

**Category BE L01** Stroop Effect- Say What?

**Abstract**

The purpose of my project was to see if Gender and Age effected ones time and accuracy when taking the stroop color and shape test. An explanation of the Stroop Effect is called interference. When asked to name the color of the word instead of reading the word, the automatic reading of the word interferes with naming the color of the word or a person's (interference).The color test has a color word printed in another color ink. An example would be the word RED printed in Blue ink. Dealing with the color identification task, a delay occurs in the processing of the words color and that leads to slower test reaction times and an increase in mistakes. The shape test is a test with shapes drawn out and the names of different shapes enscribed inside the drawn shapes. I will be timing my participants in both tests and counting the time in seconds (s) and the amount of errors made which will tell me who had the greater interference, males, females and what age.My hypothesis is if males and females of all ages are test on the Stroop color and shape tests, then I believe the speed and accuracy level will be greater with the females in their teens. I hope to find that my data will support my hypothesis or explain why my hypothesis is not correct.

**Bibliography** [http://findarticles.com/p/articles/mi\\_qa3852/is\\_200601/ai\\_n17187418/](http://findarticles.com/p/articles/mi_qa3852/is_200601/ai_n17187418/)>.

*Category* **BE** **L02** 'Language Modes' as a Determinant of Linguistic Competence

*Abstract* How does top-down processing play a role in our understanding of words?

The concept that we perceive what we expect is well established in cognitive psychology. i.e. Given lines can resemble either a mouse or a slab of cheese, but users who have been exposed to pictures of mice see the mouse whereas the latter holds true for those exposed to cheese images.

I want study the concept of expectancy in the field of linguistics. I recently realized, as a polyglot, that the word 'such' in English has a homophonic equivalent in Urdu/Hindi, but I had never noticed that before. I assumed that we must have 'language modes,' as I coin them\*, whereby a set of sounds is interpreted according to the language mode we are in. We are effectively unaware of the implications of words in languages that we are not using at the moment.

How quickly can an Urdu/Hindi-English speaker realize the double implication of 'such'? To test this, I will ask such a person to give me the definition of 'such' in one word. The problem is practically unsolvable for the English 'such' but the Urdu/Hindi homophone has a simple translation: 'truth.' I will induce them into their Urdu/Hindi mode if they initially fail by repeating the question in Urdu/Hindi, but with an air of frustration suggesting I resorted to the second language only to make myself clear. I will record how long the subject takes to recognize the cross-language meaning.

I will test another subject group for crossover from Urdu/Hindi to English. I will ask these subjects (in Urdu/Hindi) to use the word 'such' in a sentence where it does not denote 'truth'. I will with subtlety try to bring them into the English mode.

I will judge for fluency in English or Urdu/Hindi by a test where the subjects are asked to translate prose when verbally recited. Urdu/Hindi to English subjects will be tested for fluency in English, and English to Urdu/Hindi subjects will be tested for fluency in Urdu/Hindi. Everything will be recorded on camera, so I will have learned people judge the fluency of the subjects on a scale from one to ten.

I will ultimately correlate awareness of double meanings (in terms of the time required to realize the cross-language implication) with fluency in the corresponding language (on a scale of 1 to 10). As top-down processing theorizes that our experiences influence how we interpret stimuli, in this case awareness of the cross-language implication is our processing and fluency is experience.

\*The concept of language modes was in fact coined by Francis Ois Grosjean in 1985. I came up with the term myself only to find Grosjean's work afterward. I found that some of my theories have already been

established by him so I will no build on his work to correlate language modes with linguistic competence.

*Bibliography* AE, Hernandez, Dapretto M, Mazziotta J, and Bookheimer S. "Language Switching and Language Representation in Spanish-English Bilinguals: an FMRI Study." PubMed. US National Library of MEDicine National Institutes of Health, Aug. 2001. Web. 30 Nov. 2010. <http://www.ncbi.nlm.nih.gov/pubmed/11467923>>.

LI, Palng, and Michael C. Yip. "Context Effects and the Processing of Spoken Homophones." Springer.com. SpringerLink. Web. 30 Nov. 2010. <http://www.springerlink.com/content/q579767445235k71/>>.

**Category BE L03** The Influence of Sleep on Mental performance in memory and cognitive skills

**Abstract** The purpose of this experiment was to determine if there is a correlation between a greater amount of sleep and better mental performance in cognitive skills, such as reading comprehension and logic, as well as memory. A random sample of 50 undergraduate students from University of Michigan was collected. Students were asked to complete a questionnaire involving a reading comprehension test, a logic test, and a memory test. The number of hours of sleep each student got was recorded as well. Data was presented in the form of bar graphs with the number of hours of sleep categorized as less than 7 hours, 7 to 9 hours, and greater than 9 hours. The experiment supported the hypothesis as subjects who slept for less than 7 hours had the lower scores than subjects who had 7 to 9 hours of sleep. Subjects with over 9 hours of sleep also had lower scores than those who slept 7 to 9 hours per night. However, one-way ANOVA (Analysis of Variance) suggested the need to repeat the experiment to better judge the role of sleep in performance in memory and cognitive skills.

**Bibliography**

1. Major Sources of bias in research studies. (n.d.) Retrieved from <http://www.umdnc.edu/idsweb/shared/biases.htm>
2. National Institutes of Health. National Institute of Neurological Disorders and Stroke. Office of Communications and Public Liaison. (2007) Brain basics: Understanding sleep (NIH Publication No. 06-3440-c). Bethesda, MD 20892: Retrieved from [http://www.ninds.nih.gov/disorders/brain\\_basics/understanding\\_sleep.htm#for\\_us](http://www.ninds.nih.gov/disorders/brain_basics/understanding_sleep.htm#for_us)
3. National Institutes of Health. (2003) Teacher's Guide: Information about sleep (NIH Publication No. 263-99-C-0031). Colorado Springs, CO: BSCS. Retrieved from <http://science.education.nih.gov/supplements/nih3/sleep/guide/info-sleep.htm>
4. Rhodes, Glen. (2004, May 11). The power of the sleep cycle [Web log message]. Retrieved from <http://www.glenrhodes.com/?p=132>
5. Schenkman, Lauren. (2003, November 23). In the brain, seven is a magic number. Physorg.com, Retrieved from <http://physorg.com/news178220995.html>
6. Drummond, Katie (2010 May 5). Study: A good night's sleep saves you from an early grave. Retrieved from <http://www.aolnews.com/2010/05/05/study-a-good-nights-sleep-saves-you-from-early-grave/>
7. Dement, William (1997 September). What all undergraduates should know about how their sleeping lives affect their waking lives. Retrieved from <http://www.stanford.edu/~dement/sleepless.html>
8. Lowry, Richard. 2011. One-way analysis of variance for independent or correlated samples. Retrieved from <http://faculty.vassar.edu/lowry//anova1u.html>

**Category BE L04** Musicians vs. Non-musicians on Neuropsychological Tests

**Abstract** The objective of this experiment was to test musicians and non-musicians on neuropsychological tests. The purpose of this study was to examine the differences between high school musicians and non-musicians on several cognitive measures. There were ten musicians and ten non-musicians, with an equivalent number of both genders. Both sets of people were submitted to four neuropsychological tests to measure motor skills, visual spatial skills and executive functioning. The musicians performed statistically better than the non-musicians on the Verbal Memory II, Trail Making Part B, Finger Tapping Tests (right and left hand), and the Wisconsin Card Sorting Test for the number of correct cards. The hypothesis was supported by the fact that the musician's test results overall were higher than the non-musician's.

**Bibliography** Neuropsych Tests [Internet]. 1999, 2000, 2001. n/a. n/a: [date updated: 2001 July; date accessed: 2011 March]. Available from: (<http://www.brainsource.com/nptest.htm>).

Trail Making Test [Internet]. 2004. n/a. n/a: [date updated: 2004 November; date accessed: 2011 March]. Available from: ([http://www.angelfire.com/retro/michaelpoon168/trail\\_making\\_test.htm](http://www.angelfire.com/retro/michaelpoon168/trail_making_test.htm)).

Neuropsychological Impairment [Internet]. n/a. n/a: [date updated: n/a; date accessed: 2011 March]. Available from: ([http://www.tbi-impact.org/cde/mod\\_templates/12\\_F\\_08\\_TMT.pdf](http://www.tbi-impact.org/cde/mod_templates/12_F_08_TMT.pdf)).

Data Entry: Student's t-test [Internet]. n/a. n/a: [date updated: n/a; date accessed: 2011 March]. Available from: ([http://www.physics.csbsju.edu/stats/t-test\\_bulk\\_form.html](http://www.physics.csbsju.edu/stats/t-test_bulk_form.html)).

Michael S. Franklin, Katie Rattray, Katherine Sledge Moore, Jeff Moher, Chun-Yu Yip, John Jonides. The effects of musical training on verbal memory. n/a: 1-13.

Zmachinski, C. 2011, February 20-26. Musicians vs. Non-musicians on Neuropsychological Tests.

Differences in Mental Abilities between M and NM. Brandler, S and Rammsayer, T.H. Psychology of Music, January 2011 39 (1).

Brain Structures differ between musicians and non-musicians. Gaser, C and Schlaug, G. The J. of Neuroscience. October 8, 2003, 23 (27) 9240-9245.

Differences in Mental Abilities between musicians and non-musicians. Brandler, S and Rammsayer, T.H. Psychology of Music, January 2011 39 (1).

Koelsch, S., Maess, B., Grossmann, T., Friederici, A.D., (2003).

Bilhartz 1999. The effect of early music training on child cognitive development Journal of Applied Developmental Psy 20(4): 615-36 Costa-Giomi, E.

Finger Tapping and Brain Dysfunction: A qualitative and Quantitative Study [Internet]. 1997. n/a. n/a: [date updated: n/a; date accessed: 2011 March]. Available from: ([http://www.thebarrow.org/Education\\_And\\_Resources/Barrow\\_Quarterly/204840](http://www.thebarrow.org/Education_And_Resources/Barrow_Quarterly/204840)).

Band Instruments2.jpg 500x300 pixels [Internet]. n/a. n/a: [date updated: n/a; date accessed: 2011 March]. Available from:

(<http://tompattersonbanddirector.biz/Band%20Instruments2.jpg>).  
Manfred Klein 2007 [Internet]. n/a. n/a. n/a: [date updated: n/a; date  
accessed: 2011 March]. Available from:  
(<http://moorstation.org/typoasis/designers/klein07/pic03/musicians02.htm>)

.  
music-notes-circle.jpg. 800x600 pixels [Internet]. n/a. n/a. n/a: [date  
updated: n/a; date accessed: 2011 March]. Available from:  
([http://heartofaleader.files.wordpress.com/2008/05/music-notes-  
circle.jpg](http://heartofaleader.files.wordpress.com/2008/05/music-notes-circle.jpg)).

Neuroplasticity [Internet]. n/a. n/a. n/a: [date updated: n/a; date  
accessed: 2011 March]. Available from:  
(<http://www.iscid.org/encyclopedia/Neuroplasticity>).

Neuroplasticity (biology) -- Britannica Online Encyclopedia [Internet].  
n/a. n/a. n/a: [date updated: n/a; date accessed: 2011 March]. Available  
from:

(<http://www.britannica.com/EBchecked/topic/410552/neuroplasticity>).

Music and Neuroplasticity. Lin Enying Charissa, Tay Xue lian Sherilyn,  
Saengtaksin Boredin.

**Category BI L05** Proinflammatory cytokine TNF- $\alpha$ ; regulates sphingolipid signaling in Human

**Abstract** This experiment investigates the signaling pathways of endothelial cells, which are substituted by HUVEC (Human Umbilical Vein Endothelial Cells) in this project, which can cause arterial disease and inflammation. The experiment will use the fact that S1P (sphingosine-1-phosphate) has been shown to transactivate the TNF  $\alpha$ ; (Tumor Necrosis Factor-Alpha) receptor and activate VCAM (Vascular Cell Adhesion Molecule), to find the role of S1P signaling in the induction of proinflammatory cytokine in response to TNF  $\alpha$ ; activation in HUVEC and possible applications in arterial disease and cancer development cells. The experiment was performed in two steps; first, to show TNF $\alpha$ ; induces S1P receptors in the cell signaling process, and second, to prove the S1P2 receptor activates VCAM in the cell signaling process. Step one was performed by letting HUVEC treated with TNF $\alpha$ ; (no treatment, control) undertake real time PCR. The result for the first part was that S1P2 added with TNF  $\alpha$ ; yielded over twice as many cells as the control. In step two, four different scenarios were presented. They are: the control, TNF  $\alpha$ ;, JTE013 (the antagonist of S1P receptors), and the TNF  $\alpha$ ; and JTE013 treatment. The real time PCR yielded interesting results. The VCAM expression for the TNF  $\alpha$ ; treatment increased over 150 fold more than the control. The JTE013 treatment was almost the same as the control. The TNF  $\alpha$ ; and JTE013 treatment increased about five fold over the control. The results showed that JTE013 could significantly inhibit TNF- $\alpha$ ; mediation of VCAM expression, suggesting that an increase of S1P2 contributes to the introduction of inflammatory cytokine VCAM in response to TNF- $\alpha$ ;. Finally, the data strongly indicates that the S1P2 pathway is an important part of the TNF- $\alpha$ ; signaling pathway and it is at least involved in the increase of the VCAM gene. The fact that TNF  $\alpha$ ; activation of S1P2 expression contribute to VCAM signaling could be critical for the progression of arterial disease. Thus, this study provides new compelling evidence on the mechanism by which TNF- $\alpha$ ; gives rise to inflammation in Human arterial tissue, opening new perspectives for its pharmacological treatment.

**Bibliography**

- 1) Estrada, Rosendo. "Up-regulating Sphingosine 1-Phosphate Receptor-2 Signaling Impairs Chemotactic, Wound-healing, and Morphogenetic Responses in Senescent Endothelial Cells — JBC." *The Journal of Biological Chemistry*. 21 Aug. 2008. Web. 07 Nov. 2010. <http://www.jbc.org/content/283/44/30363.abstract>.
- 2) Wiess, Tania L. "Serial Subculture and Relative Transport of Human Endothelial Cells in Serum-free, Defined Conditions." *Cell*. 13 Mar. 1990. Web. 10 Nov. 2010. [Http://www.springerlink.com/content/5224v16n41201868/](http://www.springerlink.com/content/5224v16n41201868/).
- 3) Lee, Menq-Jer. "Vascular Endothelial Cell Adherens Junction." *Cell* 99 (1999): 301-12. Print.

**Category BI L06** The Effects of Epidermal Growth Factor (EGF)-like Growth Factor Ligands on EGFR

**Abstract** Epidermal growth factor receptor (EGFR) is often found to be over expressed in various cancers resulting in accumulation of EGFR to the plasma membranes of malignant epithelial tumors. Previous research has shown that one of the seven EGFR ligands, amphiregulin (AREG), promotes EGFR recycling to the plasma membrane over receptor internalization and degradation as observed following “canonical” EGF stimulation of EGFR. In this study, we used six different EGF-like ligands to investigate their effects on modulating cell growth and EGFR localization in SUM-149 cells expressing AREG short hairpin RNA (shRNA), or knock-down cells, in which AREG expression is muted. By western blot analysis, growth assays, and immunofluorescent staining assays, it was found that high concentrations of EGF promoted internalization of membrane-localized EGFR and stunted cell growth. On the contrary, low concentrations of EGF allowed for membrane-localized EGFR to remain on the cell surface and enhanced cell proliferation in the AREG knock-down cells. These results suggest that AREG expression and EGFR membrane accumulation are independent factors. Furthermore, the results of the immunofluorescence assays showed that SUM-149 cells, which express endogenous AREG, and SUM-149 AREG knock-downs had similar levels of EGFR plasma membrane accumulation. However, a morphological difference in the manner of invasion of the SUM-149 cells and the SUM-149 AREG knock-down cells was observed. SUM-149 cells, expressing endogenous AREG, migrated in sheets while the knock-down cells were more separate and spread out while migrating. These results further suggest that AREG expression facilitates cancer cell invasion, as indicated by the cancer cells’ movement in sheets. If this is so, AREG could be used as a potential biomarker, allowing for specific chemotherapeutic strategies.

**Bibliography** 1) Mendelsohn, Baird, Fan, Markowitz. “Growth Factors and their Receptors in Epithelial Malignancies.” *Cancer Biology*. 2001 2) McBryan, Howlin, Napoletano, Martin. “Amphiregulin: Role in Mammary Gland Development and Breast Cancer.” *Journal of Mammary Gland Biology and Neoplasia* 13 (2008): 159-169. 3) Wilmarth, Baillo, Dzubinski, Wilson, Riese, Ethier. “Altered EGFR Localization and Degradation in Human Breast Cancer Cells with an Amphiregulin/EGFR Autocrine Loop.” *Cell Signal* 21 (2009): 212-219.

**Category BI L07 Sweet Fermentation**

**Abstract**

In this experiment, I want to find out if the sweetener added to bread allows the yeast to begin the fermentation process faster, thus allowing the bread to rise faster. I will test 5 sweeteners- sucrose, honey, splenda, truvia and equal and compare the circumference of the loafs of bread to each other into a control which is bread without any sweetener.

The following is the procedure I will use:

1. Make the bread dough in a food processor. Add one packet yeast, 1 cup water (60 Celsius), 1 Tbs shortening, 1 tsp salt, 2 Tbs sweetener. Mix for 30 sec in food processor. Add three cups of flour- one cup at a time-then knead for 2 mins.
2. Divide the kneaded dough in three 1 cup portions and roll into 3 round loaves.
3. Place on aluminum foil with ribbon underneath (to measure circumference)spaced 12 inches apart.
4. Measure and record circumference of each.
5. Time for 10 mins. Measure in record circumference.
6. Repeat 6 times.
7. Continue to test each dough-no sweetener, sucrose, honey, splenda, truvia, equal-the same way under the same conditions.

My independent variable is the sweetener and my dependent variable is the change in the circumference of the bread.

