized that inside spicy foods, such as peppers, have a chemical inside called capsaicin, which bothers some people's stomachs. Those are my reasons why I believe spicy and acidic food impact the stomach.

NAME(s)	<b>Christina Peters</b>	PROJECT NUMBER	<b>C17</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Soda Science</b>		

## ABSTRACT

Many people ask how to cool a drink the in the fastest way possible. My research question was what is the fastest way to cool a soda. My hypothesis was the fastest way to cool a soda is by putting it in a bowl of ice water while stirring the soda. I chose this because the research I did said that water is usually better at cooling liquids than air is. I also chose this because by stirring the soda you would add a convection current, which I learned was important to cooling a liquid during my research. I had 18 cans of Pepsi. I did 6 different tests. I did each test 3 times. The different tests were refrigeration, refrigeration with a fan blowing on the can of soda, freezer, freezer with a fan blowing on the soda, a bowl of ice water, and a bowl of ice water while stirring the can soda. I would leave the soda cooling for ten minutes. I would open the can of Pepsi and take the starting temperature of the soda. I would put the can of soda into the refrigerator, freezer, or bowl of ice water. After 10 minutes of the soda cooling I would take the final temperature of the soda. After doing my experiment I can conclude that going from the most effective way to cool a soda to the least effective way to cool a soda it goes: ice water while stirring, ice water, freezer with fan, refrigeration with fan, freezer, and lastly refrigeration. This proves my hypothesis to be correct.

NAME(s)	<b>Curtis Plante</b>	PROJECT NUMBER	<b>S20</b>
SCHOOL	<b>Mater Christi</b>	GRADE	<b>7</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>The Interaction of Distraction</b>		

## ABSTRACT

This study was to find out which type of electronic distraction interferes with the memory more, video games or videos. The hypothesis stated that the video group would score higher on a memory test than the competing game group. Each group was composed of eight volunteers of the age of 12 or 13. During background research it was determined that ôraptö meant the video game type of stimulation, and ôpassiveö meant the video/television type of stimulation. Two separate rooms were utilized to separate the two groups during the distractive period. One group watched a video using a Smart Board, while the other used Ipads to play the game. During the data collection process, a test was made for the participants to take after the distraction period. For five minutes the participants studied a list of eleven words; then watched a video or played a game for four minutes; and finally took the test. The hypothesis was supported by the data, as the video group had a higher average score than the game group. Although the hypothesis was supported, it is very critical to remember that many factors could have changed the data's statistical significance. Some controlled variables such as the time of distraction period for each group were in place to help the study be more realistic. In conclusion, the video group scored five points higher than the game group. A student's t-test was performed to see if it was statistically significant, and resulted in a p value of 0.16.

NAME(s)	<b>Phoebe Plunkett, Hana Couture</b>	PROJECT NUMBER	<b>GP04</b>
SCHOOL	<b>Christ the King</b>	GRADE	<b>8</b>
TEACHER	<b>Mrs. Sirvastava</b>		
PROJECT TITLE	<b>Killer Runoff</b>		

### ABSTRACT

The reason we chose to research our topic was because it intrigued us. One, out of the many, reasons why this project inspired us to pursue in it was because we are committed to serving our community and society.

Runoff is a major problem in our community; we strive daily to correct this vast issue. We questioned the growth of plants getting water vers runoff. Burlington is placed on a slope; when rain falls, it picks up many different types of substances along its journey to the lake. This is exactly what runoff is. As you can see, this is a problem that needs to be corrected quickly.

To start off our riveting experiment, we purchased basil seeds and soil. Next, we planted the actual plants and created our home-made runoff. Every other day we watered both types of plants (one with runoff and one with water). Both the plants were recorded, charted, and photographed every other day. At the end of the recording session, we found some very valuable, community changing, information.

As a whole, we were very pleased with the information we discovered throughout the four-week cycle. Our beginning hypothesis went hand and hand with our ending results. Just as we had suspected, the runoff plants didn't even sprout, yet the pure watered plants did. We were both happy and sad to see the results. The reason being, since the runoff plants did not flourish, it shows that runoff is infact killing our plants.

To conclude our experiment, we in fact observed community-changing changing information. Our project informs the citizens of our town, that we need to watch what we littler, have less cities, use less harsh chemicals to maintain of yards, and create rain gardens(which helps put rain where it is suppose to be).

NAME(s)	<b>Maryann Pohlen, Erin ODonnell</b>	PROJECT NUMBER	<b>GP24</b>
SCHOOL	<b>Christ the King School, Burlington</b>	GRADE	<b>8</b>
TEACHER	<b>Vidula Srivastava</b>		
PROJECT TITLE	<b>Twice the Task, Half the Result</b>		

### ABSTRACT

This project tested the productivity of multitasking. We hypothesized that if students multitask, they will not work as efficiently in any of the tasks they accomplish and will produce substandard results. To begin our experiment we found a short story. Then, we separated 14 eighth grade students into two groups. Next, we gave each student a copy of a story to read; In the multitasking group, while they were reading, we texted them and required them to text us back within 30 seconds. With the non-multitasking group, we gave them the story to read without any distractions and let them move at their own pace. Both groups were instructed to raise their hand when finished with the story and were then given the comprehension test which consisted of 20 questions. Lastly, when everyone was finished, we dismissed the students, and graded and recorded the results of the test. Afterwards, we repeated the same experiment, but with a different yet similarly challenging short story. However, we switched the two groups of students so that they were in the opposite group than before. We did this to ensure that the reason behind the lower scores was not because of the individual students' intelligence but because of the format with which they were working under. Both multitasking group's test results turned out to be noticeably lower than the group focusing on one solitary task.

NAME(s)	<b>Kristen Potter, Madison North</b>	PROJECT NUMBER	<b>GP21</b>
SCHOOL	<b>Milton Middle School</b>	GRADE	<b>7</b>
TEACHER	Greer Krembs Janet Smith		
PROJECT TITLE	<b>How Does Age Effect Memory?</b>		

### ABSTRACT

How often have you heard it said that memory fades with age? We were extremely curious about the brain and focused our background research primarily on the hippocampus - the part of the brain that transfers long term memory to short term memory. Our final testable question was: How does age affect memory? Because we learned their brains are more developed, we predicted that adults would have the best memory and would be able to recall more information.

We designed this experiment by ourselves, so it took us time to decide what our subject group would look like. We decided to test three age groups: kids, teenagers, and adults. Based on our research we knew a visual test would work the best. We designed memory strips, which are strips of paper with sequences of real-life photographed images on them. We gave our test subjects 30 seconds to remember the images on the strip. The test strip was removed and the testing was paused for 10 seconds. The subjects were required to accurately tell us the sequence of images on the strip from left to right. The testing continued with increasingly longer strips until the responses were less than 100 percent accurate.

We found that teenagers have the best memory with an average of 6 memory strips successfully remembered. Adults had an average of 5.3 memory strips successfully remembered. Kids had an average of 5 memory strips successfully remembered. Our data included the amount of memory strips remembered, age group, gender, and memory strategy used. The data collected does not support our hypothesis. This surprised us since we thought adults would have the best memory. We concluded that, within our small sample size, there was not a large enough difference to indicate any specific age group has better memory.

NAME(s)	<b>Alexandra Quatt</b>	PROJECT NUMBER	<b>P15</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>8</b>
TEACHER	Mr. Mark Pendergrass		
PROJECT TITLE	<b>Solar Ovens</b>		

### ABSTRACT

○This science fair project explored the relationship between mirrors and temperature increase in a solar oven. The hypothesis stated that if more mirrors are added to the solar oven, than the temperature will increase because the heat will be reflected into a more condensed area. A 13 inch by 8 inch solar oven was built from a shoe box, duct tape, black foam board, glass, and mirrors. A heat lamp was used to make sure that the project was not weather dependent. Six, thirty minute trials were preformed where time and temperature were recorded every minute.