**Bibliography**

- 1) Wikipedia contributors, 2006. "Aspartame," Wikipedia: The Free Encyclopedia [accessed January 10, 2006]  
<http://en.wikipedia.org/w/index.php?title=Aspartame&oldid=34422683>.
- 2) Wikipedia contributors, 2006. "Sucrose," Wikipedia: The Free Encyclopedia [accessed January 10, 2006]  
<http://en.wikipedia.org/w/index.php?title=Sucrose&oldid=34571913>.
- 3) Glencoe Science, Biology, The Dynamics of Life

**Category BI L08** Effects of Fatty Acids on Skeletal Muscle Proliferation and Development

**Abstract** Studies show that fatty acids have an important role in the human body, aiding cognitive development and other human functions. I investigate how fatty acids affect skeletal muscle proliferation and muscle fiber formation, namely in the C2C12 cell line. This is important not only for athletes, but also for the elderly who tend to lose muscle with age. I treated C2C12 cells with three different fatty acids: docosahexaenoic acid (DHA), oleic acid, and palmitic acid. I hypothesize that DHA, an essential fatty acid with many positive effects on the human body, will promote the greatest muscle proliferation and development. I first examined cell proliferation by treating C2C12 cells for 24 hours with a 100 micro-molar concentration of each fatty acid and 10% FBS growth medium. Using a hemocytometer, the oleic acid consistently proved to yield the highest cell count. From this, I conclude that oleic acid promotes the greatest muscle proliferation. Next, I examined muscle fiber development by treating the cells for one week with a 50 micro-molar concentration of each fatty acid and 2% horse serum growth medium, which is known to promote muscle fiber formation. I took pictures under the microscope and found that the DHA formed the most massive muscle fibers. More quantitative results were obtained by examining relative myosin heavy chain gene expression through qPCR. Results show that the palmitic acid yielded the highest MHC expression while the DHA yielded the lowest. I conclude that DHA promotes muscle mass while palmitic acid promotes the formation of muscle fibers.

- Bibliography** Brown, John. "What the Heck is PCR?." Kansas University. Kansas University, n.d. Web. 15 Feb 2011. <<http://people.ku.edu/~jbrown/pcr.html>>.
- "Omega-3 Fatty Acids." Univeristy of Maryland Medical Center. University of Maryland, 2011. Web. 15 Feb 2011. <http://www.umm.edu/altmed/articles/omega-3-000316.htm>
- "PCR: The Polymerase Chain Reaction." Horizon Press. Horizon Press, n.d. Web. 15 Feb 2011. <http://www.horizonpress.com/pcr/>
- Phillips, Theresa. "About.com." Polymerase Chain Reaction. About.com, n.d. Web. 10 Mar 2011. <<http://biotech.about.com/od/pcr/a/PCRtheory.htm>>.
- "Polymerase Chain Reaction." Dolan DNA Learning Center. Cold Spring Harbor Laboratory, n.d. Web. 15 Feb 2011. <<http://www.dnalc.org/resources/animations/pcr.html>>.
- "Resources for Science Learning." The Human Brain-Fats. N.p., 2004. Web. 10 Mar 2011. <<http://www.fi.edu/learn/brain/fats.html>>.
- Rotella, Pam. "Essential Fatty Acids ." pamrotella.com. N.p., 2011. Web. 15 Feb 2011. <<http://goodfats.pamrotella.com/>>.

"Sabio Sciences." Validating Microarray Data Using RT2 Real-Time™  
PCR Products. Sabio Sciences, n.d. Web. 10 Mar 2011.  
<<http://www.sabiosciences.com/newsletter/validating.pdf>>.

**Category BI L09** Computational and Experimental Studies of Human SLX4 Protein BTB domain

**Abstract** As the race to cure cancer reaches a feverish pitch, being able to repair DNA and ultimately cure cancer is of the utmost importance. The human SLX4 (Synthetic Lethal of Unknown Function) protein serves as a scaffold protein which associates with other proteins to execute multiple functions in DNA repair. It contains an evolutionarily conserved BTB domain, a versatile protein-protein interaction module. To investigate the structure and function of SLX4 protein, homology modeling was used to create a 3D structure of the BTB domain in SLX4. Searching a template library yielded one template which shares a 21% sequence similarity. This template was used to generate a 3D model for the BTB-SLX4 domain which consists of five alpha-helices and three beta-sheets. The alpha-helices and beta-sheets arrange in the order of beta1-beta2-alpha1-alpha2-beta3-alpha3-alpha4-alpha5, representing the conserved core BTB fold. A recombinant protein (rBTB-SLX4) was designed to include this core BTB fold and additional alpha-helices at both the N- and C-terminus. During our experiment, rBTB-SLX4 was cloned, expressed and purified from *E. coli*. Limited proteolysis of rBTB-SLX4 revealed that Trypsin removes 44 amino acids from C-terminus of protein. We were able to show that this Trypsin-digested rBTB-SLX4 protein is responsible for protein-protein interactions in vitro using the cross-linking reagent DSS. Protein cross-linking analysis showed dimerization is the predominant form of interaction. Together, these experiments demonstrate that the BTB domain of SLX4 allows multiple copies of protein to interact with each other.

- Bibliography**
- 1) Svendsen, JM et al (10 July 2009). Mammalian BTBD12/SLX4 assembles a Holliday junction resolvase and is required for DNA repair. *Cell* 138 (1): 63–77
  - 2) Peter J Stogios et al (2005) Sequence and structural analysis of BTB domain proteins. *Genome Biology* 6:R82
  - 3) Arnold K., Bordoli L., Kopp J., and Schwede T. (2006). The SWISS-MODEL Workspace: A web-based environment for protein structure homology modelling. *Bioinformatics*, 22,195-201.

**Category BI L10** Identifying Novel Mechanisms of Cytochrome P450 2E1 regulation

**Abstract**

Cyp2E1 is a vital enzyme involved in the metabolism of many carcinogens within the liver. Cyp2E1 over expression, seen in many pathophysiological condition (diabetes, viral hepatitis, obesity, etc.), is known to increase risk for hepatocellular carcinoma. This study aimed to elucidate mechanisms by which Cyp2E1 dysregulation occurs in diabetics. Specifically, the effects of insulin and diabetic medication metformin on Cyp2E1 expression were studied. Primary rat hepatocytes were treated with appropriate substances at variable concentrations. Gene and miRNA expression was analyzed through qRT-PCR while protein expression was analyzed with immunoblots. Inhibitors/activators were used to identify functional elements of the regulatory pathway. The expression of miRNA's linked to the development of cancer was quantified.

Insulin was shown to decrease Cyp2E1 expression while metformin induced its expression. Insulin mediated regulation was dependant on PI3-Kinase, Akt, AMPK, and mTOR, with evidence that the FOXO proteins were involved. miRNA 212 and 132 were both regulated by insulin (up) and metformin (down). In silico analysis showed significant homology between the regulatory and coding regions of the human and rat gene, supporting extrapolation of data to humans.

This study provides the first detailed information of the specific mechanisms behind insulin mediated Cyp2E1 regulation and was the first to identify metformin's effects on Cyp2E1 expression, results with great potential for furthering our understanding of diabetes and its relation to cancer. In addition, insulin and metformin were shown to regulate the expression of miRNA's related to hepatocellular carcinoma, providing novel evidence that they are involved in epigenetic regulation.

**Bibliography**

Cresteil, Thierry. "Developmental Expression of CYP2E1 in the Human Liver Hypermethylation Control of Gene Expression during the Neonatal Period." *European Journal of Biochemistry*, Feb. 1996. Web.

"Crystal Structure of the Human FOXO3a-DBD/DNA Complex Suggests the Effects of Post Translational Modification." *Nucleic Acid Research*. Web. <2007, pp1-12>.

Crystal Structure of the Human FOXO3a-DBD/DNA. MS. Web. 03 Mar. 2011. <<http://www.ncbi.nlm.nih.gov/pubmed/20723539>>.

"Developmental Expression of CYP2E1 in the Human Liver Hypermethylation Control of Gene Expression during the Neonatal Period." Web.

Gonzalez, Frank. "Complementary DNA and Protein Sequences of Ethanol-inducible Rat and Human Cytochrome P 450s." *The Journal of Biochemical Chemistry*. Web. <vol261, dec1986, pp 16689-16697>.

Gonzalez, Frank. "Human Ethanol-Inducible P450 IIE1: Complete Gene Sequence, Promoter Characterization, Chromosome Mapping, and cDNA-Directed Expression." *Biochemistry* (1988): 9006-013. Print.

Gonzalez, Frank. Transcriptional Control of the Rat Hepatic CYP2E1 Gene. Vol. 10. *Molecular and Cellular Biology*. Web. <Sep 1990 pp 4495-4505>.

H3K4me3, Examining. "Identification of Preferential Target Sites for Human DNA Methyltransferases." Oxford Journals | Life Sciences | Nucleic Acids Research. Web. 03 Mar. 2011. <<http://nar.oxfordjournals.org/content/early/2010/09/12/nar.gkq774.abstract>>.

Klaassen, CD. "Alterations in Transporter Expression in Liver, Kidney, and Duodenum after Targeted Disruption of the Transcription Factor HNF1a." *Biochemical Pharmacology*. Web. <72 (2006) 512-522>.

Marmorstein, Ronen. "Structural Basis for DNA Recognition by FoxO1 and Its Regulation by Post-Transcriptional Modification." *Toxicology Sciences* 103(2), 228-240 (2008). Web.

McCarver, Gail. "Identification and Functional Analysis of a Novel Human CYP2E1 Far Upstream Enhancer." *Molecular Pharmacology*. Web. <71(2007) 1630-1639>.

Morse, Randall. "Epigenetic Marks Identify Functional Elements." *Nature Genetics*. Web. <42, 282-284 (2010)>.

Nieto, Natalie. "Increased Expression of Cytochrome P450 2E1 Induces Heme Oxygenase-1 through ERK MAPK Pathways." *The Journal of Biochemical Chemistry*. Web. <Aug 2003, 29693-29700>.

Nieto, Natalie. "Increased Expression of Cytochrome P450 2E1 Induces Heme Oxygenase-1 through ERK MAPK Pathways." *The Journal of Biochemical Chemistry*. Web. <Aug 2003, 29693-29700>.

Novak, Raymond. "Insulin Signalling in the Transcriptional and Posttranscriptional Regulation of CYP2E1 Expression." Web.

Novak, Raymond. "MiRNAs: Effectors of Environmental Influences on Gene Expression and Diseases." Web.

Novak, Raymond. "Post Transcriptional Regulation of Ray CYP2E1 Expression: Role of CYP2E1 mRNA Untranslated Regions in Control of Translational Efficiency and Message Stability." *Archives of Biochemistry and Biophysics*. Web. <vol 376, April 2000 pp 180-190>.

Ohdo, Shigehiro. "The Molecular Mechanism Regulating 24-Hour Rhythm of CYP2E1 Expression in the Mouse Liver." *Liver Biology/Pathobiology*. Web. <Feb2008>.

Print.

Rodriguez-Antona, Christina. "Influence of Cytochrome P450 Polymorphisms on Drug Therapies: Pharmacogenetic, Pharmacoepigenetic and Clinical Aspects." *Pharmacology and Therapeutics*. Web. <116 (2007) 496-526>.

Rodriguez-Antona, Christina. "Influence of Cytochrome P450 Polymorphisms on Drug Therapies: Pharmacogenetic, Pharmacoepigenetic and Clinical Aspects." *Pharmacology and Therapeutics*. Web. <116 (2007) 496-526>.

Takamiya, Masataka. "Human CYP2E1 Is Regulated by MiR-378." *Biochemical Pharmacology* (2010): 1045-052. Web.

Unterman, Terry. "FoxO Proteins in Insulin Action and Metabolism." Web. 03 Mar. 2011. <<http://www.ncbi.nlm.nih.gov/pubmed/15860415>>.

Yang, Allen. "Identification of Preferential Target Sites for Human DNA Methyltransferases." *Nucleic Acid Research*. Web. <2011, vol39,pp106-118>.

Yokoi, Tsuyoshi. "Effects of Histone Deacetylation and DNA Methylation

on the Constitutive and TCDD-inducible Expressions of the Human CYP1 Family in MCF-7 and HeLa Cells." *Toxicology Letters*. Web. <144 (2003) 247-256>.

Yokoi, Tsuyosho. "Human CYP2E1 Is Regulated by MiR-378." *Biochemical Pharmacology*. Web.

**Category BO L11** The Irreversible Effects of Greenhouse Gases on Tropical and Desert Biomes

**Abstract** The purpose of this project was to see if plant tissue changes, humidity, and soil temperature changes after being exposed to CO and CO<sub>2</sub> at increasing temperature intervals.

Procedure:

1. Create 2 biomes, tropical and desert with respective plants
2. Create CO<sub>2</sub>: In a container, pour in 1 cup of vinegar and mix in 1 tablespoon of baking soda.
3. Create CO: Light a candle in the middle of the biome and seal the biome shut. Expose for 45 minutes.
4. Repeat steps 2 and 3 at 10 degree intervals. Tropical starting point: 80° F  
Desert starting point: 60° F
5. After plants were exposed to greenhouse gasses carbon monoxide and carbon dioxide, leaf samples were cut and placed in a Petri dish
6. Leaf samples were taken to U of M Cancer Center's Keel lab and use the Olympus IX71 microscope to observe changes in plant tissue
7. Use the Olympus microscope to take magnified photos of the leaf samples.
8. Collect data

Based on the data derived from the graphs, Humidity decreased for both biomes as temperature increased. Soil temperature increased in both biomes. In the tropical biome, the range was 13 degrees. The most rapid change was 8 degrees and occurred in the last stage of air temperature increase. In the desert biome, the range of soil temperature was 10 degrees and the most rapid change was 5 degrees which occurred in the last stage of air temperature increase.

The rate of change for air temperature in both tropical and desert biomes represented an exponential increase. For the last stage, it only took one minute to rise 10 degrees while in the earlier temperature increments; it took 10-12 minutes.

The physical characteristics of all plants in both biomes changed considerably. The plant samples appeared to naked eye as unchanged but as shown in the photos attached, and observed under a microscope the impact was significant. Chlorophyll change was not as noticeable as predicted but plants had discoloration. Plant samples were dehydrated but not to the point of irreversibility. Vascular tissue slowly browned and became damaged due to greenhouse gas exposure.

The above conclusion applied to the real world environment is as follows. Due to global warming, the rate of change of temperature is not going to be linear but exponential. Once the tipping point is reached, it is near impossible to reverse the changes in the environment. Although some biomes are more resilient than others, there will be catastrophic effects not only in foliage but in weather. Drastic humidity and soil temperatures can result in extreme weather conditions.

**Bibliography** [http://library.thinkquest.org/CR0215471/global\\_warming.htm](http://library.thinkquest.org/CR0215471/global_warming.htm)  
<http://www.climatehotmap.org/>

<http://www.globalwarming.org/>

**Category BO L12** Microwave Oven Seeds

**Abstract**

The purpose of the experiment is to test sprouting ability of lentil seeds exposed to microwaves, using a microwave oven. Microwaves are used for a variety of applications besides heating food. Some individuals use microwaves to heat items such as soil to kill bugs and bacteria. The student will evaluate the effect of microwave exposure on the ability of lentils seed sprouting.

To test this proposal, the student will collect lentil seeds and microwave the seeds on high power (using a kitchen microwave oven) for 30 seconds (group 1), 60 seconds (group 2), 120 seconds (group 3, and 180 seconds (group 4). The control group (group 5) will not receive any microwave. Each group will consist of 20 lentil seeds. My hypothesis is that seeds exposed to 120 seconds or longer of microwaves will not sprout.

After seeds are exposed to microwaves, seeds will then be placed in zip lock bags with moist paper towel. Seeds will be observed daily to check for seed spouting. The presence of stems and primary and secondary roots will indicate spouting. Qualitative and quantitative observations will be recorded for a period of two weeks. The experiment will be repeated multiple times for validity.

**Bibliography**

Posted by Mercola, Dr. 2/11/2011. Why did the Russians Ban an Appliance Found in 90% of American Homes?  
<http://articles.mercola.com/sites/articles/archive/2010/05/18/microwave-hazards.aspx>

**Category BO L13** Power Plant : Trees Generating Electricity

**Abstract** Abstract

The purpose of this experiment was to measure the amount of electrical voltage produced by trees, and determine what factors, if any, altered their voltage production. The bioelectric properties of trees provide a natural source of energy (Himes, 2009) and scientists are beginning to understand the electrochemistry behind it. They have even developed small circuits to run off the very low voltages produced by trees. What remains unknown, however, are what variables affect the amount of voltage a tree produces.

This experiment looked at the factors of tree size, tree species and air temperature to determine if there was a correlation with tree voltage. The study was done in the forest at the University of Michigan – Dearborn Environmental Interpretive Center. Small devices called HOBOS, which measured air temperature, humidity, light intensity and tree voltage, were placed on the trees. The HOBOS were connected to aluminum nails placed in the tree trunks and the ground around the trees. Soil pH was measured at each tree. The HOBOS took readings every two minutes and were left in place for one week at a time. Data was collected for four and a half months, from August through December, 2010.

Results of the comparison of three different tree species showed a significant difference in voltage production, with the Northern Hackberry tree producing the most voltage and the Oak tree producing the least. Different size trees of the same species (Black Walnut) also showed a significant difference in voltage production, however results were inconsistent. There was no correlation between tree voltage and air temperatures. An unusual finding was that tree voltages reversed polarity in an apparent random manner, in all trees studied.

The conclusion of this experiment was that tree voltage production can vary significantly between different tree species. The voltage production may possibly vary between different size trees, however, more research is necessary. Air temperature changes had no significant effect on tree voltage.

**Bibliography** Ansari, A. Q., & Bowling, D. J. F., (1971). Measurement of the Trans-Root Electrical Potential of Plants Grown in Soil. *New Phytologist*, Vol. 71. (111-117)

Bickelhaupt, D., (N/A). Soil pH: What it Means  
State University of New York. Retrieved from  
<http://www.esf.edu/pubprog/brochure/soilph/soilph.htm>

Calnun, C. (2006). Plugged in: Start up hopes to tap electricity from trees. *Mass High Tech: The Journal of New England Technology*.

Evans, E., (2000). Tree Anatomy.  
North Caroline State University. Retrieved from  
<http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/trees-new/text/tree-anatomy.html>

Hayt, Jr., W. & Kemmerly, J. E., (1978). Engineering Circuit Analysis. New York, NY. McGraw-Hill Book Company

Henderson, Tom, (2010). Electrical Potential Difference. Retrieved from <http://www.physicsclassroom.com/class/circuits/u9l1b.cfm>

Labady, A. J., Thomas, D. J., Shvetsova, T., Volkov, A. G., (2002). Plant bioelectrochemistry: Effects of CCCP on electrical signaling in soybean. Bioelectrochemistry Vol. 57. (47-53).