The trials included no mirrors to four mirrors. The testing was repeated after every time a new mirror was added to the oven. It was found that the increase in mirrors increased the temperature inside the oven. The hypothesis was correct in the end because the reflective side of the four mirrors produced the highest temperatures. However, the insulation that the mirrors also helped in the increase of temperature.

NAME(s)	<b>Ryland Richardson, Josh Guadette</b>	PROJECT NUMBER	<b>GP16</b>
SCHOOL	<b>Windsor Jr/Sr High School</b>	GRADE	<b>7</b>
TEACHER	<b>Owen Campbell</b>		
PROJECT TITLE	<b>The Best Material for a Parachute</b>		

## ABSTRACT

The purpose of this experiment is to find the best material for a small scaled parachute. Our project was tested with four materials; denim, plastic grocery bag, cotton towel, and a heavy duty plastic garbage bag. We hypothesized that the garbage bag would descend the slowest and keep our mini lego character the safest. We used 8 inch by 8 inch squares of material for the parachutes and connected the material to the lego character by three 8 inch pieces of string using simple knots. We taped all four corners of the material into the center and taped the string to that. We dropped the parachutes from an altitude of 426.72 centimeters. We timed our drops in seconds and found the velocity by dividing the altitude by the time it took to land. We limited our experimental error by counting down before dropping the parachute so the timer would begin as soon as it was dropped. We decided to repeat each drop three additional times using all materials to average out our velocity data. We collected the data from all four materials used and found the hypothesis was correct. The best material for a small scaled parachute would definitely be the heavy duty garbage bag because it descended the slowest catching air under the material to guide it down to the ground safely. In the future we would like to expand on this experiment by using different shapes of materials to see what design will make an egg land without breaking open.

NAME(s)	<b>Caitlin Roberts</b>	PROJECT NUMBER	<b>B43</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Complex vs. Simple: The effects of carbohydrates on blood sugars</b>		

## ABSTRACT

The purpose of this experiment is to test specific simple and complex carbohydrates and compare their effect on blood sugars based on the Glycemic Index description. The procedure used to determine a food's GI rating was used, and each trial consisted of 5 grams of carbohydrates. The carbohydrates used were glucose, sucrose, fructose, and glycogen. Blood glucose was tested before each trial, and every 15 minutes for two hours after the carbohydrates were eaten. Glucose peaked after 35 minutes and Fructose peaked at 20 minutes, then both had little effect on blood glucose after reaching their peak. Sucrose peaked after 40 minutes, but the blood glucose decline after it reached its peak was much slower than that of the monosaccharides because disaccharides take a little bit longer to break down. Glycogen peaked after 95 minutes, and blood glucose level out after the peak, which was to be expected of a complex carbohydrate because they have to break down into simple carbohydrates before they can be absorbed into the bloodstream. It was concluded that the carbohydrates did what the glycemic index said they would, but each carbohydrate performed a limitless differently.

NAME(s)	<b>Zachary Rongo</b>	PROJECT NUMBER	<b>C18</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Rev Up</b>		

## ABSTRACT

In today's economy, the whole world is looking for a better solution to gas prices and a backup for the future if the world were to run out of oil for cars and electricity. This experiment is to test if biofuels could replace oil in case of this event. My hypothesis is that motor oil will contain more energy than vegetable oil and vegetable oil will contain more energy than olive oil.

In order to do this project, I collected my oils and built a calorimeter using a soda can. I placed 35 drops of each oil onto a 1 and a half inch piece of cotton cordage. I then burned the cord under a soda can with a 100 milliliters of water in it and wrote down the temperature of the water every 15 seconds. After my experiment, I calculated the number of joules of energy each oil put into raising the temperature of the water and calculated the averages.

One of the problems that was faced was the time of year, it's the coldest time of year and that could have affected the water temperature. Another was that this test could have used insulation instead of leaving the flame open to the air. A good conclusion for my experiment is this test was not a fair test and could use some improvement. My hypothesis was proven wrong because on one of the trials, the vegetable oil had the most averaged energy output of all the oils, including the motor oil. However, I believe my results are inconclusive and I would like to do further tests.

NAME(s)	<b>Olivia Rooney</b>	PROJECT NUMBER	<b>B16</b>
SCHOOL	Saint Mary's School, Middlebury, Vermont	GRADE	<b>6</b>
TEACHER	Michelle Eagan		
PROJECT TITLE	<b>Supercool! Exploring ice nucleation with Pseudomonas syringae</b>		

## ABSTRACT

*Pseudomonas syringae* is a bacterium on plants that allows ice to form at temperatures above freezing (pure water freezes at -40°C). This is why farmers lose crops (and money!) to the first frost. If we can stop *P. syringae* from nucleating (starting) ice formation on food crops, then they will survive frost. Hypothesis: if *P. syringae* is added to pure water at a temperature above freezing (-6°C), then ice will form. Ice will not form at -6°C if *E. coli*, a bacterium that cannot nucleate ice, is used instead. To address this hypothesis we used inoculating loops, an ice bath, glass tubes, pure water, a thermometer and the bacteria mentioned above. A smooth plastic loop (negative control) or a rough metal loop (positive control) was added to water at -6°C to demonstrate that ice formation needs a nucleator. Then *P. syringae* or *E. coli* was added to the water to demonstrate that ice nucleation is a special property of *P. syringae*. We found that the metal loop and *P. syringae* nucleated ice formation but the smooth loop and *E. coli* did not. These results support the hypothesis that *P. syringae* is an ice nucleator at relatively warm temperatures. This is important because if we can understand how *P. syringae* causes ice formation, then we may prevent frost on crops in third world countries where food crops are scarce. *P. syringae* might also be used to encourage cloud formation and precipitation in places where there is drought.

NAME(s)	<b>Ben Ryan</b>	PROJECT NUMBER	<b>B17</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The effect of nicotine, caffeine, and borax on corn root growth.</b>		

### ABSTRACT

The purpose of this experiment is to find out how caffeine, nicotine, and borax affect corn root growth. It is hypothesized that nicotine will hold back growth the most, with borax coming after that and caffeine after that.

The control group is a container with corn seeds planted in it that are not exposed to any of these. The experimental group are three containers, one with caffeine pills in the soil, one with nicotine patches in the soil, and the other with borax in the soil. The independent variables are the compounds. The dependent variables are amount of soil, water, and light. The corn seeds will be soaked in a bucket of water for twenty-four hours, then they will be transferred to Petri dishes and covered with paper towels for another twenty-four hours, then planted. They will be watered with water that has caffeine pills, nicotine pills, or borax dissolved in it.

Data collection is nonexistent as of now, but it is expected that the containers that contain soil with compounds in them will harbor corn roots that exemplify hindered growth. The corn roots will be measured at the end of the experiment to find out which groups of roots grew the most and which did not.

Crops are sometimes exposed to different chemicals and substances, which can affect their growth. With knowledge about what different compounds do to plants, people have been able to effectively induce growth in plants as well as protect them from unwanted compounds.

NAME(s)	<b>Patrick Ryan</b>	PROJECT NUMBER	<b>B29</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Affect of Varying Temperatures on Bacteria Growth</b>		

### ABSTRACT

The purpose of this experiment was to determine whether or not temperature has an effect on the general growth of bacteria. In conducting this experiment, it is hypothesized that the higher the temperature, the faster the rate of reproduction. The control group in this experiment was the strains of bacteria used. Three types of bacteria were used in this experiment, and all three were exposed to three certain temperatures. The dependent variable is the temperature. After plating three plates for each of the three types of bacteria, each were placed in respective incubators. Data collection is incomplete, but the results will probably yield that the highest temperature allowed the most bacteria to reproduce. In analysis, the data will be examined to see if temperature changed the rates of reproduction, and, if so, how much.

This information will help in the understanding of how bacteria reproduce in certain sensitive environments.