Walworth, A., (2009). Xylem. Michigan State University. Retrieved from <http://www.msu.edu/~walworth8/page3.html>

**Category BO L14** Soil vs. Hydroponics

**Abstract**

I wanted to prove that hydroponics can grow a plant faster and taller than a soil grown plant so that in poor countries, places where there is little or no nutrient rich soil, hydroponics would allow them to produce their own plants and vegetables. Maybe even whole crops stacked vertically in small spaces. Hydroponics might be able to be developed to grow crops faster and cheaper than regular farming soil farming all together. Another benefit might be to boost life expectancy where malnutrition is an issue.

To do this experiment I had to prepare the two systems then repeat the same watering/ daylight schedule each day. To prepare each system I took simple steps creating an environment for the plants to grow. While doing this I also had to keep any variables to a minimum so the outcome of the experiment will not be affected.

The data I collected proved that Hydroponics does indeed grow a plant faster and taller than a soil grown plant. In fact, at the end of the month the hydroponically grown plants averaged 5.1333 cm taller than the soil grown plants. Along with height, hydroponically grown plants budded 1 week before the soil grown plant. This proves that a bell pepper plant grown in a hydroponic system does grow faster and taller than a soil grown plant. It also proves that a hydroponically plant matures faster as well as fruits faster than a soil grown plant.

**Bibliography**

<http://en.wikipedia.org/wiki/Hydroponics>

<http://ag.arizona.edu/pls/faculty/MERLE.html>

<http://www.howtohydroponics.com/>

[http://www.gchydro.com/information\\_introhydro.asp](http://www.gchydro.com/information_introhydro.asp)

[http://www.goldcoasthydro.com/shopsite\\_sc/store/html/HydroponicsInfo.html](http://www.goldcoasthydro.com/shopsite_sc/store/html/HydroponicsInfo.html)

*Category EV L15* The Dissolved Oxygen and Phototactic Response of Daphnia on Pharmaceuticals

*Abstract* This experiment tested the aquatic organism, Daphnia magna, while on two different pharmaceuticals, in two different phases. The pharmaceuticals were lisinopril, an antihypertensive, and fluoxetine, an antidepressant. Phase one tested the phototactic behavior of the daphnia and phase two tested the dissolved oxygen.

Normally the daphnia are attracted to light, which is very important to them as it where they find their food source. The hypothesis for phase one states, "If pharmaceuticals commonly found in waste water effluents are tested on Daphnia magna, then the pharmaceuticals adversely effects the phototactic behavior of the daphnia." The effect of pharmaceuticals on Daphnia magna's phototactic behavior was studied using a phototactic light box. The daphnia were placed in test tubes containing five different amounts of the pharmaceuticals, lisinopril and fluoxetine. The experiment recorded the number of Daphnia magna swimming up and down a test tube in a specific amount of time to observe the attraction to light. The total response number of the daphnia's attraction to light decreased as the amount of pharmaceutical increased. The hypothesis was supported as the daphnia's phototactic behavior was adversely effected.

The hypothesis for phase two states, "If pharmaceuticals commonly found in waste water effluents are tested on Daphnia magna, then the pharmaceuticals raise the dissolved oxygen rate." The dissolved oxygen rate was tested using a portable dissolved oxygen meter and only one amount of each pharmaceutical. The hypothesis was not supported however, since there was little difference between the control, dissolved oxygen of the daphnia on no pharmaceuticals, and the dissolved oxygen of the daphnia on the pharmaceuticals. This was most likely because the pharmaceuticals on daphnia only effects the behavior not the metabolism of the daphnia.

*Bibliography* Cope, Gregory W., Shea Damian, Robert B. Bringolf, and Rebecca M. Heltsley. Endocrine and Reproductive Effects of the Pharmaceutical Fluoxetine on Native Freshwater Mussels. Rep. no. UNC-WRRI-382. Department of Environmental and Molecular Toxicology, North Carolina State University, Oct. 2007. Web. <<http://repository.lib.ncsu.edu/dr/bitstream/1840.4/4112/1/NC-WRRI-382.pdf>>.

"Effects of Alcohol and Nicotine on Daphnia." Washington Association of Biomedical Research, Jan. 1998. Web.

Gale Parsons, Ivy. "The Effects of Fluoxetine on Agressive Behaviors in Siamese Fighting Fish (Betta Splendens)." [Http://www.bettabrasil.com.br/downloads/the\\_effects\\_of\\_fluoxetine\\_on\\_a\\_ggressive\\_behaviors\\_in\\_siamese\\_fighting\\_fish.pdf](http://www.bettabrasil.com.br/downloads/the_effects_of_fluoxetine_on_a_ggressive_behaviors_in_siamese_fighting_fish.pdf). Fall 2005. Web.

Marcus, Adam. "Happy Fish Go Hungry?: Scientific American." Scientific American (2008). Science News, Articles and Information | Scientific American. 21 July 2008. Web. <<http://www.scientificamerican.com/article.cfm?id=happy-fish-go-hungry>>.

Savransky, Nina. Pharmaceuticals in the Water: A Look at an Emerging and Pressing Issue. Rep. Wwww.mass.gov. Brandeis University. Web. <<http://www.mass.gov/dep/toxics/stypes/pharmh2o.pdf>>.

"U.S. Prescription Drug Sales Grow Slowly." Seeking Alpha. IMS Health, 26 Mar. 2009. Web. 25 Sept. 2010. <<http://seekingalpha.com/article/128003-u-s-prescription-drug-sales-grow-slowly-hydrocodone-most-prescribed>>.

Whitman, Linda J., and Rudolph J. Miller. The Phototactic Behavior of Daphnia Magna as an Indicator of Chronic Toxicity. Rep. Stillwater: Department of Zoology, Oklahoma State University, 1982. Oklahoma State University Digital Library. Web. <[http://digital.library.okstate.edu/oas/oas\\_pdf/v62/p22\\_33.pdf](http://digital.library.okstate.edu/oas/oas_pdf/v62/p22_33.pdf)>.

Wildlife, Leah Zerbe Topics:. "Medicine and Rivers | The Meds You Flush Are Freaking Out Fish." Rodale News. Baylor University and Environmental Protection Agency. Web. <<http://www.rodale.com/medicine-and-rivers>>.

**Category EV L16** Oil in Water: Freshwater Lessons from the Gulf Oil Disaster

**Abstract**

The purpose of this experiment is to discover if recycled materials can work as adsorbent oil boom material in cleaning oil from water. Oil spills, both saltwater and freshwater, have dominated the news and legislative agenda in the last year. Cleaning up an oil spill is no easy task; it takes significant amounts of time, talent and resources. Today there are several different ways to clean up an oil spill, many of which can cause additional environmental damage as oil adsorbents are collected and disposed of following collection of the spilled oil.

Crude oil is difficult to obtain and is very difficult to dispose of. The properties of mineral oil are similar to those of crude oil and mineral oil is both easily obtained and easily disposed of. Recyclable materials are easily obtained and easily disposed of using a local recycling program. The recyclable materials that were used were human hair, plastic (polyethylene) bags, and recycled fishing line. This experiment was done using the American Society for Testing and Materials method number F726-06 Standard Test Method for Sorbent Performance of Adsorbents. Research was conducted to determine the materials which perform well in adsorbing oil. Additional research was conducted to evaluate the effectiveness of the most adsorbent materials to see if there was a discernable difference in the oil adsorbency rate between saltwater and freshwater.

The results of this experiment proved the hypothesis, that the recycled materials did work as adsorbents and the plastic bags even outperformed the existing adsorbents. These results proved both questions of the hypothesis and left room for additional research into the questions.

**Bibliography**

ASTM International. 2006. "Standard Test Method for Sorbent Performance of Adsorbents". Web January 1, 2011. [www.astm.org](http://www.astm.org).

EPA. "Response Techniques | Emergency Management | US EPA." US Environmental Protection Agency. US Environmental Protection Agency, 2009. Web. 1 Jan. 2011. <<http://www.epa.gov/oem/content/learning/oiltech.htm>>.

"Gulf Oil Spill | National Geographic Channel." National Geographic Channel - Animals, Science, Exploration Television Shows. Ed. Mike Green. 2010. Web. 1 Jan. 2011. <<http://channel.nationalgeographic.com/episode/gulf-oil-spill-5488/Overview#tab-Overview>>.

Integrated Paper Services, Inc (IPS). "Oil Boom Testing (ASTM F 726-06)." IPS Testing. Web. 1 Jan. 2011. <<http://www.ipstesting.com/LinkClick.aspx?fileticket=ctVZMo8Rtys%3D&tabid=76>>.

Johnson, R. 2001. "MiniBooNE Mineral Oil Technical Specification Version 2". Web January 1, 2001. [http://home.fnal.gov/~randy/tech\\_specs.html](http://home.fnal.gov/~randy/tech_specs.html)

Robinson, Richard A. The Gulf of Mexico Oil Disaster: A Case Study on the. Diss. University of Nevada, Las Vegas, 2010. Las Vegas: University of Nevada, Las Vegas, 2010. UNLV University Library. University of Nevada, Las Vegas, 1 Aug. 2010. Web. 1 Jan. 2011. <<http://digitalcommons.library.unlv.edu/cgi/viewcontent.cgi?article=1567&>

context=thesesdissertations>.

US EPA. "EPA Response to Enbridge Spill in Michigan | US EPA." US Environmental Protection Agency. US Environmental Protection Agency, 2010. Web. 1 Jan. 2011. <<http://www.epa.gov/enbridgespill/>>.

*Category EV L17* Solar Flair - A Study of the Impact of Temperature on Solar Cell Performance

*Abstract* Solar energy is one of the most practical forms of alternative energy. In just 40 minutes, the United States receives more energy from the sun than the total amount of fossil fuels consumed by our country in an entire year. Solar cells, also called photovoltaic cells, can convert this solar energy into useful electricity. However, while it is common knowledge that solar cells perform better in climates that receive higher amounts of solar radiation, the impact of temperature on solar cell performance is not well understood.

In this experiment, I investigated the impact of temperature on the performance of the three types of silicon solar cells: monocrystalline, polycrystalline and amorphous. This was accomplished by obtaining the three types of solar cells, building a light box, and constructing a circuit to measure the maximum voltage and current of the cell in order to calculate the cell power ( $\text{MaxPower} = \text{MaxVoltage} \times \text{MaxCurrent}$ ) and efficiency ( $\text{MaxPower out} / \text{Power in}$ ). Cell power and efficiency were measured using a 75 watt incandescent bulb as a light source. Measurements were taken at room temperature (20C), low temperature (3C), and high temperature (40C), and then compared.

My results indicate an indirect relationship between temperature and solar cell performance. A high temperature reduces cell performance, while a low temperature improves cell performance. This finding indicates that solar cells are suitable for cooler climates, and that future solar cell designs should incorporate cooling techniques in order to maximize cell performance and electricity output.

Additionally, in order to confirm the accuracy of my homemade solar circuit, cell efficiency was also measured on a precise Solar Simulator at the Toyota Technical Center. The results showed good relative correlation, confirming my results. Finally, based on my efficiency calculations, a solar panel system was designed for my high school by obtaining our school's average monthly electricity usage and calculating the number of solar panels necessary to power the school. However, the system's cost and roof area required proved to be cost-prohibited and infeasible, demonstrating a need for further improvement of solar cell performance, cost, and design.

*Bibliography* How Solar Energy Works  
Union of Concerned Scientists  
[http://www.ucsusa.org/clean\\_energy/technology\\_and\\_impacts/energy\\_technologies/how-solar-energy-works.html](http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-solar-energy-works.html)

Interview: Hongfei Jia, Sr. Research Scientist, Materials Research Department, Toyota Technical Center, Ann Arbor, MI

**Category EV L18** What Safe Detergent is Most Effective in Cleaning Birds in an Oil Spill?

**Abstract** When an oil spill occurs, the lives of thousands of animals are put into danger. Birds are especially vulnerable to oil for many reasons – the water resistance in their feathers is reduced, and they are more subject to hypothermia and being eaten by predators. In this project, the goal was to find the detergent - out of the five most commonly used to clean birds in an oil spill – that would clean the birds the most efficiently and effectively. Using the image processing features from a program called MATLAB, I was able to establish how well each detergent performed, based on its cleaning index, the coefficient of variation, and the cleaning index normalized with time. After dipping twenty feathers for each detergent in dirty motor oil, they were assigned a number from 0-250, 0 being the darkest black and 250 being the lightest white. After thoroughly cleaning them with the detergent, I scanned them once more to determine their improvement and determined the other factors I listed above.

I concluded that the brand that was most used did not perform to what I expected it to; it was outshined by the others that I tested. Out of the five I tested, a brand called “Biokleen” turned out the best, winning the two out of three ways that I analyzed my data. To save more birds, it is important to adapt a cleaner to fit their needs, and one that will work faster and more efficiently.

- Bibliography**
- [http://www.ibrrc.org/oil\\_affects.html](http://www.ibrrc.org/oil_affects.html)
  - [http://library.thinkquest.org/CR0215471/oil\\_spills.htm](http://library.thinkquest.org/CR0215471/oil_spills.htm)
  - <http://intbirdrescue.blogspot.com/>
  - [http://www.boston.com/bigpicture/2010/06/caught\\_in\\_the\\_oil.html](http://www.boston.com/bigpicture/2010/06/caught_in_the_oil.html)
  - <http://news.discovery.com/earth/oil-spill-clean-up-valdez.html>
  - [http://www.msnbc.msn.com/id/36917020/ns/technology\\_and\\_science-science/](http://www.msnbc.msn.com/id/36917020/ns/technology_and_science-science/)
  - <http://www.mnn.com/earth-matters/wilderness-resources/photos/gulf-oil-spill-cleanup-efforts/bird-rescue-in-action>
  - <http://www.mnn.com/earth-matters/wilderness-resources/photos/gulf-oil-spill-cleanup-efforts/rounding-up-oiled-birds>

**Category EV L19** An Alternative Pathway For Waste Streams

**Abstract**

The purpose of this project is to produce biochar from what one would consider waste Phragmites, Cherries, and Orange Peels, determine if the biochar produces a more environmentally friendly water runoff than fertilizer, determine if the plant fertilizer effects soil quality, determine if change in temperature during pyrolysis effects the Biochar's porosity, and determine if change in temperature during pyrolysis effects the Syngases produced. Biochar will have a more environmentally friendly effect on amending the soils. Also, the amount of nitrogen, potassium, and phosphorus will vary with the biowaste. Varying the temperature during pyrolysis different gases will be produced as well as a change in porosity in the biochar. The elemental analysis of the samples with Biochar added shows that the soils were amended by the addition of the biochar. However, the fertilizer didn't amend the quality of the soils over time. For the most part all of the samples had a pH within the optimal range pH 5.8-7.0; however five samples had values below the optimal range (Clay/Fertilizer, Top Soil/Cherry Biochar, Sand/Cherry Biochar, Top Soil/Orange Biochar, and Top Soil/Fertilizer). It is known that fertilizer make soils acidic. The Boiling point of all of the Biofuels synthesized were above 208 oF. With the Biofuel of cherries (500oF) showing peaks at 240oC. The 900oF Phragmites showed peaks in the C14 hydrocarbon which has a retention time of approximately 8 minutes. Whereas the other Biofuels had an elution time of only two minutes. Also in some cases as temperature increased to 900oF peaks decreased. The highest amounts of Nitrate were found in Clay/Control, Clay/Orange Biochar, and Top Soil/Cherry Biochar. The lowest amounts of Nitrate were found in Clay/Phragmites Biochar which contained 1.034 mg/L. Cherries yielded the highest amount of organics among the 3 starting materials. Cherries at 900 oF contained approximately 31.4% of organics. The organic oil can be potentially recovered and can be used as renewable chemical feedstock or fuel.

**Bibliography**

- 1)Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.
- 2)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.
- 3)"Michigan Cherry Growers Could Be Helping Others Instead of Dumping Produce." Breaking News, Current Events, Latest News and World Events at Allvoices.com. Web. Summer 2010.  
<<http://www.allvoices.com/contributed-news/3926615-michigan-cherry-growers-could-be-helping-others-instead-of-dumping-produce>>.
- 4)"Name The Factors Which Influence The Thickness Of Orange Peel?" Foodista.com - The Cooking Encyclopedia Everyone Can Edit. Web. Dec. 2010. <<http://www.foodista.com/question/WR3BDM66/name-the-factors-which-influence-the-thickness-of-orange-peel>>.
- 5)"Biochar - Wikipedia, the free encyclopedia." Wikipedia, the free

encyclopedia. N.p., n.d. Web. 28 Dec. 2009.  
<<http://en.wikipedia.org/wiki/Biochar>>.

6)"Gardening with Biochar FAQ / FrontPage." Gardening with Biochar FAQ / FrontPage. N.p., n.d. Web. 23 Dec. 2009.  
<<http://biochar.pbworks.com/>>.

7)" Making Biochar - Page 3 - Science Forums." Hypography Science Forums . N.p., n.d. Web. 20 Dec. 2009.  
<<http://hypography.com/forums/terra-preta/10685-making-biochar-3.html>>.

8)"Pyrolysis - Wikipedia, the free encyclopedia." Wikipedia, the free encyclopedia. N.p., n.d. Web. 2 Jan. 2010.  
<<http://en.wikipedia.org/wiki/Pyrolysis>>.

9)"The Best Conditions to Grow Radishes | DoItYourself.com." DIY Home Improvement Information | DoItYourself.com. N.p., n.d. Web. 28 Dec. 2009. <<http://www.doityourself.com/stry/the-best-conditions-to-grow-radishes>>.

10)"What Is Biochar? | International Biochar Initiative." International Biochar Initiative | International Biochar Initiative. N.p., n.d. Web. 27 Dec. 2009. <<http://www.biochar-international.org/biochar>>.

11)crazyhorsesghost. "Planting Your First Vegetable Garden." HubPages. N.p., n.d. Web. 4 Jan. 2010.  
<[http://hubpages.com/hub/Planting\\_Your\\_First\\_Vegetable\\_Garden](http://hubpages.com/hub/Planting_Your_First_Vegetable_Garden)>.

12)Amending Your Garden Soil - Making Good Soil out of Bad By Marie Iannotti,

13) Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

14)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

1)Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

2)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

3)"Michigan Cherry Growers Could Be Helping Others Instead of Dumping Produce." Breaking News, Current Events, Latest News and World Events at Allvoices.com. Web. Summer 2010.  
<<http://www.allvoices.com/contributed-news/3926615-michigan-cherry-growers-could-be-helping-others-instead-of-dumping-produce>>.