NAME(s)	<b>Joey Salvas</b>	PROJECT NUMBER	<b>C19</b>
SCHOOL	<b>Milton Middle School</b>	GRADE	<b>8</b>
TEACHER	<b>Janet Smith</b>		
PROJECT TITLE	<b>Beyond the Smoke - How a Science Experiment with Cigarettes Changed a Boy's Life</b>		

### ABSTRACT

○Cigarette smoking disrupts and tampers with the body by putting tar and other cancer-causing chemicals into the lungs. I was interested in investigating tobacco. I learned that even a very small amount of concentrated nicotine can be deadly. Because of this, I decided instead to investigate what percentage of solid matter is actually inhaled when a cigarette is smoked. I predicted that twenty percent of a cigarette is inhaled as solids since the majority of cigarette becomes ash.

○I tested this by assembling an apparatus that acted like lungs when cigarette smoke is inhaled. The smoke was filtered through extremely fine filter paper to collect any solids. I weighed the filter paper before lighting the cigarette and again after it burned and the smoke was filtered. This let me measure the amount of solids that were filtered from the smoke. I did this for 1, 2, 4, and 6 cigarettes per filter paper. I also tested the smoke of a cigarette with the cigarette filter removed to see how much solid material is trapped by the cigarette filter.

○The filter paper turned dark brown after the smoke went through the apparatus. The residue left on the filter paper only weighed enough to be measured for 4 cigarettes and 6 cigarettes per filter. This showed that an average of only 0.33 percent of a cigarette is inhaled solids.

○I was surprised that my hypothesis was incorrect and so few solids are inhaled. It seems that the smoke becomes more concentrated with harmful chemicals, like nicotine, if most of the solids are really trapped in the cigarette filter. This would be what I might test next. I do not believe all of the solids were filtered from the smoke. Maybe if I used a finer filter paper I might get different results.

NAME(s)	<b>Max Sample</b>	PROJECT NUMBER	<b>B18</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>Combustion of Natural Wood Biofuels</b>		

### ABSTRACT

The purpose of this experiment is determine which type of wood produces the most heat at the best efficiency. Wood is used as fuel all around the world, and finding the optimum variety will greatly enhance the usage of wood as a biofuel. Wood burns in multiple stages, and the wood that fulfills all of the optimal conditions will be best. The most efficient burning wood will be pine.

To test the efficiency of species of wood, a small chamber will be used, over which is a container of water. The heating rate of the water, and duration of fire will be compared between types of wood. The results of each portion of wood will be compared against each other, and the best will be found. Needed for this experiment is the mentioned chamber, a thermometer, the wood types which will be tested. Data collection at this time has not been fully completed, but as of now, the chamber has worked flawlessly and all variables have been controlled. The most efficient species of wood used in heating, out of samples tested, is pine.

This has a major real world applications, the issue that is being resolved will help all those that use wood as a biofuel. Wood has proven to be an effective heat source.



NAME(s)	<b>Emma Saucier</b>	PROJECT NUMBER	<b>P16</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>11</b>
TEACHER	<b>Catharine Engwall</b>		
PROJECT TITLE	<b>Weight Sensing Walking Boot</b>		

## ABSTRACT

The purpose of this project was to design a new medical device that will allow patients with a hip, knee, ankle, or foot injury to be notified when they are exceeding their weight bearing limitations. The current model is inadequate because it informs the patient by sound, making it insufficient for patients with hearing impairments. It also straps to a shoe, making it insufficient for patients with an injury below the knee. The new product uses Arduino, open source coding platform, and flexiForce sensors. The wiring was soldered to a breadboard that was cut down based on the size of the boot. When a patient exceeds their weight bearing limitations, the flexiForce sensors trigger a light that is placed on the top of the boot. The sensors output an arbitrary number, so they have to be calibrated. After calibration was completed, the sensors were placed into various parts of the boot. These spots were determined by the different phases of a person's gate. The next phase of this project would include creating an app and a separate device that would vibrate to inform the patient when they exceed their limitations.

NAME(s)	<b>Noa Saunders</b>	PROJECT NUMBER	<b>B30</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>At What Environment Does the Epigenetics of Ecoli Undergo the Most Change?</b>		

## ABSTRACT

The purpose of this experiment is to determine what environment causes the most change to the epigenetics of Ecoli. Former studies have shown that the preferred temperature for most pathogens is similar to the bodies, around 37C or 98F. In conducting this experiment, it is hypothesized that at warm environment the epigenetics of Ecoli will show the most change.

The experiment will consist of five different environments with an equal amount of Ecoli distributed between each. The environments consist of a cold climate, climate of dry heat, a moist environment, a room temperature climate, and a climate that is wet. The Ecoli will live in the environment for about a week and at the end of the week the data will be analyzed.

Data collection is incomplete at the moment, but it is expected that at the room temperature environment the Ecoli will undergo the greatest change. The data will be analyzed by finding the percentage of altered Ecoli from the organisms that had no physical change. The factors that will be used to determine if there have been changes are obvious physical traits that can be seen under the microscope.

Studies on microorganisms such as this provide information about the most suitable environment to genetically mutate a microorganism to the top breeding condition.

NAME(s)	<b>Madedline Sawyer</b>	PROJECT NUMBER	<b>P17</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>6</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>Striking a Chord: How Do Temperature Changes Affect Vibration Levels of Violin Strings?</b>		

### ABSTRACT

This Science Fair project titled Striking a Chord: How Do Temperature Changes Affect Vibration Levels of Violin Strings? was designed to answer this question: How does the vibration level of violin strings change depending on the temperature of the room? It was hypothesized that at a higher temperature, the violin strings would vibrate at a higher rate. Research has indicated that sound waves travel quicker at higher temperatures, and that the acoustics in a room may affect the results of the testing. Therefore, the testing was done in the same room the entire time. The room was prepared for testing by setting the heater at the desired temperature and leaving the violin in the room for an hour, and frequently checking the room temperature with a digital thermometer. Then the A string was played, and the hertz adjusted on the tuner until it indicated that the string was in tune at that temperature. This was done at the temperatures 55 degrees Fahrenheit, 65 degrees Fahrenheit, and 75 degrees Fahrenheit. It was tested five times at each temperature, leaving one minute between each test at each temperature. The results of the hertz of the A string at each temperature were recorded in the data table. The humidity level decreased as the temperature of the room increased, possibly affecting the data collection. Results indicate that the hertz of the violin A string does not increase as the temperature of the room increases, but rather decreases, showing that the hypothesis was incorrect. These findings, while unexpected, provide an opportunity for future research.

NAME(s)	<b>Steven Sayers</b>	PROJECT NUMBER	<b>G06</b>
SCHOOL	<b>Northfield Middle High School</b>	GRADE	<b>11</b>
TEACHER	<b>Ms. Urling</b>		
PROJECT TITLE	<b>The Effect of the Northfield Golf Course on the Water Quality of the Dog River</b>		

### ABSTRACT

During this experiment, I did a chemical analysis, a habitat assessment, and a macroinvertebrate test on the Dog River before, on, and after the Northfield Golf Course. For the chemical analysis test, I tested how much phosphate, nitrate, and dissolved oxygen was in the water. I also tested the pH, temperature, and transparency of the water. For the habitat assessment, I used a VT Habitat Assessment Field Form and found a score for each of the three areas. For the macroinvertebrate test, I moved my feet around in the water and used a net to catch the macroinvertebrates. For the chemical analysis test for the area before the Dog River, I got an average of .12 for the amount of phosphate. The average temperature was at 4.8 degrees Celsius. The habitat assessment score for the area before the Dog River was .845 which was good and the macroinvertebrate survey score was 1.75 which was excellent and was the same for the downstream area. For the area of the Dog River on the Golf Course, it had an average phosphate level of .59, an average .12 of nitrate, an average pH level of 4.9 and an average temperature was at 4.8 degrees Celsius. For the habitat survey of the area of the Dog River on the golf course, I got a score of .53 which is fair. For the area of the Dog River after the golf course, I got an average of .09 of phosphate, an average pH of 5.8 and an average temperature of 4.5 degrees Celsius. For the habitat assessment of the area, I got a score of .635 and I got a score of 1.5 for the macroinvertebrate survey which were good. Overall, the Northfield Golf Course does not have a large effect on the Dog River.

NAME(s)	<b>Emily Scott</b>	PROJECT NUMBER	<b>B44</b>
SCHOOL	Missisquoi Valley Union High School	GRADE	<b>11</b>
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	<b>Effectiveness of Homemade Stethoscopes</b>		

## ABSTRACT

Official Abstract  
Effectiveness of Homemade Stethoscopes

Stethoscope Science Fair Project  
Emily Scott  
Missisquoi Valley Union Highschool, Swanton Vermont 05488

For my science fair project, I completed a project testing homemade stethoscopes. I made three different types of stethoscopes. One stethoscope was made of rubber tubing with two funnels at each ends. Another was made of a cardboard paper towel tube with a plastic funnel. Lastly, the third stethoscope was made of the same rubber tubing but with a funnel and metal plate attached with wax paper. I tested how loud the participants heartbeats came through the stethoscopes, how many heart beats per minute, and which stethoscope was most environmentally friendly. My Procedure consisted first of gathering the materials being used for the first stethoscope, and constructing it. I then tested the stethoscope on a ôpatientö or peer to see how well the stethoscope worked. I put these results in a table that is organized by type of stethoscope, loudness, and bpm. I then made a graph of the beats per minute for each stethoscope. Out of this project, I was able to draw a few conclusions. One, I realized that stethoscope three (made out of cardboard) was most environmentally friendly because the stethoscope part was recyclable. Also, I found out that the stethoscope made of rubber and the metal disk worked the most effectively. These different stethoscopes could potentially be used around the world to help in troubled areas, and could help aid in healthcare in areas where stethoscopes are hard to come by. The independent variable is type of stethoscope used, and the dependent would be how loud the heart beat comes through and the bpm.

NAME(s)	<b>Savana Senecal</b>	PROJECT NUMBER	<b>C20</b>
SCHOOL	St. Francis Xavier School	GRADE	<b>8</b>
TEACHER	Mary Ellen Varhue		
PROJECT TITLE	<b>Lather. Rinse. Repeat</b>		

## ABSTRACT

How much shampoo do we really need and how much pollution is caused by what we currently use? My research questions what factors affect the amount of suds produced by shampoo. By determining how much shampoo is needed to adequately clean hair, we could possibly decrease the amount people use and in doing so, decrease the amount of pollution caused by shampoo. Three shampoos were selected; Burt's Bees Very Volumizing, Pantene Volume, and Garnier Fructis Volume Extend. A small canning jar was filled with one fourth cup of hard water, then one drop of the first type of shampoo was added and shook it three times. The experiment was repeated with five types of water, and the other two types of shampoo. The five types of water used were hard water, softened water, distilled water, spring water, and drinking water. I hypothesized that hard water would require the most shampoo for suds production. My data was not consistent, so no distinct conclusions can be made from my experiment. However, I did notice that Pantene, and Garnier Fructis created more suds than Burt's Bees. This could possibly be due to Burt's Bees being sulfate free. Upon repeating this experiment, more sulfate free shampoos would be used to determine if they would react like Burt's Bees as well as an alternative method for determining suds creation.

NAME(s)	<b>Beatrice Shlansky</b>	PROJECT NUMBER	<b>P18</b>
SCHOOL	<b>Mater Christi School</b>	GRADE	<b>8</b>
TEACHER	<b>Mark Pendergrass</b>		
PROJECT TITLE	<b>Gliding the Distance</b>		

### ABSTRACT

The purpose of this science fair project was to determine if humidity affected the fluid friction on a flying object such as a paper airplane. It was hypothesized that as humidity increased, the friction would lessen, and the object would fly further. During research, much was learned about relative humidity and the decrease in air resistance as humidity increases. It was also learned how a plane works using drag, lift, and force. To test this question, a large room was sealed off and a person folded 2 different types of paper airplanes. The tester stood behind a set line and launched the planes by hand. After flight, the flight distance was measured in inches and recorded. This process was repeated 25 times per plane. Then, the humidity was increased in approximately 10% increments for 3 remaining trials, and the flight process was repeated. After 100 trials were completed per plane type, the flight distance was averaged per each humidity level and plane type to find the mean distance per plane type. The main factor that affected data collection was that lower humidity levels had to be used because humidity was inconsistent and it was hard to reach higher levels of humidity to test. By the end of testing, humidity did affect the friction on the plane because average flight distance always varied from the control. Yet the results were too inconsistent or minimal to conclude what the specific affect humidity had on flight. Therefore, the hypothesis was incorrect since no exact conclusion could be drawn.

NAME(s)	<b>Noah Simonds</b>	PROJECT NUMBER	<b>P19</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Coming Ohm</b>		

### ABSTRACT

Electricity is a big part of modern society. Almost everywhere you go electricity will be needed for houses, buildings, cars, etc. But there are still issues with the conductors that carry the current. Electrical resistance slows down electrical current and there is less energy delivered. My project was testing different types of materials to find out differences of resistance measured in Ohms between each wire. I chose this project because I thought that topic of electrical current was fascinating.

○My hypotheses were that if the volume of a conductor increases then the resistance will decrease and if the length of the conductor increases, the resistance will increase. I tested different length and volume conductors to investigate and prove my hypothesis. For my procedure I firmly pressed the two probes of the multi meter to the ends of each conductor to see what the resistance was.

My results showed that the longer wire had higher resistance levels than the shorter wires. The wire with the greatest resistance was the 750 kcm. wire (750,000 circular mils). It had the greatest resistance which should disprove the first part of my hypothesis but it did have a great amount of insulation. Insulation restricts the movement of electrical current.

My project concluded that greater lengths of wires removes efficiency from electrical current. For better efficiency someone could use a greater volume of a conductor or gold or silver which is very impractical because they are both very expensive.

NAME(s)	<b>Alexa Slocum</b>	PROJECT NUMBER	<b>C21</b>
SCHOOL	<b>Northfield Middle High School</b>	GRADE	<b>11</b>
TEACHER	<b>Ms. Urling</b>		
PROJECT TITLE	<b>The Effect of Road Salt on the Growth of Bean Plants</b>		

## ABSTRACT

### Abstract

Two experiments were done to find the effect of road salt on the growth of bean plants. The procedure was the same for each group of plants with the different amounts of salt added and is as followed: I planted 25 different bean plants, (five groups of five, one group of five for each amount of road salt- 0 tsp to 2 tsp going up by  $\frac{1}{2}$  tsp), each in its own single cup. I placed a group of five together and added one of the five different amounts of road salt to the five plants, (starting with zero as the control and then going up by a  $\frac{1}{2}$  teaspoon), added to the other groups of five up until two teaspoons is added to the last group of five. Once the salts are added to each and have been given about five days to set into soil, allowing about five days to start growing at a normal rate. I then measured each plant to track the growth over the next few weeks. I measured the plants every seven-10 days. The heights I received during half of the last month's heights, (in order from 0 to 2 teaspoons), were: 41.27 cm, 19.05 cm, 13.97 cm, 0 cm, and 0 cm at 50 days, and 43.18 cm, 17.78 cm, 12.7 cm, 0 cm, and 0 cm at 60 days. The averages all of the last month's heights were: 41.11 cm for 0 tsp, 19.36 cm for  $\frac{1}{2}$  tsp, 15.08 cm for 1 tsp, 17.78 cm for 1  $\frac{1}{2}$  tsp, and 1.90 cm for 2 tsp road salt. The trend I noticed for the average heights was that a higher concentration of road salt equaled wilting and dying of plants much quicker than the plants with little or no salt added.