4)"Name The Factors Which Influence The Thickness Of Orange Peel?" Foodista.com - The Cooking Encyclopedia Everyone Can Edit. Web. Dec. 2010. <<http://www.foodista.com/question/WR3BDM66/name-the-factors-which-influence-the-thickness-of-orange-peel>>.

5)"Biochar - Wikipedia, the free encyclopedia." Wikipedia, the free

encyclopedia. N.p., n.d. Web. 28 Dec. 2009.  
<<http://en.wikipedia.org/wiki/Biochar>>.

6)"Gardening with Biochar FAQ / FrontPage." Gardening with Biochar FAQ / FrontPage. N.p., n.d. Web. 23 Dec. 2009.  
<<http://biochar.pbworks.com/>>.

7)" Making Biochar - Page 3 - Science Forums." Hypography Science Forums . N.p., n.d. Web. 20 Dec. 2009.  
<<http://hypography.com/forums/terra-preta/10685-making-biochar-3.html>>.

8)"Pyrolysis - Wikipedia, the free encyclopedia." Wikipedia, the free encyclopedia. N.p., n.d. Web. 2 Jan. 2010.  
<<http://en.wikipedia.org/wiki/Pyrolysis>>.

9)"The Best Conditions to Grow Radishes | DoItYourself.com." DIY Home Improvement Information | DoItYourself.com. N.p., n.d. Web. 28 Dec. 2009. <<http://www.doityourself.com/stry/the-best-conditions-to-grow-radishes>>.

10)"What Is Biochar? | International Biochar Initiative." International Biochar Initiative | International Biochar Initiative. N.p., n.d. Web. 27 Dec. 2009. <<http://www.biochar-international.org/biochar>>.

11)crazyhorsesghost. "Planting Your First Vegetable Garden." HubPages. N.p., n.d. Web. 4 Jan. 2010.  
<[http://hubpages.com/hub/Planting\\_Your\\_First\\_Vegetable\\_Garden](http://hubpages.com/hub/Planting_Your_First_Vegetable_Garden)>.

12)Amending Your Garden Soil - Making Good Soil out of Bad By Marie Iannotti,

13) Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

14)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

1)Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

2)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

3)"Michigan Cherry Growers Could Be Helping Others Instead of Dumping Produce." Breaking News, Current Events, Latest News and World Events at Allvoices.com. Web. Summer 2010.  
<<http://www.allvoices.com/contributed-news/3926615-michigan-cherry-growers-could-be-helping-others-instead-of-dumping-produce>>.

4)"Name The Factors Which Influence The Thickness Of Orange Peel?" Foodista.com - The Cooking Encyclopedia Everyone Can Edit. Web. Dec. 2010. <<http://www.foodista.com/question/WR3BDM66/name-the-factors-which-influence-the-thickness-of-orange-peel>>.

5)"Biochar - Wikipedia, the free encyclopedia." Wikipedia, the free

encyclopedia. N.p., n.d. Web. 28 Dec. 2009.  
<<http://en.wikipedia.org/wiki/Biochar>>.

6)"Gardening with Biochar FAQ / FrontPage." Gardening with Biochar FAQ / FrontPage. N.p., n.d. Web. 23 Dec. 2009.  
<<http://biochar.pbworks.com/>>.

7)" Making Biochar - Page 3 - Science Forums." Hypography Science Forums . N.p., n.d. Web. 20 Dec. 2009.  
<<http://hypography.com/forums/terra-preta/10685-making-biochar-3.html>>.

8)"Pyrolysis - Wikipedia, the free encyclopedia." Wikipedia, the free encyclopedia. N.p., n.d. Web. 2 Jan. 2010.  
<<http://en.wikipedia.org/wiki/Pyrolysis>>.

9)"The Best Conditions to Grow Radishes | DoItYourself.com." DIY Home Improvement Information | DoItYourself.com. N.p., n.d. Web. 28 Dec. 2009. <<http://www.doityourself.com/stry/the-best-conditions-to-grow-radishes>>.

10)"What Is Biochar? | International Biochar Initiative." International Biochar Initiative | International Biochar Initiative. N.p., n.d. Web. 27 Dec. 2009. <<http://www.biochar-international.org/biochar>>.

11)crazyhorsesghost. "Planting Your First Vegetable Garden." HubPages. N.p., n.d. Web. 4 Jan. 2010.  
<[http://hubpages.com/hub/Planting\\_Your\\_First\\_Vegetable\\_Garden](http://hubpages.com/hub/Planting_Your_First_Vegetable_Garden)>.

12)Amending Your Garden Soil - Making Good Soil out of Bad By Marie Iannotti,

13) Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

14)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

1)Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

2)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

3)"Michigan Cherry Growers Could Be Helping Others Instead of Dumping Produce." Breaking News, Current Events, Latest News and World Events at Allvoices.com. Web. Summer 2010.  
<<http://www.allvoices.com/contributed-news/3926615-michigan-cherry-growers-could-be-helping-others-instead-of-dumping-produce>>.

4)"Name The Factors Which Influence The Thickness Of Orange Peel?" Foodista.com - The Cooking Encyclopedia Everyone Can Edit. Web. Dec. 2010. <<http://www.foodista.com/question/WR3BDM66/name-the-factors-which-influence-the-thickness-of-orange-peel>>.

5)"Biochar - Wikipedia, the free encyclopedia." Wikipedia, the free

encyclopedia. N.p., n.d. Web. 28 Dec. 2009.  
<<http://en.wikipedia.org/wiki/Biochar>>.

6)"Gardening with Biochar FAQ / FrontPage." Gardening with Biochar FAQ / FrontPage. N.p., n.d. Web. 23 Dec. 2009.  
<<http://biochar.pbworks.com/>>.

7)" Making Biochar - Page 3 - Science Forums." Hypography Science Forums . N.p., n.d. Web. 20 Dec. 2009.  
<<http://hypography.com/forums/terra-preta/10685-making-biochar-3.html>>.

8)"Pyrolysis - Wikipedia, the free encyclopedia." Wikipedia, the free encyclopedia. N.p., n.d. Web. 2 Jan. 2010.  
<<http://en.wikipedia.org/wiki/Pyrolysis>>.

9)"The Best Conditions to Grow Radishes | DoItYourself.com." DIY Home Improvement Information | DoItYourself.com. N.p., n.d. Web. 28 Dec. 2009. <<http://www.doityourself.com/stry/the-best-conditions-to-grow-radishes>>.

10)"What Is Biochar? | International Biochar Initiative." International Biochar Initiative | International Biochar Initiative. N.p., n.d. Web. 27 Dec. 2009. <<http://www.biochar-international.org/biochar>>.

11)crazyhorsesghost. "Planting Your First Vegetable Garden." HubPages. N.p., n.d. Web. 4 Jan. 2010.  
<[http://hubpages.com/hub/Planting\\_Your\\_First\\_Vegetable\\_Garden](http://hubpages.com/hub/Planting_Your_First_Vegetable_Garden)>.

12)Amending Your Garden Soil - Making Good Soil out of Bad By Marie Iannotti,

13) Abend, Lisa. "Carbon: The Biochar Solution - TIME." Breaking News, Analysis, Politics, Blogs, News Photos, Video, Tech Reviews - TIME.com. Web. Fall 2010.  
<<http://www.time.com/time/magazine/article/0,9171,1864279,00.html>>.

14)"DEQ - Control and Management of Invasive Phragmites." SOM - State of Michigan. Web. Winter 2010.  
<[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3677\\_8314-178183--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3677_8314-178183--,00.html)>.

**Category EV L20** An Alternative Fertilizer

**Abstract**

In this experiment, I want to find out what benefits leaves contribute to plant growth if they are left in the soil during growth. Right now, all of our dead leaves are thrown away as garbage. Instead of throwing them away, leaves can be put to good use as an alternative fertilizer. First, I tested the infiltration rate of water, water retention, pH level, levels of various other macronutrients, and also how well pea plants and grass grew in sand and soil, after different leaves were added. To obtain data, I designed an experiment using a funnel, 200 mL of sand and of soil, 10 mL of each type of leaf (pine, oak, and maple), and 150 mL of water. This tested for both the infiltration rate and water retention of each type of leaf mixture compared to the control (the sand and the soil). Taking the sand and soil from this experiment, I placed them in pots and planted 6 pea seeds in each one. The different mixtures contained sand control, sand and maple, sand and pine, sand and oak, and the same mixtures for the soil. I took measurements of how tall the plants grew after one week and after two weeks. I then used different testing kits to test the change in pH and the levels of macronutrients brought on by the addition of the different types of leaves. I also did a second trial of the plant growth section of the experiment, but this time using grass instead of pea plants, and also using the fertilizer with soil and sand as the control instead of only soil and sand. I also varied the different amounts of each type of leaf. The data from this will help determine which type of leaf, and in what amount, will be the best alternative fertilizer. Thus, if leaves can be proven as an alternative fertilizer, then the use of leaves would mean less artificial fertilizer would be used, which would stop chemicals from flowing into streams, rivers, and groundwater.

**Bibliography**

- 1) Environment 6th edition  
Peter H. Raven, Linda R. Berg, David M. Hassenzahl
- 2) Plant growth:  
interactions with nutrition and environment  
John R. Porter, David W. Lawlor
- 3) Soil conditions and plant growth  
Sir Edward John Russell

**Category EV L21** Sustaining a Greener Environment By Recycling Soiled Diapers

**Abstract**

In this experiment, an innovative method was proposed to directly use soiled diapers in the soil to improve water retention and aid in the growth of plants. The presented method would save landfill space, and help to maintain a greener environment. This experiment consists of two parts: Phase I and Phase II.

Phase I: To investigate whether diapers and their locations have any effect on soil moisture, 5 pots are used and filled with soil, placing soaked diapers at the top, middle and bottom layers of the soil. The moisture of the soil is measured at three different depths for 3 weeks, and the raw data is graphed to compare the moisture changes of the pots.

Phase II: Applying the knowledge gained from Phase I, soiled diapers are placed at the top and middle levels of 4 pots with *Dracaena* plants to determine whether the plants can grow better. To observe the different effects of water and urine in soiled diapers on plants, the height of the plants in the pots are measured every other day over a period of 2 weeks.

The proposed experiment shows that soiled diapers not only improve water retention of the soil, but also significantly aids in the growth of plants by up to 100% more. When this method is implemented in large numbers, it will lead to less watering for agriculture and higher-yielding soil for dry, poor countries.

**Bibliography**

Richer, Carlos. Disposable Diaper Net. Richer Investment Consulting Services, 2007. Web. February 17, 2011

"Environmental Impact of Disposable Diapers", The Environmental Blog.org. Environmental Blog, Oct. 2, 2007. Web. February 17, 2011.

"The Great Disposable Diaper Debate." sustainer.org. The Donella Meadows Archive, n.d. Web. February 17, 2011.

"Out of Sight, Out of Mind-The Disposable Diaper Myth."

libaware.economads.com. Libaware, 1988. Web. February 17, 2011

"Environmental Impact of Disposable Diapers." Livestrong.com.

Livestrong, June 15, 2010. Web. February 17, 2011

*Category EV L22* What Method Works Best to Control Bedbugs: Organic or Commercial?

*Abstract* PANDEMIC IN MANHATTAN, NEW YORK!!!!  
What makes bedbugs so important? These pests have been making a comeback! Nowadays, it seems as though bedbugs are getting more attention than political figureheads. Since the ban of DDT, bedbugs have been invading every threshold that a human occupies. These pests are hard to get rid of due to their ability to hide anywhere, fast reproduction process, and ability to live off of one blood meal for over a year. This project looks at the best control for bedbugs: organic vs. commercial methods. Controls that were tested included aerosol Hot Shot, aerosol Terro, Dry Ice (Carbon Dioxide), No-Pest Strips, steam, and a homemade organic solution. It was hypothesized that organic methods would be more effective than the commercial. The experimental results supported the hypothesis because after 12 seconds of steam (the fastest-acting organic control) 100% of the population was dead compared to the 12 minutes it took for both commercial aerosol sprays (which were the fastest-acting commercial controls).

*Bibliography* Bibliography

- Foster, Erik. "Bedbugs for Science." Message to the author. 3 Feb. 2011. E-mail.
- McGavin, George C. *Insects: Spiders and Other Terrestrial Arthropods*. Dorling Kindersley Hand, 2000. 88-89. Print.
- Preston-Mafham, Ron, and Ken Preston-Mafham. *Encyclopedia of Insects and Spiders*. 2005. 98-99. Print.
- Abarbanel, Joshua, and Jeff Swimmer. *A Field Guide to Household Bugs*. 2007. 2-11. Print.
- Waldbauer, Gilbert. *What Good Are Bugs?* 2003. 188+. Print.
- Hotz, Robert L. "Why Bedbugs Won't Die." *Wall Street Journal* 20 Jan. 2011: A3. Print.
- "Fact Sheet: Bed Bugs." Michigan Department of Community Health. July 2006. Web. Jan. 2011.  
<[http://www.michigan.gov/documents/MDCH\\_Bedbugs\\_Factsheet\\_165671\\_7.pdf](http://www.michigan.gov/documents/MDCH_Bedbugs_Factsheet_165671_7.pdf)>.
- Allan, David. Personal interview. 24 Jan. 2011.
- Wang, Changlu. "Request for Materials and Collaborations on Research." 30 July 2009. E-mail.
- Jung, Nicole, and Stefan Bräse. "Synthesis of Natural Products on Solid Phases via Copper-Mediated Coupling: Synthesis of the Aristogin Family, Spiraformin A, and Hernandial." WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 27 July 2009. Web. 14 Jan. 2011.
- "Synthesizing Ideas." 22 July 2010. Web. 11 Jan. 2011.  
<<http://syntheticorganic.blogspot.com/>>.
- "Don't Let the Bed Bugs Bite!" Michigan.gov. The Official State of Michigan Website. Web. 16 Jan. 2011.  
<[http://www.michigan.gov/emergingdiseases/0,1607,7-186-26346\\_25949\\_55522---,00.html](http://www.michigan.gov/emergingdiseases/0,1607,7-186-26346_25949_55522---,00.html)>.

**Category ME L23** Potential of Cord Blood Derived AC133+ Stem Cells to Give Neuronal Cell Types

**Abstract** Stem cells/progenitors are central to the development of therapies for various diseases. Human umbilical cord blood (CB) presents clear advantages over other sources due to its immediate availability, non-invasive collection, simple and efficient characterization, and ease of banking. All individuals are at risk from neurological damage including spinal cord injuries and stroke. CB progenitor cells (CBPCs) hold enormous promise for developing treatments for neurological diseases. The aim of this study was to determine the neurogenic potential of AC133+ CBPCs after long term in vitro amplification. Flow cytometry and western blot analysis determined that the cell population expanded by a 221-fold over a period of thirty days while preserving stem cell characteristics. Immunocytochemistry demonstrated that cells expressed neuronal markers &#946; III tubulin, MAP-2, NeuN, Nestin, and TH. These indicate that AC133+ CBPCs can successfully give rise to differentiated neuronal lineage progeny. Therefore, these cells can be utilized both as therapeutic tools for neurological conditions and in studies on progenitor cell biology and development.

**Bibliography** 1) Krtolica, A., Stem cell: balancing aging and cancer. The International Journal of Biochemistry & Cell Biology, 2005. 37(5): p. 935-941. 2) McGuckin, C.P. and N. Forraz, Potential for access to embryonic-like cells from human umbilical cord blood. Cell Prolif, 2008. 41: p. 31-40. 3) Klimanskaya, I., et al., Human embryonic stem cells derived without feeder cells. The Lancet, 2005. 365(9471): p. 1636-1641.

**Category ME L24** Comparative Significance of Cell Spreading and Division in Monolayer Reform

**Abstract** The reformation of a contiguous cell monolayer is a multifaceted process that involves an intricate coordination of two general processes: cell division and cell spreading. In response to interruptions in a cell monolayer, cell division, a well-studied process employed by cells to reproduce, works in conjugation with cell spreading, a gradual flattening and locomotion of cells, to restore lost contiguity. This study focuses on the comparative significance of cell division and cell spreading in monolayer restoration. Monolayers of PtK2 Potorous Kidney Epithelial Cells were treated with the drugs Aphidicolin and EHT-1864 to selectively inhibit cell division and cell spreading, respectively, and were struck to introduce a disruption in contiguity. The initial rate of monolayer restoration in non-spreading monolayers was 71% slower than in non-dividing monolayers. However, over a 65 hour period, the reformation rate in non-spreading monolayers doubled while the rate halved in non-dividing monolayers. Interestingly, a stain analysis of intracellular dynamics indicated an upregulation of microfilament production in non-dividing monolayers while incidence of mitoses remained constant between non-spreading monolayers and the control. The results suggest that cell spreading is a key component in initial monolayer restoration while cell division requires time to substantially contribute to reformation. Also, the inhibition of cell division appears to promote cell spreading, but not vice versa. Monolayer reformation, although an intricate process in itself, plays an integral role in other, more complex process. Studies of monolayer reformation are often incorporated in wound surrogacy analyses and have numerous implications in wound healing, ulcer treatment, and skin cancer care.

- Bibliography** Namekata, Kazuhiko, Yasushi Enokido, Kazu Iwasawa, and Hideo Kimura. "MOCA Induces Membrane Spreading by Activating Rac1." *The Journal Of Biological Chemistry* 279 (2004): n. pag. *The Journal of Biological Chemistry*. Web. 2 Jan. 2010.
- Seluanova, Andrei, Christopher Hine, Jorge Azpurua, Marina Feigenson, Michael Bozzella, Zhiyong Mao, Kenneth Catania, and Vera Gorbunova. "Hypersensitivity to contact inhibition provides a clue to cancer resistance of naked mole-rat." *Proceedings of the National Academy of Sciences of the United States of America* 106 (2009): n. pag. *PNAS*. Web. 2 July 2010.
- Shutes, Adam, Cercina Onesto, Virginie Picard, Bertrand Leblond, Fabien Schweighoffer, and Channing Der. "Specificity and Mechanism of Action of EHT-1864, a Novel Small Molecule Inhibitor of Rac Family Small GTPases." *The Journal Of Biological Chemistry* 282 (2007): n. pag. *The Journal of Biological Chemistry*. Web. 3 Jan. 2010.
- Small, J., Theresia Stradal, Emmanuel Vignal, and Klemens Rottner. "The lamellipodium: where motility begins." *Trends in Cell Biology* 12.3 (2002): 112-120. *ScienceDirect*. Web. 9 July 2010.