NAME(s)	<b>Claire Smith</b>	PROJECT NUMBER	<b>P20</b>
SCHOOL	<b>Hinesburg Community School</b>	GRADE	<b>7</b>
TEACHER	<b>Stephanie Konowitz</b>		
PROJECT TITLE	<b>Ice, Ice, Baby</b>		

## ABSTRACT

Many automobile accidents occur when cars slide out of control on glare ice. This project was designed to determine if a car would stop closer to where it started to slide if its tire treads were smooth instead of knobby. I'm interested in this topic because I've observed many cars encounter black ice on the highway and begin to skid. I wondered if the condition of their tires might affect the driver's ability to stop in a shorter distance. It was helpful to research that friction slows objects down. It is useful to know that a smoother tire tread might stop a car before one with knobby tires because there is more surface area. I hypothesized that smooth tires would stop shorter because there would be more surface area to create more friction.

I used an ice track and shoes with different treads to model tires on ice. To conduct this experiment I built a track, in which water could be filled and allowed to freeze, and a slingshot device, called a shuttle. I weighed three shoes representing the varied tire treads. To control the variable of friction, I added materials to make sure they all had the same mass. Using the shuttle, I flung each shoe down the track and measured the distance it stopped from where the shoe started.

After comparing the three tire tread models, I discovered that the smoother tire model did stop after a shorter distance than the knobbier ones. I then concluded that my hypothesis was correct. Tires with a smooth tread pattern will stop in a shorter distance. Winter tires are often knobby which may be better for gaining traction to start, but my experiment indicates that they are not as beneficial for stopping, especially on black ice.

NAME(s)	<u>Emily Smith</u>	PROJECT NUMBER	<u>S21</u>
SCHOOL	<u>Windsor High School</u>	GRADE	<u>9</u>
TEACHER	<u>Andy Marquis</u>		
PROJECT TITLE	<u>Multi-tasking for all</u>		

## ABSTRACT

Do adults or teenagers focus better while multi-tasking? To test this a video was made to test one's ability to focus. The video shows two different teams of three passing a basketball to their teammates. One team is wearing white and the other team is wearing black. All players randomly rotate positions while passing the basketballs. During the video, an extra player joins the black team in passing the basketball. Eventually, an original black team player exits the video. The two teams continue to pass the basketballs.

If the video is shown to adults and teenagers, then more teenagers will notice the difference than the adults.

Show this video to an equal number of adults and teenagers. Before showing the video, explain that they will see two teams, a team wearing white and a team wearing black. Each team has basketball and will pass to their own teammates. The viewer must count how many times the white team passes the ball. Show the video and record the number they counted and record if they noticed the change

In the Adult Results, fifty percent of the adults counted only the correct number of passes. They did not notice the switching of the team members. In the Teenager Results, thirty-five percent of teenagers counted the correct number of passes, but did not notice the switching of the team members. From the data, we can verify that teenagers had an easier time finding the change in players than the adults.

NAME(s)	<u>Quincey Smith</u>	PROJECT NUMBER	<u>P21</u>
SCHOOL	<u>Windsor High School</u>	GRADE	<u>12</u>
TEACHER	<u>Andy Marquis</u>		
PROJECT TITLE	<u>Vermont Yankee: Location, Location, Radiation</u>		

## ABSTRACT

The relationship between levels of radiation, and the distance a location is away from Vermont Yankee was examined. It was hypothesized that, there would be no correlation between the distance from VY and the levels of radiation. This was tested with a geiger counter. The unit of measurement used was counts per minute(CPM). The first measurement was at VY and was continued to various locations away from VY in five mile increments up to 55 miles away. The highest recorded level of radiation was at VY, with a negative slope of -.0126. The data was very sporadic from location to location. When examining the slope, the slope uncertainty was a positive number. The probability of getting cancer from a particle of radiation is 1 in 30 quintillion. To determine how the danger from living at VY compares to the danger in Windsor, the lowest measured radiation within 55 miles (16 CPM), one begin by comparing the amount of radiation that would travel through the body of people living in the two places. The average lifespan of a Vermont is 80.5 years. One living at VY for 80.5 years would have had  $8.25 \times 10^8$  particles of radiation go through their body. In Windsor they would have had  $6.77 \times 10^8$  particles of radiation go through their body. The difference is  $1.48 \times 10^8$ . The increase in probability is found by dividing this number by 30 quintillion (the likelihood of someone getting cancer from radiation), and the result is, a person living at VY is  $4.93 \times 10^{-12}$  more likely of getting cancer than living in Windsor. The data shows that there is a slight increase in radiation at VY, but its significance must be put into perspective.

NAME(s)	<u>Annie Soho</u>	PROJECT NUMBER	<u>S22</u>
SCHOOL	<u>Windsor High School</u>	GRADE	<u>9</u>
TEACHER	<u>Andy Marquis</u>		
PROJECT TITLE	<u>Are you smarter than a middle schooler?</u>		

## ABSTRACT

If you give adults the same test as middle-schoolers will the majority of the adults have higher test scores than the middle-schoolers? The materials needed are a basic science test, an answer sheet, and willing participants. To test this, a basic science test was administered to 10 seventh graders, 10 eighth graders, and 10 adults. If the test is given to them, the adults will have lower test scores than the middle-schoolers because the adults will have spent many years not learning about science. The background for this was knowing that middle-schoolers are learning about Earth/Space Science, Life Science, and Physical Science, while adults haven't learned about science since high school or college in some cases. The purpose of this was to find out how important science, and how much school's should focus on it. The 7th grade average was a 73%. The 8th grade average was an 82.3%, and the adults average was a 79.6%. The results showed that the adults didn't know as much as the 8th graders, but they knew more than the 7th graders. The conclusion is that adults don't know as much as most middle-schoolers, and this connects to another question. Is science really important after high school? How much science is important to be a successful person?

NAME(s)	<u>Kendall Spaulding</u>	PROJECT NUMBER	<u>C22</u>
SCHOOL	<u>Missisiquoi Valley Union High School</u>	GRADE	<u>10</u>
TEACHER	<u>Dana Maria Dezotell</u>		
PROJECT TITLE	<u>Are fingerprints created randomly or genetic in siblings?</u>		

## ABSTRACT

Are fingerprints created randomly or are they genetic in siblings?

My research purpose is to find out if fingerprints can tell if one person is related to other member of the family. For my project I needed about 6 related people and 6 random people, so I could get a clear conclusion whether or not fingerprints are inherited. This experiment can tell your identity and to see how you can relate to someone or even what your fingerprints look like. This will help find an answer so people know who they are related to, just by their fingerprint. The independent variable is the people in my experiment and the dependent is their fingerprints and also be called heritage. I drew a conclusion from all the fingerprints telling if they are related or not.

After my experiment, I have found that fingerprints are genetics; however, there are no two fingerprints alike. Fingerprints can skip over generations because some may not have the same fingerprint. Most of the fingerprint patterns that I found were a loop like pattern to the left. There was only one arch and one whorl qualities in some fingerprints. I looked at the size, pattern, shape, line spacing, ridges and much more to come to the conclusion that fingerprints are genetic between family members, but not everything will be the same, only some characteristics.

NAME(s)	<b>Hannah St.Denis</b>	PROJECT NUMBER	<b>C23</b>
SCHOOL	Randolph Educational Resource Center	GRADE	<b>7</b>
TEACHER	Gina Sweet		
PROJECT TITLE	<b>Sugar in Brownies</b>		

## ABSTRACT

○The objective of my experiment is to determine how different amounts of sugar affect the brownies and a persons preference for the taste of the brownie. I hypothesized that that more people would prefer the original recipe based on taste,which lots of people did. Then I decided that that wasn't enough. So I went back to my hypothesis and dug deeper and asked three more questions. Which one looks the best? Which one has the best texture? Would the density increase or decrease based on the amount of sugar in each brownie?

○To test the taste,texture, and looks I found some subjects and asked them to take a sample of each brownie and gave them a survey to fill out. To test the density I weighed a piece of each brownie on a scale, and used a ruler to measure the height,width,and depth.