Snyder, Ronald, and James Regan. "Differential Responses of Log and Stationary Phase Human Fibroblasts to Inhibition of DNA Repair by Aphidicolin ." *Biochimica Et Biophysica Acta* 697 (1982): 229-234. ScienceDirect. Web. 4 July 2010.

Tsubouchi, Asako, Junko Sakakura, Ryohei Yagi, Yuichi Mazaki, Erik Schaefer, Hajime Yano, and Hisataka Sabe. "Localized suppression of RhoA activity by Tyr31/118-phosphorylated paxillin in cell adhesion and migration." *The Journal of Cell Biology* 1594 (2002): 673-683. PubMed. Web. 2 July 2010.

Vasquez, R J, B Howell, A M Yvon, P Wadsworth, and L Cassimeris. "Nanomolar concentrations of nocodazole alter microtubule dynamic instability in vivo and in vitro.." *Molecular Biology of the Cell* 8.6 (1997): n. pag. PubMed. Web. 3 July 2010.

*Category* **ME** **L25** Cancer Stem Cells: The Key to Cancer Cure?

*Abstract*

Despite the drastic leaps in technology, scientists have yet to find a cure for cancer. Neuroblastoma, which is one of the most common types of cancer amongst children, has become the subject of much experimentation because of the similarities of neuroblastoma cells to stem cells. The cancer stem cell theory suggests that tumor initiating cells with stem cells like properties are responsible for cancer relapse. Using two neuroblastoma cell lines that were cultured to have different stem cell like properties, the chemotherapeutic drug Cisplatin was applied to the cell lines over the course of three days to see how it affected the cell lines. In addition, an anti-oxidant agent, ginger, was applied to the same two cell lines in hope of finding alternatives to fighting this cancer. Although Cisplatin killed over 90% of all cells in both cell lines, it appeared to be more effective in the cell line more similar to stem cells. Ginger, on the other hand, had little effect compared to Cisplatin but inhibited growth in both cell lines. In conclusion, the two different cell lines seemed to behave differently in response to an effective chemotherapeutic agent and ginger might have some role in cancer prevention. Neuroblastoma cell lines might provide crucial insight to the behavior of cancer stem cells and further experimentation in this area is warranted to expand understanding of the cancer stem theory.

*Bibliography*

1) Bhattacharyya S., & Khanduja, K.L. (2010). New hope in the horizon: cancer stems cells. *Acta Biochimica Sinica*, 42, 237-242. 2) Brodeur GM, Maris JM. Neuroblastoma. In: Pizzo PA, Poplack DG, editors. *Principles and practice of pediatric oncology*. Lippincott: Williams & Wilkins; 2006. p. 934. 3) Eve, DJ., Marry, P.J., McDermott, R.J., Klasko, S.K., & Sanberg, P.R. (2008). Stem cell research and health education. *American Journal of Health Education*, 39, 167-179.

**Category ME L26** The Synergistic Effect of the PIK3CA gene mutation H1047R and the Her 2 gene i

**Abstract**

The PI3K signaling pathway is directly responsible for cell proliferation, survival, and the many processes which contribute to the growth of breast cancer. Phosphatidylinositol 3- kinases (PI3Ks) are a group of lipid kinases that are major players in this pathway. Class I PI3Ks are composed of two subunits, an 85 kDA adaptor subunit (p85) that lacks PI3K activity, and a 110 kDA catalytic subunit (p110), which is coded by the PIK3CA gene. PIK3CA has been found to have a 20-30% somatic mutation rate in breast cancer. In recent studies, H1047R, a mutation position of PIK3CA, was found to have the fastest and strongest growing ability with or without the epidermal growth factor (EGF), and was the most potent mutation. Her2 (c-erbB-2 / Neu), or the Human epidermal growth factor 2, is a proto-oncogene that is over-expressed in 30% of breast cancer, making Her 2 amplification the most frequent mutation in breast cancer. Her 2 codes for a tyrosine-kinase growth factor receptor, which regulates normal cell function, growth, and proliferation. In clinical studies it has been shown that the PIK3CA gene is connected with Her 2, maybe because the tyrosine kinase growth factor receptors that Her2 code for phosphorylate and activate the PI3K pathway. Furthermore in clinical studies patients with no PIK3CA mutations had less resistance to Her2 treatment than patients with any kind of PIK3CA mutation, indicating a possible relationship between the two genes and also between the two genes for treatment.

In this study, a cell proliferation, colony formation, and invasion assay were performed using the MCF10A cell line with over-expressed H1047R gene mutation, Her 2, both genes, or Lac Z as a control, to determine if the two genes have a synergistic effect. Furthermore, the MCF10A cell line with both over-expressed Her2 and H1047R were tested for cell growth in the presence of different concentrations and combinations of the Her2 and PIK3CA inhibitors in order to see a possible benefit of having both genes present during treatment with inhibitors.

In conclusion, it was found that the PIK3CA mutation H1047R and the Her2 gene have a synergistic effect in the growth of breast cancer, since in both the cell proliferation and colony formation assay the added effect of both genes increased cell growth and colony formation numbers. Also, when inhibitors were added to the cells with both Her2 and H1047R mutations, it was proven that when the PIK3CA inhibitor LY294002 was used when the Her2 inhibitor, CP-724714, was also added, cell growth and colony formation was low also supporting their synergistic effect. Overall, these results suggest that the mutation H1047R in the PIK3CA gene and the Her2 gene are synergistic and that as a result these genes may be a potent target for anti-cancer therapies in breast cancer.

**Bibliography**

. Jitesh P. Jani, Richard S. Finn, Mary Campbell, et al. Discovery and Pharmacologic Characterization of CP-724,714, a Selective ErbB2 Tyrosine Kinase Inhibitor Cancer Res 2007;67:9887-9893.

**Category ME L27** Comparison of Method for Hemoglobin Quantification: Electrical Conductivity vs

**Abstract** The purpose of this study is to create an alternative method for analyzing hemoglobin that is accurate, efficient, simple, safer and more cost effective than the current gold standard (colorimetry). Blood samples were collected in EDTA tubes from consenting individuals. Dilutions of blood in de-ionized water were made and I used an electrical conductivity probe to measure iron ions from the samples collected. The ADVIA 2120i (colorimetric method), was then used to measure the same diluted blood samples in normal saline. The data collected was compared with samples of blood run on ADVIA 2120i. My project demonstrates that the conductivity method is a simple and effective method for analyzing hemoglobin levels. The results show that my method is comparable to the colorimetric method in estimating hemoglobin levels. The conductivity method also has the ability to quantify hemoglobin at higher dilutions, but this was not seen in colorimetry.

In conclusion my method using the conductivity probe to measure Fe<sup>++</sup> ions in the de-ionized aqueous solution is just as effective as the colorimetric method. It is also economical and does not use toxic substances such as potassium cyanide, which is present in hemolyzing solution used in the colorimetric method. Therefore the conductivity technique is a method that can potentially be employed in areas that can't afford a colorimeter or it can be used as a small hand held device at home for patients that need to regularly check their hemoglobin.

- Bibliography**
1. McPherson R, Pincus M: Henry's Clinical Diagnosis and Management by Laboratory Methods, 21st Edition, Saunders Elseviers, 457-467,2007
  2. Ackerman P: Electronic Instrumentation in the Clinical Laboratory: Boston, Little Brown & Co., 1972 p140
  3. Bentley SA, Johnson A, Bishop CA: A Parallel Evaluation of Four Automated Hematology Analyzers. Am J Clin Path 1993; 100: 626-632.
  4. Wintrobe MM. 'Clinical Hematology' 9th Edition. Philadelphia: Lea and Febiger; 1993, pp 123
  5. Hemoglobin estimation by the revolutionary colorimetric method of Kennedy, JAMA. 1944;126(2):95-96.

**Category MI L28** Is the Salsa Safe?

**Abstract**

An astounding 1 in every 25 cases of restaurant related foodborne illnesses is traced back to salsa! Salmonella is the main bacterial culprit. Many of these cases stem from workers not using sanitary techniques (hand washing, wearing gloves, etc.) or not refrigerating the salsa properly (1). That is why I decided to find out if there was a way to prevent foodborne illnesses caused by contaminated salsa. Three common ingredients in salsa - garlic, hot peppers, and lime juice - have been shown to inhibit various types of bacteria (2, 3, 4, 6, 7). I believe that adding garlic, hot peppers, or lime juice will decrease or prevent bacterial growth in salsa contaminated with Salmonella typhimurium (ATCC 14028). I tested this by making a salsa without garlic, lime juice, or hot peppers. Then I made salsa samples with varying amounts of each ingredient individually and then contaminated the samples with *S. typhimurium*. The samples were cultured at two different time points, 2 hours and 22 hours after contamination. By seeing how much bacteria grew in each sample, I found out whether garlic, lime juice, or hot pepper inhibited bacteria. Unfortunately, all the plates were confluent, therefore the results were inconclusive.

**Bibliography**

- 1.Center for Disease Control and Prevention (CDC). (2010). Salsa and Guacamole Increasingly Important Causes of Foodborne Disease. [www.cdc.gov/media/pressrel/2010/r100712.htm](http://www.cdc.gov/media/pressrel/2010/r100712.htm).
- 2.Deresse, D. (2010). Antibacterial Effect of Garlic (*Allium sativum*) on *Staphylococcus aureus*: An in vitro Study. *Asian Journal of Medical Sciences* 2(2): 62-65.
- 3.Jones, N.L., Shabib, S., Sherman, P. (1997). Capsaicin as an inhibitor of the growth of gastric pathogen *Helicobacter pylori*. *FEMS Microbiology Letters* 146: 223-227.
- 4.Jonkers, D., van den Broek, E., van Dooren, I., Thijs, C., Dorant, E., Hageman, G., and Stobberingh, E. (1999). Antibacterial effect of garlic and omeprazole on *Helicobacter pylori*. *Journal of Antimicrobial Chemotherapy* 43: 837-839.
- 5.Microbiology Techniques. [www2.hendrix.edu/biology/CellWeb/Techniques/microspread.html](http://www2.hendrix.edu/biology/CellWeb/Techniques/microspread.html).
- 6.Neilsen, M.K., and Arneborg N. (2006). The effect of citric acid and pH on growth and metabolism of anaerobic *Saccharomyces cerevisiae* and *Zygosaccharomyces bailii* cultures (Abstract). *Food Microbiology* 24: 101-105.
- 7.Snyder, O.P. (1997). *Antimicrobial Effects of Spices and Herbs*. Hospitality Institute of Technology and Management, St. Paul, Minnesota.
- 8.Todar, K. (2011). *Salmonella and Salmonellosis*. Today's Online

Textbook of Bacteriology.  
[www.textbookofbacteriology.net/salmonella.html](http://www.textbookofbacteriology.net/salmonella.html).

9.U.S. Department of Health & Human Services. (2007). Bacteria and Foodborne Illness, NIH Publication No. 07-4730.

**Category MI L29** Isolated Meiosis Related Genes in Fungi

**Abstract** Isolating Genes Related to Meiosis in Fungi

The genes Rad51 and Dmc1 are genes known to exist in virtually all organisms that carry out meiosis. Rad51 is present in both mitosis and meiosis, while Dmc1 is a meiosis specific gene. Confirmation of its presence and sequencing of these genes within various species of fungi (ascomycetes and basidiomycetes) allows for several comparisons that can give insight on the relation of species to one another, or the nature in which meiosis has possibly evolved. The loss or degeneracy of either gene can suggest that meiosis within a species has been lost, or has evolved in a way that no longer requires Rad51/Dmc1. The project's objective was to confirm the presence or lack of Rad51/Dmc1 within various species of fungi.

Samples are run through a series of PCR reactions and gel electrophoresis in order to determine the size potential Rad51 or DMC1 gene fragments. Several "nested" PCRs may be run until a viable band of DNA is found. Once bands are found, the sample is run through a low melt gel in order to isolate the gene fragment for cloning. The genes are cloned via E. coli plasmid cloning vectors and subject to further PCR screening in order to confirm the existence of the targeted gene fragment of the correct size. If correct, the colonies of the correct insert are cultured then purified to isolate the desired plasmid DNA, which is sent in to be sequenced.

The project identified a total of 18 species with Rad51, and 4 species with Dmc1. Several fragments of Rad51 were successfully extended as well. The project identified several samples of fungi DNA with contaminations. Confirmations of Rad51 and Dmc1 within species of fungi with no previous genotypes were also found. *Bisporrella* sp. was found to have two varying copies of Rad51, suggesting possible gene duplication.

- Bibliography**
- 1) Schurko, A.M. and J. M. Logsdon, Jr. 2008. Using a meiosis detection toolkit to investigate ancient asexual scandals and the evolution of sex. *BioEssays*, 30:6:579 - 589.
  - 2) Villeneuve, Anne M., and Kenneth J. Hillers. "Whence Meiosis?" *Cell*. Vol. 106. Cell, 2001. 647-50. Print.
  - 3) Birren, Bruce W. "The Fungal Genome Initiative and Lessons Learned from Genome Sequencing." *Methods in Enzymology*. By Christina A. Cuomo. Vol. 470. Elsevier, 2010. 834-53. Print.

**Category ZO L30** Role of Drosophila Glial Cells in Circadian Regulation of Locomotor Activity

**Abstract** The brain of the fruit fly *Drosophila* consists of approximately 100,000 neurons, around 150 of which regulate the circadian clock. Within those 150 neurons, two major proteins, PERIOD (PER) and TIMELESS (TIM), both transcribed by the CYCLE/CLOCK (CYC/CLK) heterodimer, help maintain a circadian rhythm by oscillating in concentration. These proteins help maintain a daily rhythm of 24 hours even in the absence of environmental cues. While the neuronal circuitry regulating the circadian cycle of *Drosophila* have been widely researched, little is known about the role of glial cells in circadian timekeeping. Previous studies have revealed that glia express PER and TIM in an oscillating manner, suggesting that glia may play a role in circadian timekeeping. This study seeks to determine the role of glia in circadian timekeeping. In this study, the oscillation of PER and TIM in glia was eliminated by preventing the formation of the CYC/CLK heterodimer, which initiates the transcription of the genes *per* and *tim*. This elimination of the oscillation was achieved using a GAL4/UAS system in which flies containing the gene *uas-CYC* are crossed with flies containing the *Repo-GAL4* gene. *Repo-Gal4* is a gene that expresses the yeast transcription activator protein Gal4 exclusively in glia. *uas-CYC* is a gene containing the promoter UAS that uses Gal4 to express *CYC*, a dominant-negative mutation of the *CYC* gene. In addition, a cross between *Repo-GAL4* flies and flies containing the gene *uas-DBTS* was tested. *Double-timeS* (*dbtS*) is one of the alleles of the gene *double-time* (*dbt*). *dbtS* expresses a kinase that increases the rate of degradation of PER and TIM concentrations, leading to a shorter circadian period. Lastly, *Repo-GAL4* flies were crossed with *per<sup>01</sup>;uas-PER* flies in an attempt to rescue rhythmicity in *per<sup>01</sup>* flies, flies that express no circadian rhythm. To monitor and analyze behavior, *Drosophila* Activity Monitoring (DAM) systems were used. Flies were individually loaded into the DAM systems and entrained for 7 days under a light/dark cycle of 12 hours of light and 12 hours of darkness. Afterwards, the flies kept in constant darkness at the same temperature for 9 full days. Analysis of the activity under constant darkness indicates that the *w;uas-CYC/+;repo-Gal4/+* flies continued to display a rhythm, even without PER/TIM cycling in the glia. Also, *w;uas-DBTS/+;repo-Gal4/+* flies also did not display any reduced circadian period time. Furthermore, the *per<sup>01</sup>;Repo-Gal4/uas-PER* flies did not display any rhythm, suggesting that the circadian cycle was not rescued.

**Bibliography** Helfrich-Förster C. 2005. Neurobiology of the fruit fly's circadian clock. *Genes Brain Behav* 4: 65–76.

**Category ZO L31** Exposure to low-dose bisphenol A causes hatching delays in Medaka fish

**Abstract** Bisphenol A (BPA), a widely used monomer of polycarbonate plastics, has raised concern as it has been found to leach out of the epoxy resin in canned goods and common plastic containers such as baby bottles, and water bottles (Whitteelsey, 2003). Bisphenol A is an estrogen mimic that can act as an endocrine disruptor, which can interfere with hormone-controlled physiological processes such as homeostasis, growth, development, and reproduction (Howdeshell et al. 2003). With bisphenol A leaching into so many common food and beverage containers, several studies on fish and mice have shown that exposure to low doses of BPA during embryo development hinder the development of the embryo, and may cause adverse reproductive affects (Ramakrishnan and Wayne, 2008). In this study, Japanese Medaka (*Oryzias latipes*) fish embryos at both 5 hours post-fertilization and 4 days post-fertilization were exposed to varying levels of bisphenol A: 0 µg/L, 200 µg/L, and 1,000 µg/L. The Medaka embryos exposed to BPA at both 5 hours post-fertilization and 4 days post-fertilization had a delayed hatch rates compared to the age related controls. Thus, the results showed that bisphenol A exposure in Medaka embryos decelerated rate of hatch. In previous studies examining the biological reasons for BPA disrupting the normal hatching behavior, it has been concluded that BPA disorders the osmoregulation, the maintenance of an optimal constant osmotic pressure in the body of a living organism, and thereby affects the normal hatching behavior and the morphogenesis, the development of structural features (Zhou et al., 2010). Moreover, as well as affecting the osmoregulation of the embryos, other studies of the effects of BPA in fish embryonic development have speculated that the BPA interferes with the normal function of endogenous hormones, and affects the cell cycle by causing a delay in the metaphase stage of mitosis by destabilizing microtubules (Zhou et al., 2010). Altogether, the embryos exposed to 200 µg/L and 1,000 µg/L of BPA four days after fertilization and the embryos exposed to 200 µg/L of BPA five hours after fertilization had a decreased rate of hatch because bisphenol A affected the physiological equilibrium of the embryos and caused the eggs to lose control of the cell-cycle regulation (Zhou et al., 2010).

**Bibliography** Howdeshell KL, Peterman PH, Judy BM, Taylor JA, Orazio CE, Ruhlen RL, Saal FS, Welshons WV. 2003. Bisphenol A Is Released from Used Polycarbonate Cages into Water at Room Temperature. *Environmental Health Perspectives* 9:1180-7.

Ramakrishnan S, Wayne NL. 2008. Impact of bisphenol A on early embryonic development and reproductive maturation. *Reproductive Toxicology* 2:177-183.

Whitteelsey FC. 2003. Hazards of Hydration. *Sierra* 6: 16-18.