○My results were that overall people prefer brownies with lots of sugar. On the taste part of the survey people preferred the brownies with the original recipe. The brownie with the most popular vote for looks was the brownies with the most sugar. When I asked about texture most people preferred the brownie with the most sugar. (density part)

○My hypothesis was not correct because people preferred the brownie with the most sugar and not the brownie with the original recipe.

NAME(s)	<b>Luke Stevens, Libby Stevens</b>	PROJECT NUMBER	<b>GP05</b>
SCHOOL	Saint Mary's School, Middlebury, Vermont	GRADE	<b>6</b>
TEACHER	Craig Hill and Michelle Eagan		
PROJECT TITLE	<b>Man versus Machine</b>		

## ABSTRACT

The purpose of this project was to discover if Doppler ultrasound is an effective way to measure heart rate. Doppler ultrasound is used to measure blood flow/frequency by bouncing sound waves off circulating blood. It is important to know your heart rate because if it is too high/low it should be checked by a doctor.

○In this project we measured heart rate using two methods: Doppler ultrasound and measuring pulse with fingers. We believe that using a Doppler will be more accurate than using a finger to measure heart rate; the reasoning is when using fingers, you may have trouble feeling/finding a pulse or lose track of the number of beats as you count.

○The materials we used were: Doppler ultrasound, ultrasound gel and stopwatch. Our procedure was to sit the test subject down, place finger to locate the radial pulse, count beats for one minute and record results. We repeated the same steps for the carotid. Next we spread ultrasound gel on the test subject's wrist, used the Doppler to locate the radial pulse, counted beats for one minute and recorded results. We repeated these steps for the carotid.

○The Doppler results were closer together than when measuring heart rate with fingers. Test subject number one's Doppler results were 60 and 61, while their results using a finger were 58 and 64. This concludes that when you use machines designed to measure heart rate, it reduces human mistakes, therefore it is the most effective way to measure heart rate.



NAME(s)	<b>Rachael Stone</b>	PROJECT NUMBER	<b>B19</b>
SCHOOL	South Burlington High School	GRADE	<b>10</b>
TEACHER	Curtis Belton		
PROJECT TITLE	<b>Compost Composition and its Effects on Wisconsin Fast Growing Plants</b>		

## ABSTRACT

This experiment was designed to determine which organic compost composition had the best effect on Standard Wisconsin Fast Plants. The hypothesis for this experiment is that out of six different compost mixtures, a Vermicompost from Highfields Composting Center mixed with a potting mix in a ratio of one to nine will have the best effect on the growth and nutrition of the plants.

The control group in this experiment is a plain potting mix with no added nutrients or compost. There are four experimental groups which consist of two vermicomposts and two thermophilic composts. Each contain different ratios of compost to potting mix. This experiment is being run twice so results can be compared.

Data collection for the first experiment is complete, and from the results, the potting mix without any compost did the best. Data for the second experiment has not been collected yet since the plants are still growing. They take about seventeen days to completely grow and currently the plants are on currently on the fifth day of growth.

Compost composition is very relevant in Vermont life today especially with the passing of Act 148 also known as the Universal Recycling and Composting Law in two thousand twelve. Among other provisions, it will require everyone to compost their food.

NAME(s)	<b>Katie Sweet</b>	PROJECT NUMBER	<b>C24</b>
SCHOOL	Randolph Educational Resource Center	GRADE	<b>10</b>
TEACHER	Gina T Sweet		
PROJECT TITLE	<b>Consuming Iron</b>		

## ABSTRACT

The objective of my science project was to determine whether or not increasing the boiling time of water will increase the amount of iron. And will adding oil to the pan increase the iron even more. My hypothesis was that having the water boiled longer each time will increase the iron; my hypothesis for the oil was that it would not make a difference.

○To test my hypothesis I boiled water in a cast iron pan, and increased the time for each trial. In the oil test, I added oil to the bottom of the pan. Then I boiled it and increased the time also. I measured the ppm with a Hanna Iron Meter using iron Reagent (Sodium metabisulfite and Sodium hydrosulfite).

○There was an overall increase in the iron concentration as the water was boiled longer, however, the graph did not show a steady increase in ppm. For the oil test, the ppm started to decrease as I added oil to the pan for each of the ten trials.

My hypothesis was correct for the water test, but was inconclusive for the oil test because adding oil to the water added 2.46ppm of iron on the iron meter even though there was no iron in the water. The oil reacted with the iron reagent, and gave a false reading. That's why there was a bigger difference between the water test and the oil test. Adding oil to the pan for every trial seemed to decrease the amount of iron released from the pan because more oil was being built up on the pan.

NAME(s)	Caitlin Vollmann	PROJECT NUMBER	P22
SCHOOL	Weathersfield School	GRADE	8
TEACHER	David E. Lambert		
PROJECT TITLE	Mysteries of Radiation		

## ABSTRACT

For my science project the problem I have come up with was: Is there radiation around us? If so where is it, what level is it, and can it harm us? The reason I chose this is because I was hearing a lot about Vermont Yankee and I wanted to see if the radiation was as bad as people thought it was.

This is some of the background research. The first type of radiation is alpha radiation; this type of radiation cannot pass through a person's skin layer. It can be harmful if it is swallowed, inhaled or gets into an open cut. Alpha radiation does not travel far through the air so it's kind of hard to detect. For example Radon produces alpha radiation. Another type of radiation is Beta radiation. This type of radiation can go as far as the "germinal layer" of skin, which is the layer in which new cells are made. If Beta radiation is on skin for a long period of time it could cause skin injuries. Most Beta particles can be detected, but some are too low to detect. The third type is Gamma radiation. Gamma radiation is electromagnetic, this means it's like visible light and radio waves. Gamma radiation can travel very far in air and it is sometimes called "penetrating radiation". It's called this because it can pass through most objects including human skin. Radon is a radioactive gas which cannot be sensed with taste, sight or smell and also can cause lung cancer. Radon comes from cigarettes, granite and other natural minerals. The Surgeon General told people that radon gases are the second leading cause of lung cancer. Some scientific studies say that children could be more sensitive to radon. The last type of radiation I'm going to talk about is natural background radiation. Natural background radiation is the natural radiation in our earth. There are a few categories under natural background radiation like cosmic radiation and natural body radiation. Cosmic radiation is radiation caused by solar flares, the sun and other stars.

NAME(s)	John Waligory	PROJECT NUMBER	P23
SCHOOL	Milton Middle School	GRADE	7
TEACHER	Janet Smith		
PROJECT TITLE	Generating Wind Energy		

## ABSTRACT

Wind power is an alternative source of clean energy that does not burn fossil fuels. There are several wind farms in our community and in our state that are using this technology. The purpose of my experiment was to build a working model windmill and then determine what blade angle would produce the most energy using this model. I predicted that the blade with the largest angle would work better because it would catch more of the wind, thus spinning faster and generating more energy. Based on my knowledge of energy transfer I developed a windmill design that used common and reclaimed materials. Using neodymium magnets and copper wire, I made a generator that was able to produce electricity which I measured using an amp meter. Two different blade designs were tested. One blade was made with a larger angle which measured 15 degrees. I used a fan to create consistent wind then measured the amps the windmill generated every 10 seconds up to 200 seconds for each blade design. I found the windmill design worked and I was able to generate electricity with the model. The average electricity generated with the smaller angle blade was 0.243 amps. The average electricity generated with the blade with the larger angle was 0.383 amps. I found that the blade with the larger angle worked better making my hypothesis correct.

NAME(s)	<b>Kiran Waqar, Lena Ginawi</b>	PROJECT NUMBER	<b>GP03</b>
SCHOOL	Frederick H. Tuttle Middle School	GRADE	<b>8</b>
TEACHER	Amelia Lutz		
PROJECT TITLE	<b>Endorphins and Exercise</b>		

## ABSTRACT

Have you ever heard about a term called runner's high? This is because of endorphins that are released during exercise or running. In our test, knowing that exercise does release endorphins, we are trying to find if and what kind of exercise would release more endorphins. Our hypothesis is that the more vigorous the activity, the more endorphins would be released.

The purpose of this project is to determine the connection between endorphins released and mood. Endorphins are any of a group of peptides occurring in the brain and other tissues of vertebrates, and resembling opiates, that react with the brain's opiate receptors to raise the pain threshold. This means that when endorphins are released they react with the brain's opiate receptors, which gives the person a happy feeling and diminishes the feeling of pain. Endorphins can get released in many ways, including eating dark chocolate, eating spicy foods such as peppers, listening to music, smiling, natural laughter, etc. Endorphins are also released from exercise. We conduct our test by having middle schools students do four different types of activities for one minute. Before the student even begins any one of the four tests, we asked him/her what their mood was, on a scale of 1-10, 1 being the worst and 10 the best. We test four main exercise groups; endurance, strength, balance, and flexibility. For endurance we have the student walk briskly, for strength they use resistance bands, for balance standing on one foot, and for flexibility arm stretches. After completing each test we then again question the student on their mood and determine if there was a change. We are currently collecting and analyzing data to see if certain types of activities produce more endorphins and if so which kind of activity.

NAME(s)	<b>Greg Ward</b>	PROJECT NUMBER	<b>B45</b>
SCHOOL	Northfield Middle Highschool	GRADE	<b>9</b>
TEACHER	Ms. Urling		
PROJECT TITLE	<b>The Effect of Soaking for 100 hours in Commonly Consumed Beverages on the Average Mass (in</b>		

## ABSTRACT

Nowadays every mom on the block is telling their child, "Don't drink colas! They'll rot your teeth!" And yet everyone seems to be still drinking colas about ten times as many times as they call their mothers. This study provides the information needed to enlighten those still drinking cola. The information that letting colas in contact with bone is more detrimental to the structural integrity of the bone than letting bone come in contact with other commonly consumed beverages. The study went as follows: Bones from chickens were soaked in a cola, a citrus soda, or water for 72 hours. These beverages were selected as the variables, with water being the control, because they (the soft drinks) are the fourth most commonly consumed beverages in the world, with the first being water. Then, after various drying processes, the bones were tested for their maximum mass supported before breaking. Through this process the average maximum mass was obtained for each set of bones soaked in each type of liquid. Three types of chicken bones were tested; radius, ulna, and humerus. The data obtained from the humerus tests showed that the Coca-Cola was most effective at destroying the structural integrity of the humerus bones with the Coca-Cola soaked bones supporting the least amount of mass before breaking, with an average of 2080g and the highest average supported mass before breaking showing up in the water soaked bones, with an average of 2516g. This means that the Coca-Cola soaked bones held 17.3% less mass than the water soaked bones and 8.2% more than the Sprite soaked bones. The data suggested that the cola beverage was the most effective, of the drinks tested, at deteriorating the structural integrity of bones. The data was obtained through a series of mass testing by hanging a weighed gallon jug from the middle of the bone and then pouring water into the jug until the bone snapped in the middle, once the bone snapped the amount of water in the jug was measured in grams (using a graduated cylinder and a tri-beam scale) and this number (with the mass of the gallon jug subtracted) is the maximum amount of mass the bones supported before breaking. With these numbers the averages were calculated and conclusions were made.

NAME(s)	Grace Washburn	PROJECT NUMBER	G07
SCHOOL	Hinesburg Community School	GRADE	7
TEACHER	Stephanie Konowitz		
PROJECT TITLE	Photosynthe-Size		

## ABSTRACT

Plants most commonly live under sunlight or under LED lights inside your house. Though in some houses their lighting may be different. I designed this experiment to see if different light colors (red, green, blue, white, and black) changed how fast in height wheatgrass grows. Photosynthesis is an essential need for plants to grow and thrive in life. I predicted that the wheat grass would grow quickest under the white and slowest in the black. My family loves growing plants and so this investigation will help me find the best light for growing plants. Before I started, it was helpful to learn about photosynthesis and what it does to help the plant live and grow. Fifteen plants were placed in five sections of a giant box, putting three in each section. Each section had a different colored light. They were watered every day with the lights on for twelve hours each day. I recorded the height once a week on Sundays; this procedure went on for 5 weeks. At the end of my experiment I identified two considerable outliers. The first was under the black light on week 2. The final results of was white just barely fitting into first with with 24.5cm, 25cm, and 23cm, the green with 22cm, 24.5cm, and 25cm, red with 23.5cm twice and 22cm. Black and blue were the last two and pretty close together with blue the fourth best with 23cm, 20cm, and 19.5cm and black the dimmest with 19.5cm, 20.5cm, and 23cm. From this I learned that the white was the quickest light for the wheatgrass to grow under, but the green grew it most consistently.

NAME(s)	Hannah Wells	PROJECT NUMBER	G08
SCHOOL	Missisquoi Valley Union High School	GRADE	11
TEACHER	Dana Maria Dezotell		
PROJECT TITLE	Plant Herbicides		

## ABSTRACT

Name: Hannah Wells  
School: Missisquoi Valley Union High School  
Grade: 11  
Research Plan  
○○○ ○Plant Herbicides

I plan to investigate if herbicides affect near by plants. The weeds that herbicides kill the most are broad leaf plants. Herbicides work by inhibiting the growth of cells in the plant. They do this by targeting the enzymes responsible for fat formation by halting the development of the cells. The enzymes that promote cell growth in broad leafed plants are not the same enzymes as those in grass. Herbicides take advantage of this by targeting one type of enzymes not the other. The effectiveness of the herbicides depends on the application. I will do this by taking different types of of herbicides and spraying it on the leaves and the soil of plants and see which plant dies. The independent variable is the plant that I would not do anything to just let it grow. The dependent variable is the one that I would test the herbicides on. I would put the herbicides on the leaves for one plant and put the herbicides in the soil for the other plant. In my research found out that the plant where you spray the soil on the plant will be affected by the herbicides the most.

NAME(s)	<b>Eliza White</b>	PROJECT NUMBER	<b>P24</b>
SCHOOL	<b>St. Francis Xavier School</b>	GRADE	<b>7</b>
TEACHER	<b>Mary Ellen Varhue</b>		
PROJECT TITLE	<b>Insulation Situation</b>		

## ABSTRACT

Insulators help keep us warm in the winter. My project was determining which insulator will keep in the most warmth. I wanted to do this project because I live in a cold weather climate and I wanted to see which would keep in the most warmth. My hypothesis was I thought wool would be the best insulator out of all of the fabrics. I used four 16 ounce glass canning jars and took the lids off so I could drill a hole through the top that was big enough to fit the digital thermometer through but small enough so it wouldn't lose any excess heat. Then I took four different materials, metalized polyester, fleece, cotton, and wool and hot glued them around the canning jars but leaving the top uncovered. I then let the jars dry for about a half an hour before I started my experiment. I boiled the water to about 192 degrees fahrenheit. While the air temperature was 72 degrees fahrenheit, then I poured the water into the jar. I took the temperature every five minutes for fifteen minutes to see how much the temperature had decreased. I repeated this five times. The problem I ran into during my experiment was that I think the water was too hot because the glue would melt and the fabric would start to slide down the side of the jar. I concluded that that I proved my hypothesis wrong, wool is not the best. Metalized polyester was the winner, but fleece was also very close. They were about 2 degrees apart.