Zhou J, Zhu XS, Cai ZH. 2010. The impacts of bisphenol A (BPA) on abalone (*Haliotis disersicolor supertexta*) embryonic development.

Chemosphere 56: 459-510.

**Category CH P01** The Effect of Chemical X on the Health of Brown Planaria

**Abstract** The hypothesis for this science experiment states if the amount of chemical "X" is more than 40 ml, then the health of the Brown Planaria will be affected negatively. The procedure for this experiment involves four plastic containers that contain one of six concentrations. These concentrations are 125 ml of pond water, 100 ml of pond water with 25ml of chemical "X", 85 ml of pond water with 40 ml of chemical "X", 75 ml of pond water with 50 ml of chemical "X", 125 ml of pond water with 1 pipette full (2 ml) of chemical "X", and 125 ml of pond water with 1 drop of chemical "X". After completing this experiment what can be concluded is chemical "X" is hazardous to the health of Brown Planaria because most of the worms that were exposed to chemical "X" died, yet for the 125 ml of pond water with 1 drop of chemical "X" the Brown Planaria all survived and maintained normal activity.

**Bibliography** <http://www.nature.com/nrg/journal/v3/n3/abs/nrg759.html>  
<http://www.apologeticspress.org/articles/2070>

**Category CH P02** Are all Blood Glucose Meters Created Equal?

**Abstract**

Blood-Glucose meters are commonly used in households all over the world to help monitor one's blood-sugar levels. However, there are several factors that can have an influence on the measurements. In this experiment, the effect of certain factors on the accuracy and precision of three common blood-glucose meters, Free Style®, One Touch®, and Contour®, are tested. The three meters are selected based on a variation of the price range. The accuracy and precision of the measurements at a normal concentration of glucose in water, a high concentration of glucose in water, and testing the use of expired test strips. Also, each of the meters is used to measure the sugar level in blood samples. At a normal concentration, the Free Style® meter was found to be the most accurate, but all monitors showed a percent error in excess of 10%. At a high concentration of glucose, the Free Style® meter continued to be the most accurate. In all cases, the standard deviation as a measure of precision was relatively low. Using expired test strips gave varying results, with readings up to 354 mg/dL and extremely high standard deviations. The older the strips were, the worse the readings. When using blood samples, the Free Style® meter was the most precise, although all the meters showed relatively similar readings. In conclusion, the readings of blood-glucose meters may be affected by a number of factors. The Free Style® meter, appears to be the most accurate and precise in all conditions throughout the experiment.

**Bibliography**

1. Frost, L. Glucose Assays Revisited: Experimental Determination of the Glucose Concentration in Honey. The Chemical Educator (web publication at: <http://chemeducator.org/sbibs/s0009004/spapers/940239ld.htm>). 2004, 9 (4).
2. Krouwer, J. and Cembrowski, G. A Review of Standards and Statistics Used to Describe Blood Glucose Monitor Performance. J. Diabetes Science and Technology, 2010, 4 (1), 75-83.
3. Landin-Olsson, M., Ohlin, A., Agardh, C. Blood Glucose: Influence of Different Methods for Analysis and Procedures for Sampling. Practical Diabetes Int. 1997, 14(2), 47-50.
4. Nolte, M. Pancreatic Hormones and Antidiabetic Drugs. In Katzung's Basic and Clinical Pharmacology; Eleventh Edition; Katzung, B.; McGraw-Hill, New York, 2009.
5. Paul, I. Blood Sugar Regulation, , Available at: (<http://www.biologyreference.com/BI-Ce/Blood-Sugar-Regulation.html>)
6. Zavod, R., Krestenansky, J. and Currie, B. Insulin and Drugs Used for the Treatment of Diabetes. In Foye's Principles of Medicinal Chemistry; Sixth Edition; D. A. Williams and T. L. Lemke; Lippincott Williams and Wilkins, Philadelphia, 2008, 855-857.

7. Blood Sugar, Wikipedia, Available at:  
([http://en.wikipedia.org/wiki/Blood\\_sugar](http://en.wikipedia.org/wiki/Blood_sugar))

8. Blood Glucose Control, American Diabetes Association, Available at:  
(<http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/>)

9. Diabetes. Mayo Clinic. Available at:  
(<http://www.mayoclinic.com/health/diabetes/DS01121>)

10. Diabetes, Fact Sheet # 312, January 2011. WHO website, available at: (<http://www.who.int/mediacentre/factsheets/fs312/en/>)

11. Diabetes Overview. Available at:  
(<http://diabetes.niddk.nih.gov/dm/pubs/overview/index.htm>)

12. Getting Up to Date on Glucose Meter. FDA Website, available at:  
(<http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm049051.htm>)

13. Hypoglycemia Directory, Web MD, Available at:  
(<http://diabetes.webmd.com/tc/hypoglycemia-low-blood-sugar-topic-overview>)

14. Insulin Synthesis and Secretion. Available at:  
(<http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin.html>)

15. Medical Diagnostic Kits. BCC Research, available at:  
(<http://www.bccresearch.com/report/HLC007G.html>)

16. Medical Devices. FDA Website, available at:  
(<http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/Overview/ClassifyYourDevice/default.htm>)

**Category CH P03** Do Detergents Cause Flammability

**Abstract**

Children's pajamas are legally required to be nonflammable. Research shows that although there are guidelines for those garments to be nonflammable, children's sleepwear still can ignite. The purpose of this project was to find if children's sleepwear can become flammable after it is washed in different detergents up to three times each.

4.5" by 4.5" fabric squares of children's nonflammable sleepwear were washed in four different detergents. The four detergents used were Up & Up for Delicates, Tide plus Febreze, Arm & Hammer, and Eco Wash. Each fabric square was washed once, twice, or three times in one detergent. Each square was then put in a fire pit and was ignited using a lighter. The results measured were the time the fabric started to melt, the time the fabric started to ignite, and the time that the fabric stopped igniting.

The data depicts that the Tide plus Febreze caused the fabric squares to ignite for the longest amount of time. These results show that even though children's sleepwear is legally required to be nonflammable, after washing the sleepwear, the fabric will ignite.

**Bibliography**

Clothing flammability/cases. (2010). Retrieved from <http://www.fosterfoster.com/CM/BurnInjuryFlammableProducts/ClothingFlammabilityCases.asp>

Flammable fabrics. (2001). Retrieved from <http://phoenix.gov/firefbr.html>

**Category CH P04** To Bleach, or not to Bleach?

**Abstract** The purpose of the project is to see if bleach can get permanent marker out of cotton material, and if it can, which strength of bleach will be most successful. The procedure involved cutting three inch by three inch squares out of material and putting a line of permanent marker on each square. It also involved measuring to make sure each container had the correct concentration of bleach and water in it. One square of material was then placed in each container and left in and observed for nine hours. After the squares were removed, they dried overnight and the tensile strength was tested. The data concludes that none of the strengths of bleach were successful in getting the marker stain out, and a few of the squares got ruined by the bleach. In conclusion, bleach is not something that should be used to get permanent marker stains out of cotton material.

**Bibliography** <http://www.temarry.com/chemicals/xylene.htm>  
<http://www.patentstorm.us/patents/6015783/fulltext.html>

**Category CH P05** Titration of Vitamin C in Citrus Fruits

**Abstract** The experiment I am performing will involve fresh fruit juice from 4 citrus fruits: orange, grapefruit, lemon, and lime. I will measure the amount of vitamin C in each juice using a starch-iodine titration method. In this experiment, I will titrate a known amount of vitamin C then use the same starch-iodine titration to calculate the amount of vitamin C (mg) in 4 fruit juices using the formula:  
$$\text{mg. juice vit.C/ml. titrant} = \text{mg.known vit.C/ml titrant.}$$

I will measure how much dilute iodine solution from a burette it takes to oxidize a known amount of vitamin C (250 mg. tablet dissolved in 100 ml. distilled water). This procedure will be repeated 3 times and an average calculated. The same titration will be performed 3 times on 25ml of each juice. The amount of vitamin C is then calculated, compared, and graphed.

My independent variable is the type of fruit juice. The dependent variable is the amount of vitamin C. The control is the known vitamin C tablet solution.

**Bibliography** 1) <http://www.chem4kids.com> 2) <http://faculty.mansfield.edu/bganong/biochemistry/vitaminc.htm>. 3) Holt Chemistry (Holt, Rinehart, Winston)

**Category CH P06** Chirality: The Relationship Between Angle of Rotation and Concentration

**Abstract** Chirality is the property of a molecule such as glucose to be non-superimposable on its mirror image. Chiral molecules also have the unique property of rotating plane-polarized light, which is light whose waves oscillate in the same plane (emitted from sources such as computer screens). The change in the orientation of the plane of polarization by a chiral molecule is known as the angle of rotation. In this experiment I constructed a polarimeter (using a laptop computer screen, a rotating base, polarized sunglasses, and a digital camera), with the purpose of determining the relationship between the angle of rotation and the concentration of glucose solutions. I did so by utilizing 0% (water), 25%, 50%, and 100% glucose solutions. I hypothesized that the angle of rotation and the concentration would be inversely related, with the angle decreasing as concentration increased. Each solution was tested using the polarimeter to determine the extent to which each solution rotated the light's plane of polarization.

The results suggest a direct relationship between the concentration of a solution containing chiral molecules and its corresponding angle of rotation, which disproved my hypothesis. This finding has many applications in manufacturing, mainly in determining the concentration of chiral molecules such as carbohydrates, amino acids, and drugs (such as penicillin). By using a large-scale version of the polarimeter described here, the process could be expanded to an industrial scale.

**Bibliography** 1) All of Science, by Allan R. Glanville 2) "Stereochemistry" from the Gale Encyclopedia of Science.  
[http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GVRL&userGroupName=catholiccenhs&tabID=T003&searchId=R1&resultListType=RESULT\\_LIST&contentSegment=&searchType=AdvancedSearchForm&currentPosition=1&contentSet=GALE|CX3418502185&&docId=GALE|CX3418502185&docType=GALE&role=](http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GVRL&userGroupName=catholiccenhs&tabID=T003&searchId=R1&resultListType=RESULT_LIST&contentSegment=&searchType=AdvancedSearchForm&currentPosition=1&contentSet=GALE|CX3418502185&&docId=GALE|CX3418502185&docType=GALE&role=) 3) Introduction to Stereochemistry, by Kurt Mislow

**Category CS P07** Catastrophic Disaster Response and Recovery Logistics System Simulation

**Abstract** Directed or digraphs graphs provide means to address network flow problems that consider flow capacities and flows in edges connecting the vertices and a particularly important application is to maximize flow in the network. In graph theory, graph,  $G (V, E)$ , consists of vertices,  $V$ , and edges,  $E$ . The flow,  $f$ , and capacity,  $c$ , along an edge,  $u-v$ , are given, and maximum flow is obtained using augmenting path, using Ford-Fulkerson algorithm or Edmonds-Karp algorithms that use depth-first search (DFS) and breadth-first searches (BFS) respectively. In this project, the basic Maximum Flow network problem was adapted to cater to the unique conditions that pose real world challenges. For instance, weighted categories of flow “candidates” or elements that need to reach targeted intermediate destinations under temporal constraints; and appropriate resource allocation to enable the flow are of specific interest and are addressed in the paper. An algorithm was developed and a new metric, yield performance index, YPI, was proposed to adequately quantify and rank performance for different paths to maximize positive outcomes for the problem set. A complex scenario of a nuclear explosion in a populated city was considered for this case study. The object oriented programming language, JAVA, was utilized to formulate the nuclear blast explosion problem and to generate the input parameters and graph,  $G (V, E)$  for the enhanced network flow algorithm to compute YPI values for maximizing flow, flow rate and yield. The computer program, Catastrophic Disaster Response and Recovery Logistics System Simulation (C-DRRLSS), was developed based on the proposed algorithm which will enable sensitivity studies to help plan and prepare for rescue operations in the event of a disaster in a highly populated city.

**Bibliography** 1) Chartrand, Gary; Zhang, Ping, Introduction to Graph Theory, McGraw-Hill publication, 2005. 2) The Effects of nuclear weapons <http://www.atomicarchive.com/Effects/index.shtml>, National Science Digital Library, funded by the Division of Undergraduate Education, National Science Foundation Grant 0434253. 3) L. R. Ford and D. R. Fulkerson, Maximal flow through a network, Canadian Journal of Mathematics, vol. 8, pages 399-303, 1956.

*Category CS* **P08** Optical Music Recognition of Printed Music Score

*Abstract*

Computer vision is one of the most interesting areas in Computer Science. For many musicologists, manually encoding musical information is expensive and time consuming. Since the 1950s, researchers have attempted to turn sheet music into digitized files through the use of a computer. There has been progress and success in Optical Character Recognition (OCR) to the point it can be used commercially. However, Optical Music Recognition (OMR) has been studied since late 1959 but its success has been minor compared to that of OCR. Difficulty of OMR has deterred researchers from further research. Nonetheless, OMR can be just as efficient as OCR and is a promising tool for musicians and musicologists. Some of the benefits of OMR are listed.

1. Read in a score of music and then play it out, using an appropriate audio-music-producing program.
2. Read existing score to transfer the data to storage or transmission media.
3. Read in a newly engraved piece of music and proofread it for syntactic and other errors.

For the project, Mathematica 8 was used to implement and test algorithms. Eight pages of Mozart's "String Quintet in B-flat Major, K. 174" score were scanned in full 300 dots per inch (dpi) at full page mode and with 1 bit per pixel. To optimize performance, they were saved as TIFF (Tagged Image File Format) in a 2550 by 3300 pixel format. After importing them to Mathematica, each page was cut into individual measures using segmentation techniques. Using pattern recognition techniques, various types of annotations like notes and rests were assigned sounds. ASCII file was used as an intermediate to store information like pitches, duration, and note names. Then, the file was converted to MIDI file format, which could be played on Windows Media Player.

This experiment was attempted to read printed music scores using existing pattern recognition algorithms on Mathematica 8. The emphasis was on using more efficient methods such as projection matching and size classification, rather than brute force ones such as pattern matching. Although many improvements are still needed to make a general OMR system, the benefit of OMR is enormous. With electronic synthesizer sound coming closer to real instruments, OMR can bring full orchestra sound to a composer from a conceptual stage and also make it easier for composers to have their music printed. Musicologists can concentrate on their research rather than wasting time inputting the data into the computer.

- Bibliography*
- 1) <http://www.npcimaging.com/thesis/Chap1.html>
  - 2) <http://journal.code4lib.org/articles/84>
  - 3) <http://www.jstor.org/pss/832471>

**Category EA P09** Rocket Science: The Wings to Fly

**Abstract**

This science fair project explores the study of rocket wing aerodynamics. It involved comparing twelve different wing shapes and sizes to see which would create the least amount of drag. This would indicate which type of wing would fly the best because of its ability to cut through the wind. The hypothesis was, if the rocket's wings are large and rounded, then they will have the least amount of drag. The variable in this project was wing size and shape. The control was a wingless rocket. Each rocket had three wings and was tested using a homemade milk carton wind tunnel. In total, thirty-six wings were constructed and used in this project. Twelve of the wings were triangle shaped, another twelve were four-sided, and the last twelve were rounded. Each set of shapes had various wing sizes labeled A, B, C, or D, noting largest to smallest. The rockets were tested keeping the wing speed constant. The amount of drag was calculated using the equation:  $\text{drag} = (\tan x^\circ)(9.81)(\text{mass in kg})$ . After running six trials for every wing shape and size, the hypothesis was disproven and unsupported by the data. In fact, the size D triangle wing created the smallest amount of drag. This project is a useful discovery in the field of aerodynamics because if small-scale triangle wings fly the best, rocket scientists should be able to incorporate them into newer designs of rockets, proving to make them more efficient. The concept may even be applied to airplanes, though the design would have to face slight modifications.

**Bibliography**

Benson, T. (2010, August 10). The Drag Equation. National Aeronautics and Space Administration. Retrieved August 26, 2010, from <http://www.grc.nasa.gov/WWW/K-12/airplane/drageq.html>>

Jones, Larry. (2009, June 27). Physics Information. Journey into Science. Retrieved July 9, 2010, from [http://www.sciencebyjones.com/physics\\_definitions.htm](http://www.sciencebyjones.com/physics_definitions.htm)>

Lanese, Tina. (2007, March 21). Rocket Aerodynamics. Science Buddies. Retrieved July 8, 2010, from [http://www.sciencebuddies.org/science-fair-projects/project\\_ideas/Aero\\_p002.shtml](http://www.sciencebuddies.org/science-fair-projects/project_ideas/Aero_p002.shtml)>

Scott, Jeff. (2003, November 23). Rocket Nose Cones and Altitude. Aerospaceweb.org. Retrieved August 12, 2010, from

*Category EA P10* Ocean Floor Affecting Tsunami Size?

*Abstract* Tsunamis are huge waves that can cause a lot of damage to cities, and can kill many people. They can travel very fast and leave people with little time to prepare and get away from where the tsunami will hit. They can cause great damage to cities that can take a long time to rebuild. Can the shape of the ocean floor affect the size of these huge waves? A tsunami created by a landslide can be simulated using a tank and gravel dropped down a slope. Using this it is possible to test if the ocean floor really does affect the size of a tsunami. Flat, sloped, valley, one hill, two hill, and three hill ocean floors were tested. Five trials of each sea floor type were done, and the results were surprising. Tsunamis are affected by the sea floor's shape, and that can contribute to why some areas have been known to have huge tsunamis. The tsunami starts out small and as the water gets shallower pushes on the sea floor causing it to grow taller and become this huge destructive wave. As the Tsunami is pushing down on the sea floor its shape can affect how large the tsunami is.

*Bibliography* <http://www.es.ucsc.edu/~ward/papers/single.pdf>

*Category EN P11* Propane Lawnmower

*Abstract*

The purpose of this experiment was to determine the effects of running a lawnmower on propane using an affordable propane conversion, compared to running the lawnmower on gasoline. This experiment examined the fuel consumption for the lawnmower when run on propane and gasoline under the same load condition, and which fuel was more cost effective. To generate repeatable load conditions, the lawnmower blade was replaced by an automotive fan blade. By controlling the RPM of the engine, the load could be controlled. The RPM was measured with a digital multi-meter calibrated using a variable speed strobe light. The fuel consumption part of the experiment was conducted by running ten minute tests on low, medium, and high RPM, and then measuring the fuel consumed. The amount of fuel used was then converted to grams for comparison. Finally, a fuel cost analysis was performed. The results of these tests showed that the lawnmower running on propane consumed more fuel than when it was run on gasoline. The cost analysis showed that the cost of running the lawnmower on propane was almost ten times greater than gasoline. In conclusion, although propane is said to burn cleaner than gasoline, the experiment showed that propane is not cost effective to use as fuel for home lawnmowers, and it consumes more fuel.

*Bibliography*

- Alley, M. (Jan. 2009). "Propane: An energy-efficient alternative". Residential Design and Build. :44. General OneFile . Web.
- Alternative Fuels Technologies, Inc. Propane Carbs. Retrieved April 10th, 2010 from [//www.propanecarbs.com/propane.html](http://www.propanecarbs.com/propane.html)
- (2008). Cleaner Air: Gas Mower Pollution Facts. People Powered Machines. Retrieved April 10th, 2010 from [//www.peoplepoweredmachines.com/faq-environment.htm](http://www.peoplepoweredmachines.com/faq-environment.htm)
- (May 10, 2010). Facts About Propane America's Exceptional Energy. NPGA. Retrieved April 10, 2010 from [//www.npga.org/files/public/Facts\\_About\\_Propane.pdf](http://www.npga.org/files/public/Facts_About_Propane.pdf)
- Isaacs, L. (2008). Fueling up of Cleaner Air. American City and Country. Retrieved April 13th, 2010 from [http://americancityandcountry.com/pubwks/parks\\_grounds\\_pests/fueling\\_cleaner\\_air/](http://americancityandcountry.com/pubwks/parks_grounds_pests/fueling_cleaner_air/)
- Peters, E. (May 26, 1997). "Automaker offers cats on propane, natural gas, ethanol." Insight on the News. 40+.General OneFile. Web. Retrieved April 13th, 2010
- (September 17, 2009). "Propane Key to Federal Government's Clean Energy Strategy". Politics and Government Business: 7. General OneFile. Web. Retrieved on April 13th, 2010
- (October 2006). Straight Answers on advanced Technologies. Maryland Clean Cities. Retrieved April 10th, 2010 from [//www.energy.state.md.us/incentive/transportation/factsheets/Propane.pdf](http://www.energy.state.md.us/incentive/transportation/factsheets/Propane.pdf)
- What is Propane and History of Propane. Colorado.edu. Retrieved April 10, 2010 from [//lsa.colorado.edu/summarystreet/texts/propane.htm](http://lsa.colorado.edu/summarystreet/texts/propane.htm)

**Category EN P12** Solar Cells vs. Fuel Cells

**Abstract** I am studying the subject of "clean" energy. Therefore I have decided to find out what are more efficient, fuel cells, or solar cells. It is my hypothesis that fuel cells are the more efficient of the two. To test this I took one fuel cell and one solar cell, and then after providing each with the necessary products they need to work, be it light or hydrogen and oxygen, I took readings of the electrical output from both for a certain time period, checking both at even intervals. For a result I found that the fuel cell had on average 73.52% efficiency, at least on voltage. The solar cell had a 12.86% average efficiency. So in conclusion the fuel cell is most definitely more efficient than the solar cell.

- Bibliography**
- "2004 Project Summary." California State Science Fair. California State Science Fair, 2 April 2004. Web. 22 Sept. 2010. <<http://www.usc.edu/CSSF/History/2004/Projects/J0715.pdf>>.
  - Toothman, Jessika, and Scott Aldous. "How Solar Cells Work" 01 April 2000. HowStuffWorks.com. <<http://science.howstuffworks.com/environmental/energy/solar-cell.htm>> 27 September 2010.
  - Nice, Karim, and Jonathan Strickland. "How Fuel Cells Work" 18 September 2000. HowStuffWorks.com. <<http://auto.howstuffworks.com/fuel-efficiency/alternative-fuels/fuel-cell.htm>> 28 September 2010.
  - "How to make a solar cell." Instructables. Instructables, n.d. Web. 22 Sept. 2010. <<http://www.instructables.com/id/How-to-MAKE-PV-Solar-Panels/>>.
  - Harper, Gavin. "How to make a fuel cell." Makezine. Makezine, 2006. Web. 22 Sept. 2010. <[http://blog.makezine.com/archive/2006/06/how\\_to\\_build\\_your\\_own\\_ban.html](http://blog.makezine.com/archive/2006/06/how_to_build_your_own_ban.html)>.
  - Schuch, Sarah. "Solar Rebirth Lennon Company back in the Business of Making Furnace Systems." Flint Journal 24 Oct. 2010, Sunday ed.: D1. Print.

**Category** *EN P13* Engineering a Space-Efficient Design of an Electrolytic Hydrocarbon Fuel Cell

**Abstract** To be Added

**Bibliography** To be Added

*Category EN P14* On Shaky Ground: A Study of Structural Strength During Earthquake Simulations

*Abstract* The purpose of this experiment was to determine which type of structure was the strongest during earthquake simulations. Ultimately, the goal was to apply this research to apartment building-sized structures for application in high-risk residential areas.

Three types of structures were modeled and tested in this experiment: untrussed structures, x-braced structures, and central-tube structures. Untrussed structures were the control, and represent buildings with no built-in reinforcement. X-braced structures are more commonly used in high-risk areas, and tube structures are also used for similar situations. However, tube structures are often applied in skyscrapers because they reduce the need of internal columns, providing much more open space (which can be used as office space). This led to the hypothesis that the x-braced structure would be the strongest, the tube the second strongest, and the cube structure the weakest.

A shake table was designed and created to test each building, and a motion sensor and accelerometer were used to capture data. The data recorded suggest that the hypothesis was partially supported; the cube structure was clearly the weakest, but the x-braced and tube structures were quite close. Unfortunately, the shake table failed before conclusive data could be recorded on the tube structure. However, the tube structure was cheaper to construct than the x-braced structure, and it is still possible that it will prove to be as strong, if not stronger.

*Bibliography* Works Cited

Biggs, John M. Introduction to Structural Engineering Analysis and Design. Englewood Cliffs, NJ: Prentice-Hall, 1986. Print.

Bolt, Bruce A. Seismic Strong Motion Synthetics. Orlando, FL: Academic, 1987. Print.

Chen, Wai-Fah. The Civil Engineering Handbook. Boca Raton: CRC, 1995. Print.

"Earthquake Facts." U.S. Geological Survey Earthquake Hazards Program. 27 Oct. 2009. Web. 31 Jan. 2011. <<http://earthquake.usgs.gov/learn/facts.php>>.

"Find Live and Dead Loads." Courses.cit.cornell.edu. Web. 22 Feb. 2011. <<http://courses.cit.cornell.edu/arch264/calculators/example2.1/index.html>>.

"MCEER Information Service "How Earthquakes Affect Buildings"" MCEER, from Earthquake Engineering to Extreme Events | Home Page. Web. 31 Jan. 2011. <[http://mceer.buffalo.edu/infoservice/reference\\_services/EQaffectBuilding.asp](http://mceer.buffalo.edu/infoservice/reference_services/EQaffectBuilding.asp)>.

**Category EN P15** Liquid Organic Compost Fertilizer

**Abstract**

The Liquid Organic Compost Fertilizer project is a challenge to the traditional methods of fertilization and preview of a bright future with environmentally friendly natives. The hypothesis: "if the liquid organic compost fertilizer is applied to radish plants, then more plants will survive and the plants will grow taller than radish plants grown using a traditional fertilizer (Scotts Miracle-Gro®), therefore it will be more effective than the traditional fertilizer" is a bold answer to the pollutant fertilizers of the past. After extensive procedural experimentation, involving the creation of the new Liquid Organic Compost Fertilizer and the growing of three different sets of radish plants, one by the Liquid Organic Compost Fertilizer, another by a traditional fertilizer, and finally, one by plain water. It was found that the hypothesis was achieved and supported by observations and data collected by the experiment.

**Bibliography**

- 1) Lerner KL, Lerner BW. Fertilizers. The Gale Encyclopedia of Science. 2004. 2:1594-1595. Available at:  
[http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom\\_hfordcommcol&tabID=T003&searchId=R1&resultListType=RESULT\\_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=5&contentSet=GALE%7CCX3418500913&&docId=GALE|CX3418500913&docType=GALE&role=](http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom_hfordcommcol&tabID=T003&searchId=R1&resultListType=RESULT_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=5&contentSet=GALE%7CCX3418500913&&docId=GALE|CX3418500913&docType=GALE&role=). Accessed October 26, 2010.
- 2) Lerner KL, Lerner BW. Composting. The Gale Encyclopedia of Science. 2008. 2:1045-1049. Available at:  
[http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom\\_hfordcommcol&tabID=T003&searchId=R1&resultListType=RESULT\\_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=1&contentSet=GALE%7CCX2830100572&&docId=GALE|CX2830100572&docType=GALE&role=](http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom_hfordcommcol&tabID=T003&searchId=R1&resultListType=RESULT_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=1&contentSet=GALE%7CCX2830100572&&docId=GALE|CX2830100572&docType=GALE&role=). Accessed October 26, 2010.
- 3) Blashfield JF. Composting. The Gale Encyclopedia of Science. 2008. 2:981-984 Available at:  
[http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom\\_hfordcommcol&tabID=T003&searchId=R3&resultListType=RESULT\\_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=2&contentSet=GALE%7CCX3418500563&&docId=GALE|CX3418500563&docType=GALE&role=](http://go.galegroup.com/ps/retrieve.do?sgHitCountType=None&sort=RELEVANCE&inPS=true&prodId=GURL&userGroupName=lom_hfordcommcol&tabID=T003&searchId=R3&resultListType=RESULT_LIST&contentSegment=&searchType=BasicSearchForm&tPosition=2&contentSet=GALE%7CCX3418500563&&docId=GALE|CX3418500563&docType=GALE&role=). Accessed October 27, 2010.

**Category EN P16** Optimizing Windmill Efficiency Based on Number of Blades

**Abstract**

It is becoming more and more important to use alternative fuel sources like wind energy, and to get as much energy from the source as possible. In this project, I am trying to contribute to that by maximizing the energy collected from the wind. The goal of this project is to determine which amount of blades on a windmill will be more effective in generating energy, therefore optimizing the rotor of the windmill. Factors such as aerodynamics of the windmill blade are ignored in this project. I am going to do this by actually building a model windmill, as well as eight sets of rotors with evenly spaced blades. For wind, I will use a small fan. To test the efficiency, I will use the equation  $E = \frac{1}{2} I \omega^2$ , which is the energy equation for rotating bodies, to calculate the rotational energy of the spinning rotor, which will eventually attain a constant speed. The constant speed is a balance between the force on the blades and the frictional force on the rotor. The energy contained in the rotor is proportional to the efficiency, and therefore can be used to compare the efficiency of the blade sets. Through experimentation, I got that while eight blades will pick up the most energy, two or three blades will pick up the most energy per blade.

**Bibliography**

1. Introduction to Physical Science by Shipman, Wilson, and Todd- For Electricity and Physics-based equations
2. [www.copernicusproject.ucr.edu/.../Optimizing%20Windmill%20Blade%20Efficiency.doc](http://www.copernicusproject.ucr.edu/.../Optimizing%20Windmill%20Blade%20Efficiency.doc)- Optimizing windmill blade efficiency
3. [http://www.energybeta.com/windpower/windmill/windmill-blades/-Windmill Blades](http://www.energybeta.com/windpower/windmill/windmill-blades/-Windmill%20Blades)
4. [http://digital.library.okstate.edu/oas/oas\\_pdf/v56/p121\\_124.pdf](http://digital.library.okstate.edu/oas/oas_pdf/v56/p121_124.pdf)- On the aerodynamics of windmill blades
5. <http://www.creative-science.org.uk/8blade.html>- Starting to explore wind power.
6. Gere, J.M., and Timoshenko, S.P., Mechanics of Materials, PWS publishing company, p. 814-817, 1997
7. <http://hyperphysics.phy-astr.gsu.edu/hbase/mi.html>

*Category* **EN P17** Anti-Gravity Lifter

*Abstract* Around the 1920's Dr. Alfred Biefeld and his student Tomas Townsend Brown discovered "anti-gravity" by experimenting with high voltage capacitors. They're work together is now called the Biefeld-Brown effect. In my experiment, first the electrons went through the high voltage lead to the cathode ray tube, to the wire around the system. As the electrons leave the wire they attach themselves to air molecules, however they are still attracted to the positive ions below. As they move down to the positive ions they bring the air molecules with them, then detach to go to the positive ions. The air molecules are then forced down by the momentum they built up from the electron moving them down creating an air flow. This air flow, if strong enough, should lift the system to make it "float".

*Bibliography* <http://jnaudin.free.fr/html/lftbld.htm>

Also obtained important information from Bryan Pickard from Glens TV Repair 3925 S. Telegraph Rd Dearborn Heights, MI 48125, Mike Travis (BSME), and Bill Cruickshank (BSEE)

*Category* **EN P18** Humidity and Impact on EGR Scheduling

*Abstract* The purpose of the project was to study the effect of humidity on the usage of EGR (Exhaust Gas Recirculation) in boosted engine applications. The study concentrated on non-trivial behavior of humidity and the physics behind the behavior with respect to temperature, pressure, engine operating conditions, etc. Based on the empirical relationships of humidity and its interaction with other changing engine variables, a mathematical model was developed to calculate the limitation of EGR that can be used under different operating conditions without condensation. The results show that the condensation that limits the EGR% is directly related to humidity, temperature, and pressure. EGR decreases whenever relative humidity, ambient temperature and pressure increase. To avoid condensation, the increase in charge temperature (Air + EGR) over ambient temperature is a strong function of the ambient temperature. The hypothesis was verified in the dynamometer laboratory using a barometer under various conditions. The EGR limit calculations were tested by changing the ambient air temperature, humidity, EGR, and pressure at the CAC outlet and comparing them to the expected results. A user-friendly tool was developed with all the mathematical relationships and the models implemented for ease of use by the engine dyno and vehicle calibration teams. This study provides critical conclusions on the EGR operating conditions and limitations to avoid condensation and other failure modes.

*Bibliography* Van Basshuysen, Richard, and Schäfer, Fred, "Internal Combustion Engine Handbook," SAE International, 2004.

**Category EN P19** Mimicking the Drag Reducing Qualities of Shark Skin

**Abstract**

The goal of this science fair experiment is to design a shark skin coating that can be applied to a rocket in order to decrease the drag. Everything used in the experiment will be either made or acquired at low costs. A negative mold will be attempted to be made and then cast on to the actual rocket using a resin. If that is unable to happen, then a product designed to model shark skin will be used.

The method of measuring drag will be to place the rocket in a wind tunnel and then calculate the force and coefficient of drag using the drag equation. The rocket will also be launched and the maximum height will be found and that data will be compared. The hypothesis is that the modified rocket will have a lower coefficient of drag than the unmodified rocket. Estes model rockets will be used because they are premanufactured, which will eliminate a variable. They also have parachutes that allow for recovery after launching.

Many different companies and even the US Navy is doing research in this field of shark skin aerodynamics. Most have large budgets and are testing laser inprints and UV drying paints.

**Bibliography**

<http://www.scientificcomputing.com/news-DS-Sharkskin-Improves-Aerodynamics-052510.aspx>

<http://marinelife.about.com/od/glossary/g/dermaldenticle.htm>

Donald E. Sabourin, D.D.S.

<http://www.enchantedlearning.com/subjects/sharks/anatomy/Skin.shtml>

*Category EN P20* Engineering a Space-Efficient Design of an Electrolytic Hydrocarbon Fuel Cell

*Abstract* Consumers in America and elsewhere in the world are coming to a sobering realization that their habits and lifestyles are not sustainable on this planet. High-output economies are creating more and more waste on the planet and eventually, this waste must be disposed of to make room for new wastes that are produced daily and we are gradually (to state it in the least maligning way) running out of places to keep this. The same problem is also appearing with greenhouse gasses and the high-output fills the atmosphere faster than it can be consumed and converted by chemo- and photosynthetic creatures. This process is only worsened by the world's incessant need for wasteful creature comforts like remote car starters so they won't have to feel the chilled air for a moment or two in the car, and having the best engine no matter how much it costs the environment. Producers like Chevy, General Electric, and LG are taking responsibility and attempting to remedy the problem by using low-emission and efficient power sources for their products and encouraging sustainable use patterns. A solution that is expected to integrate well with the shift is the fuel cell, which is a battery of sorts.

A fuel cell (particularly an electrochemical cell) converts chemical energy into electrical energy; it does so through a series of reductions and oxidations inside some medium, which is called an electrolyte. A wide variety of electrolytes have been used in different fuel cells, ranging from molten carbonate ions to solid ceramic membranes and aqueous solutions. This fuel cell uses an aqueous NaOH solution. The electrolyte is convenient in the "slower" oxidation of the fuel, yielding more electrons than a different chemical oxidation (like MnO<sub>2</sub>).

This fuel cell is rather compact in design and it would be easy to implement them in series in order to increase power output. This ability would serve very useful if it came to power large jets or even communities, since it would not take a great transformation in design to bring it to this level. The fuel cell does have a small CO<sub>2</sub> output, but the ratio of power output to CO<sub>2</sub> output is far greater than that of gasoline and some other fuel cells. The greatest obstacle standing in the way of progress for this, is a lack of sufficient financial resources, since so many of the materials used in the construction are so expensive. As a reassurance to a consumer or potential investor, this would not increase commercial pricing by much since the more expensive materials can be reused almost indefinitely.

The design could eventually become a commonplace power source and alternative to coal, natural gas, other fossil fuels, geothermal power, nuclear energy, solar energy, and even to other fuel cells!

*Bibliography* <[http://www.utcpower.com/fs/com/bin/fs\\_com\\_Page/0,11491,0122,00.htm](http://www.utcpower.com/fs/com/bin/fs_com_Page/0,11491,0122,00.htm)  
>  
<<http://web.mit.edu/afs/athena.mit.edu/org/m/mecheng/fcp/about%20f%20cells.html>>

<[http://www.ika.rwth-aachen.de/r2h/index.php/Water\\_and\\_Air\\_Management\\_for\\_Fuel\\_Cells](http://www.ika.rwth-aachen.de/r2h/index.php/Water_and_Air_Management_for_Fuel_Cells)>  
<[http://www.dnv.com/publications/dnv\\_forum/no3-2006/Fuelcelltechnologyintroducesultracleanships.asp](http://www.dnv.com/publications/dnv_forum/no3-2006/Fuelcelltechnologyintroducesultracleanships.asp)>

*Category MA P21* Reformulating the Newton Direction Computation as a Least Squares Problem

*Abstract* From robust data fitting in statistics to L1  $\square$  finite element methods for fluid dynamics, the overdetermined L1 minimization problem arises in many practical applications. First, this paper presents a proof of the convergence of Newton's method for the smoothed overdetermined L1 minimization problem. Next, new formulas are derived for computing the Newton search direction by solving a linear least squares problem. Numerical examples show that the new least squares reformulation stably computes L1 minimizers for coefficient matrices with condition numbers from  $10^3$  to  $10^6$ . In contrast, the existing normal equations formulation completely failed to provide an accurate solution for the ill-conditioned coefficient matrices with condition numbers of  $10^5$  and  $10^6$ . The reformulation currently holds great potential for any overdetermined ill-conditioned L1 minimization problem and can be easily extended to nonlinear or underdetermined problems. This paper presents many practical applications and the circumstances where ill-conditioned matrices appear.