NAME(s)	<b>Brooke Winter</b>	PROJECT NUMBER	<b>C25</b>
SCHOOL	<b>Windsor High School</b>	GRADE	<b>9</b>
TEACHER	<b>Andy Marquis</b>		
PROJECT TITLE	<b>The Chemical Effect of Water Temperature on Water Activated Medicines</b>		

## ABSTRACT

Does the temperature of water affect the chemical reaction of water activated medicines? Usually, medicines that dissolve in water are taken with cold water. But do the medicines react faster in hotter water? To test, Alka Seltzer and Airborne were used. Both claim to rapidly dissolve in water. For this experiment, the medicines were dropped into three different conditions. These were ice water, warm water, and hot water. The ice water was the same temperature in all trials, as were the warm water trials, and so on. Once the one cup of water was ready, a single tablet was dropped into the water, and the timer begun. Without stirring, the reaction was observed and recorded. Once the tablet was completely disintegrated, the timer stopped. This process was repeated in three trials, in all three of the water conditions, and with both the Alka-Seltzer and Airborne. The results were quite obvious. The tablets dissolved much slower in the ice water, and much quicker in the hot water. In the ice water, the process was slow and gas wasn't produced rapidly. In the warm water, the tablets seemed to be disintegrating much faster, and the carbon dioxide gas was released faster. The hot water produced the most carbon-dioxide gas, and was very rapid. It took about three times longer for the tablet to dissolve in the ice water than it did the hot. So, the results show that in fact the temperature of water does affect the chemical reaction of these medicines. The reasoning is that sodium bicarbonate dissolves in water, and it is split into sodium and bicarbonate ions. Then, the sodium bicarbonate reacts with hydrogen ions from citric acid, causing carbon dioxide. Therefore, the hot water activates these chemicals more, resulting in a much faster reaction time.

NAME(s)	<b>Peter Wolosinski</b>	PROJECT NUMBER	<b>S24</b>
SCHOOL	Saint Mary's School, Middlebury, Vermont	GRADE	<b>6</b>
TEACHER	Michelle Eagan		
PROJECT TITLE	<b>Brain Dominance vs. Abilities</b>		

## ABSTRACT

The problem that is investigated in this project is to see if brain hemisphere dominance corresponds with what a person is good at. Sports, music, and public speaking are examples of things that have been linked to certain hemispheres of the brain. This is important in work that involves understanding how people think such as in negotiation, education, medicine, and other occupations. My hypothesis is that if tests are performed to determine what hemisphere of the brain the person uses the most, then it can be figured out what he or she excels at. The procedure used for this project included first determining brain hemisphere dominance for the volunteers. This was done with a questionnaire and a series of physical tests. Another questionnaire was used to determine what they are good at. Finally, I determined if the "What you are good at" questionnaire results corresponded with the brain dominance results. Graphs were used to plot the results of the data.

The results show that brain dominance does not determine what people are good at, at least not overwhelmingly. I disagree with my hypothesis due to the results of this project. However, in certain activities, abilities did show a trend toward left or right brained dominance. This project is important because it shows that you cannot prejudge what a person is good at by their brain dominance.

NAME(s)	<b>Elizabeth Wright</b>	PROJECT NUMBER	<b>S25</b>
SCHOOL	Milton Middle School	GRADE	<b>7</b>
TEACHER	Nathan Caswell	Janet Smith	
PROJECT TITLE	<b>Reading Emotions in Eyes</b>		

## ABSTRACT

Have you every heard that eyes are a gateway to the soul? I find that I am good at predicting when people are sad or happy. I wanted to see how well other people could read emotions just by looking at the eyes of other people. In particular, I was interested in seeing if there was a gender difference in the ability to read emotions this way. My hypothesis was that girls would read eye emotions more accurately than boys because in my research I learned that since women are primary caretakers they can instinctively sense the emotions of their children.

I measured the ability to read emotions using six middle school students (three boys and three girls). The students were given a test where they predicted the emotions that were being expressed in a photograph by looking only at the eyes of a given subject. The students were scored based on whether the emotions were identified correctly.

The results showed that girls were able to recognize emotions with 42 percent accuracy and boys were able to recognize emotions with 58 percent accuracy. I was surprised that the results did not support my hypothesis that girls can recognize emotions more accurately than boys. I wonder if we have been judging boys the wrong way and they are more sensitive than society makes us believe. I also wonder if these results would change if people in different ages groups were tested.

NAME(s)	<b>Taegen Yardley</b>	PROJECT NUMBER	<b>B31</b>
SCHOOL	<b>The Renaissance School</b>	GRADE	<b>5</b>
TEACHER	<b>Caryn Shield</b>		
PROJECT TITLE	<b>Pasteurization</b>		

## ABSTRACT

My experiment explored how pasteurization affects beneficial bacteria in raw milk, as shown through the consistency when it is made into yogurt and cheese. I studied the process and history of pasteurization, and the types of bacteria and enzymes present in raw milk. My hypothesis was that the yogurt and cheese made with raw milk would be less firm than the yogurt and cheese made with pasteurized milk. In my procedure, I took a sample of raw milk and pasteurized another sample of raw milk, and made both into yogurt and cheese to measure the consistency. Controlled variables included using milk from the same source, and keeping the temperature the same for the same amount of time. For the yogurt, my hypothesis was supported by my data because the data showed that raw milk created a more liquid consistency than the pasteurized milk. For the cheese, my hypothesis was not supported by my data because the data showed that the raw milk cheese had a drier and firmer consistency.

NAME(s)	<b>Daniel Yi</b>	PROJECT NUMBER	<b>B32</b>
SCHOOL	<b>South Burlington High School</b>	GRADE	<b>10</b>
TEACHER	<b>Curtis Belton</b>		
PROJECT TITLE	<b>The Bacterial Resistance of Antibiotics by Escherichia Coli</b>		

## ABSTRACT

The purpose of this experiment was to determine whether or not Escherichia coli and Staphylococcus aureus gain resistance when they are exposed to certain antibiotics. South Burlington High School student Daniel Yi, under the guidance of Christina Wojewoda, Assistant professor at the University of Vermont College of Medicine, conducted the experiment over the course of several weeks to confirm that bacterial resistance to antibiotics does indeed occur. In conducting the experiment over a period of several weeks, it was hypothesized that both the Escherichia coli and Staphylococcus aureus would gain at least some resistance to three distinct antibiotics, Piperacillin, Ampillicin, and Trimethoprim Sulfamethoxazole.

The control variables include the same antibiotics used throughout the duration of the experiment, the same type of culture plates every time, the same intervals of concentration of the antibiotics along the E test strips, and the same incubator. Materials utilized in the experiment include culture plates, E test strips containing the various antibiotics, sterile saline, wooden sticks, sterile applicators, a densitometer, and an incubator.

The data recorded in the experiment were analyzed to determine whether or not bacterial resistance occurs based on trends in the data. The quantitative data recorded in this experiment were the minimum inhibitory concentrations, measured in micrograms per milliliter. Further experiments will be conducted focusing on the sphere of influence of the antibiotics.

The current situation of bacterial resistance to antibiotics is becoming increasingly prominent, and further delving into this issue will only be beneficial in the future.

NAME(s)	<b>Jonathan Youmans</b>	PROJECT NUMBER	<b>M03</b>
SCHOOL		GRADE	<b>9</b>
TEACHER	Gina Sweet		
PROJECT TITLE	<b>Crab Grab</b>		

## ABSTRACT

Blender is open source 3D software that is used mainly to make animated movies. It also has a decent game engine that people have used to create some pretty good computer games. I wondered if I could create a non-violent game on my own that would hold playersÆ interest.

First I had to think of an idea for a game. Eventually I came up with the idea of a crab moving around the screen, picking up ôlootö. I had the coding skill to create the initial graphics, but I didn't know how to do anything more complicated. For the first version of the game, I learned how to make the player pick up items. Then I learned how to set up a basic heads up display (HUD). A HUD tells you important information, such as how many points you have earned. In this first version it was just a bar at the top of the screen that gave the player an idea of how many points they have. This is all that I did on this version, then I started from scratch and re-coded everything.

In each subsequent version, I added features to the game. By its ninth version the game had a main menu, scene selection, and two scenes. To play the second scene you had to get to level five in the first scene. For some reason, this version did not work without jamming up.

I started from scratch again, now with a better idea of how to set up the code in my game. This version looks a lot nicer than the previous versions. I still plan to add unlock-able levels and scenes. I have called the game Crab Grab, and multiple testers have given it positive ratings.