- Bibliography* P. B. Bochev and M. D. Gunzburger, Least-Squares Finite Element Methods, Springer, New York, NY, 1 ed., 2009.
- E. J. Cands, M. Rudelson, T. Tao, and R. Vershynin, Error correction via linear programming, in Proceedings of the 46th Annual IEEE Symposium on Foundations of Computer Science, IEEE, 2005.
- J. Demmel, Applied Numerical Linear Algebra, Siam, Philadelphia, 1 ed., 1997.
- M. S. Gockenbach, Newton's method for unconstrained minimization. <http://www.math.mtu.edu/~msgocken/ma5630spring2003/lectures/newton/newton/node5.html>, January 2003.
- J. L. Guermond, A finite element technique for solving first-order PDEs in LP , SIAM Journal of Numerical Analysis, 42 (2004), pp. 714-737.

*Category MA P22* Costly Car Cunundrum

*Abstract*

The question on most Americans' minds in today's financial crisis is "How can I save money?" One simple answer to that question lies in the cost of buying and maintaining automobiles. Cars are something that everyone needs in order to get from one place to another. Most people buy a car that gets good mileage, but what they may not realize, is that there may be a car better suited for them than what they chose. For instance, a car a person plans to own for 5 years, but costs thirty thousand dollars to purchase may get only slightly better gas mileage than a car that costs only ten thousand dollars to buy. The factor of how far a person drives per day also comes in to play. Therefore the real question is, "Does the average American pay too much for the car they currently drive?" The answer to that is that most of them do, even in a person owns a fuel saving car, unless it is the Smart For Two, the car will cost more for the consumer.

*Bibliography*

<http://www.toyota.com/prius-hybrid/specs.html>

<http://www.automotive.com/2010/12/smart/fortwo/specifications/index.htm>

|

[http://wiki.answers.com/Q/Average\\_number\\_of\\_work\\_days\\_per\\_month\\_in](http://wiki.answers.com/Q/Average_number_of_work_days_per_month_in)

**Category MA P23** Bloody Math

**Abstract** The purpose of my project is to determine the origin of blood spatters. As we all know crimes happen all the time. The mystery to every crime is who did it and what really happened. It is very rare that the crime scene investigators, or forensic scientist, are at the scene. Therefore, in this project I will play the role of an impartial scientist. To figure out what really happened, I will be Investigating blood spatter to deliver the facts using mathematical models.

The procedures involve spraying synthetic blood from a spray bottle using the droplet setting from a pre-determined height. After the synthetic blood has dried, measurements will be taken of the length and width of several droplets. These measurements will allow me to determine the angle of impact. I will then draw lines through the center of these droplets to see where they meet, called the area of convergence. Measuring the back of the stain to the area of convergence, allows me to find the origin of the blood spatter, which should be above the area of convergence. Multiple methods involving mathematical principles will be used to get the most accurate data possible.

**Bibliography** [http://www.clt.uwa.edu.au/\\_\\_data/page/112508/fsb05.pdf](http://www.clt.uwa.edu.au/__data/page/112508/fsb05.pdf)  
<http://www.suite101.com/content/determining-direction-in-blood-spatter-analysis-a171816>

*Category MA P24* Converging Logarithmic Spirals on the Complex Plane

*Abstract* The iteration of the logarithmic function on a complex number is rather complicated to calculate by hand; however, using computer programs to mathematically simplify the logarithmic operations gives us data that suggests that iterating the logarithmic function on any complex number will eventually reach a unique limit no matter what the initial inputted value is. My project revolves around giving a rigorous mathematical proof to explain why this convergence occurs. Manipulating common equations in Complex Analysis and applying the Mean Value Theorem on the complex plane shows not only that the limit does exist but also shows that continuously taking the logarithm of a number, real or complex, will showcase a function that converges to the limit at a constant rate. Furthermore, collecting data using mathematical software supports the proof with hard data. Graphing the data points on the complex plane, we see that the function creates a spiral that has interesting properties on its own. With these new constants we can find new equilibriums in areas applying complex logarithms such as quantum mechanics, computer science, and electrical engineering. Thus, this research gives an interesting proof for a unique mathematical phenomenon in which potential real-world application may lie.

*Bibliography* Introduction to Complex Analysis by Rolf Nevanlinna and Veikko Paatero

**Category PH P25** Detection of Radioactive Isotopes in the Radon Decay Chain

**Abstract**

The purpose of this experiment was to construct and test an ion chamber to determine whether it could detect radioactivity being emitted by certain items and quantify the relative amounts of these emissions. The ion chamber, together with a dust collector, was also used in an attempt to detect the presence of radon in a home and being produced by common construction materials.

The ion chamber was built out of common, inexpensive, electronic components and recycled steel cans. When radioactive particles passed through the main body of the chamber, ions were produced. The interaction of these ions with the chamber caused a small current to flow which could be amplified by using a transistor. This amplified current flow was measurable with a digital multimeter.

The radiation emitted by several radioactive items was detected by the ion chamber and could be quantified by using the voltage readings provided by the multimeter. The ion chamber was also able to measure the presence of radon gas produced by the radium paint on dial of a pre-1950's clock.

The ion chamber was used to test for radon in different areas of a home. It was not able to indicate the presence of radon in any of the areas tested, either because there was indeed no radon or because the ion chamber was not sensitive enough to detect it.

Two common construction materials, granite and brick, were also tested to determine if they were sources of radon gas. The ion chamber did not indicate the presence of radon being emitted by these two sources, either because there was none or because the ion chamber was not sensitive enough to detect it.

**Bibliography**

Books:

Christensen, J. (1990). *The Structure of an Atom*. London: Wiley.

Giancoli, D. (1980). *Physics: Principles with Applications*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Gray, T. (2009). *The Elements: A Visual Exploration of Every Known Atom of the Universe*. New York, NY: Leventhal Publishers, Inc.

Lauf, R. (2008). *Introduction to Radioactive Minerals*. Atglen, PA: Schiffer Publishing Ltd.

Mims, F. (2000). *Getting Started in Electronics*. Niles, IL: Master Publishing Inc.

Moore, A. (1997). *Electrostatics: Exploring, Controlling, and Using Static Electricity Second Edition*. Garden City, NY: Laplacian Press.

Urone, P. (2001). *College Physics Second Edition*. Pacific Grove, CA: Brooks/Cole.

Wehr et al. (1984). *Physics of the Atom Fourth Edition*. Reading, MA:

Addison-Wesley Publishing Company.

Wile, J. and Shannon, M. (2001). The Human Body: Fearfully and Wonderfully Made. Anderson, IN: Apologia Educational Ministries, Inc.

Personal Communication:

Charles Wenzel

Websites:

A Citizen's Guide to Radon  
<http://www.epa.gov/radon/pubs/citguide.html>

A Quick Radon Detector for the Student  
Ion Chambers  
<http://www.techlib.com/science/ionchamber.htm>

About Antique Vaseline Glass.  
<http://www.collectorsweekly.com/glassware/vaseline-glass>

Americium-241. <http://www.doh.wa.gov/ehp/rp/factsheets/factsheets-pdf/fs23am241.pdf>

Americium Information  
[www.ead.anl.gov/](http://www.ead.anl.gov/)

Cancer and Radon: Studies on the Carcinogenicity of Radon  
Radon Fact Sheet  
<http://www.radon.com>

Consumer Household Radiation Sources. (2009).  
<http://www.hps.org/documents/consumerproducts.pdf>

<http://www.epa.gov/rpdweb00/radionuclides/radon.html>

Fiesta Ware (ca. 1930's).  
<http://www.orau.org/ptp/collection/consumer%20products/fiesta.htm>

General Information About Radiation  
<http://www.unitednuclear.com>

Genesee County Radon Information  
<http://county-radon.info/MI/Genesee.html>

Granite Made Easy  
<http://www.granitemadeeasy.com/whatisgranite>

Natural Radioactivity in Building Materials – Czech Experience and European Legislations

[http://www.aarst.org/proceedings/2008/03-NATURAL\\_RADIOACTIVITY\\_IN\\_BUILDING\\_MATERIALS-CZECH\\_EXPERIENCE\\_AND\\_EUROPEAN\\_LEGISLATION.pdf](http://www.aarst.org/proceedings/2008/03-NATURAL_RADIOACTIVITY_IN_BUILDING_MATERIALS-CZECH_EXPERIENCE_AND_EUROPEAN_LEGISLATION.pdf)

Picture, stories, and facts about the element Radium in the Periodic Table. <http://www.periodictable.com/Elements/088/index.html>

[http://www.practicalphysics.org/go/Guidance\\_79.html](http://www.practicalphysics.org/go/Guidance_79.html)

Radium

<http://www.epa.gov/rpdweb00/radionuclides/radium.html>

Radon. (2009). <http://www.epa.gov/rpdweb00/radionuclides/radon.html>

Radon and Its Progeny

<http://www.iem-inc.com/homeset.html>

Radon Testing Devices

[http://www.jrvhomeinspections.com/main/Radon\\_testing\\_devices](http://www.jrvhomeinspections.com/main/Radon_testing_devices)

Radon: What is Radon?

<http://www.cancer.org/Cancer/CancerCauses/OtherCarcinogens/Pollution/radon>

Transistors

That Pair's DARLINGTON

<http://www.williamson-labs.com>

Uranium Decay Chart

Uranium: Its Uses and Hazards.

<http://www.ieer.org/fctsheet/uranium.html>

What is a Meter?

[http://www.allaboutcircuits.com/vol\\_1/chpt\\_8/1.html](http://www.allaboutcircuits.com/vol_1/chpt_8/1.html)

What's Lurking in Your Countertop?

[http://www.nytimes.com/2008/07/24/garden/24granite.html?\\_r=1](http://www.nytimes.com/2008/07/24/garden/24granite.html?_r=1)

**Category PH P26** Geomagnetic Effects on the Wide Area Augmentation System

**Abstract** Geomagnetic storms occur frequently through the solar maximum, which happens to be in the year 2011. It is important to understand Geomagnetic storms because they cause disturbances in satellites. Satellites were once rare and mostly government owned, but today they are more numerous and owned by many people. Today people heavily depend on satellites for weather information, television, communication, and navigation. A WAAS enabled GPS will be used to determine error signals given off. The latitude, longitude, and altitude will be found and the difference between the readings will be the error signal. Then, the Kp level of the Geomagnetic Storm will be found at the NOAA Space weather website. The relationship between error signal and Kp index level will be plotted out and mapped using Excel.

**Purpose:**

Why is this all-important? GPS is most important to people who drive into unfamiliar territories or go for hikes, business travelers who frequent new cities and towns. The system offers quick and accurate routing to locations in strange areas and so users are not stressed when looking for unknown locations while on road trips or vacations. There are many more reasons but GPS helps many find their way around the world. In this project the hypothesis is that Geomagnetic Storms does cause error signals in Wide Area Augmentation Systems (WAAS) enabled Global Positioning Systems (GPS).

**Results:**

After conducting and analyzing the results, the hypothesis that Geomagnetic storms cause error signal in the Wide Area Augmentation System is supported. In this research project the independent variable is the Geomagnetic Storm KP level, while the error signal calculated is the dependent variable. After analyzing the mode and median, it can be shown that during the month of November and December the KP level was generally at 4, which gives off a strong error signal. The median, which is also 4 KP shows that the latitude, longitude, and altitude, were greatest once the sun hit a KP level of 4. The median and mode help to understand what the sun's activity and the effect it has on GPS activity during the past two months. Another statistical function is the correlation found for the latitude, longitude, and altitude. The latitude has a correlation of 0.70542127 which is significant. This correlation states that 70.5 percent of the time as KP level increases, error signal increases as well. Second, the longitude correlation is more significant at 0.829672768, which also says that 83 percent of the time as KP level increases so does error signal in GPS calculations. Lastly, the altitude correlation calculated is 0.946774383, resulting in the same concept as the latitude and longitude. These strong correlations support the hypothesis that Geomagnetic activity causes error signals in the Wide Area Augmentation System (WAAS).

*Bibliography*

4. Huttunen, K. Emilia J. (2002), April 2000 magnetic storm: Solar wind driver and magnetosphere response, Available at: <http://www.agu.org/pubs/crossref/2002/2001JA009154.shtml> Accessed October 27,2010

5. Zolotukhina, N. A., O. I. Bergardt, and B. G. Shpynev (2007), Studying magnetospheric disturbances accompanied by midlatitude coherent echo signals, Geomagn Aeron Available at : <http://www.springerlink.com/content/r0556m631656uvm3/> Accessed October 26,2010

**Category PH P27** Car Collisions

**Abstract** In my experiment I plan on studying the use of different materials and their thicknesses as bumpers on model cars to determine the best type of bumper that would absorb energy in a collision. To do this, I need to build an apparatus that would allow me to release a car down a ramp, determine the speed at which the car hits a wall, and measure the distance it bounces back. Using the speed at which the car collides and the distance it bounces back, I will be able to calculate the energy absorbed in the collision. The goal is to find a bumper that absorbs the most energy.

**Bibliography** 1) <http://theory.uwinnipeg.ca/physics/mom/index.html> 2) [http://ffden-2.phys.uaf.edu/211\\_fall2002.web.dir/ben\\_townsend/physicsofcarcollisions.htm](http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/ben_townsend/physicsofcarcollisions.htm) 3) <http://www.euclideanspace.com/physics/dynamics/collision/index.htm>

**Category PH P28** Torridal Rings

**Abstract** This project explores the behavior of air when influenced by specific sound waves. The purpose of my experiment is to test the variation of energy of a torridal ring when the frequency of the sound wave that produces it is changed; and to test whether a torridal ring will be formed when the amplitude of the sound wave that produces it will be changed.

For this experiment, I am going to produce a ring of air, which will be visible to the naked eye as there will be tiny smoke particles in it. This smoke ring is made by attaching a speaker to the top of the cup. Next, a circular hole is cut in the bottom of the cup about  $\frac{4}{10}$  the radius of the bottom of the cup. Now when a saw tooth tone is played through the speaker, and the cup is filled with smoke, a ring of smoke will be produced.

By changing the frequency and amplitude of this sound wave, I will see how the energy of the smoke ring is affected. The energy will be measured by seeing at how far a cotton ball, which is attached to a string and the string that is attached to the underside of table, will move in term of degrees when different frequencies and amplitudes are played.

**Bibliography** 1) [http://www.worldlingo.com/ma/enwiki/en/Toroidal\\_ring\\_model](http://www.worldlingo.com/ma/enwiki/en/Toroidal_ring_model) 2) [http://www.commonsensescience.org/pdf/articles/atomic\\_structure.pdf](http://www.commonsensescience.org/pdf/articles/atomic_structure.pdf) 3) [www.flodesign.org/technologies.html](http://www.flodesign.org/technologies.html)

**Category PH P29** Determining the Effects of Club Head Speed and Drivers on Golf Ball Flight

**Abstract** The main objective of this experiment is to determine which specifications of different brand drivers will create the most distance off a tee shot. Also, to determine how different club head speeds along with a combination of the different specifications affect the distance of the ball. The three drivers tested were the Taylormade burner, Ping G5, and the Cobra s2. Each driver was equipped with a regular and stiff flex shaft, along with a 9.5 and a 10.5 face angle club head. The hypothesis of this experiment is that the Cobra s2 equipped with the regular shaft and the 9.5 degree face angle would create the most distance on the shot. The drivers were swung by two golfers with different club speed in front of the vector shot analyzer to record the distance and the launch angle of the shot. There were fifteen trials done for each driver. Upon analyzing the data, some unexpected trends were noticed. The Ping G5 drove the ball the farthest for both golfers under all conditions. The data also suggest that the Ping G5 also has the largest sweet spot. The Taylormade burner produced the second-farthest distance, and the Cobra s2 produced the least distance from the tee.

**Bibliography** " PING : Clubs : Drivers ." PING : Welcome . N.p., n.d. Web. 11 Mar. 2011. <<http://www.ping.com/clubs/driversdetail.aspx?id=6964>>.  
" TaylorMade Golf - Drivers ." TaylorMade Golf Official Site. N.p., n.d. Web. 11 Mar. 2011.  
<<http://www.taylormadegolf.com/mainlevel/golfshop/drivers.html?IsPopUp=0#30>>.  
"Cobra S2 Driver." Cobra Golf. N.p., n.d. Web. 11 Mar. 2011.  
<[www.cobragolf.com/golf-clubs/Cobra-S2-Driver](http://www.cobragolf.com/golf-clubs/Cobra-S2-Driver)>.  
"Golf Ball Trajectories." OSU Math Golf. N.p., n.d. Web. 11 Mar. 2011.  
<[www.math.osu.edu/~overman/math607/golf.pdf](http://www.math.osu.edu/~overman/math607/golf.pdf)>.  
"Head - Particular Material Composition Or Mass Distribution inventions." Freshpatents.com: Patent Applications Updated Each Week, RSS, Keyword Monitoring. N.p., n.d. Web. 11 Mar. 2011.  
<<http://www.freshpatents.com/x1473349000psbc.php>>.  
Mgrdichian, Laura, and Copyright 2006 PhysOrg.com. "Physics Reveals the Key to a Great Golf Swing." PhysOrg.com - Science News, Technology, Physics, Nanotechnology, Space Science, Earth Science, Medicine. N.p., n.d. Web. 11 Mar. 2011.  
<<http://www.physorg.com/news85663321.html>>.  
"The Physics of the Golf Swing." David Newman's Page. N.p., n.d. Web. 11 Mar. 2011. <[http://ffden-2.phys.uaf.edu/211\\_fall2002.web.dir/josh\\_fritts/swing.html](http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/josh_fritts/swing.html)>.

**Category** *PH* **P30** Improving a Wind Tunnel: an Effort to Reducing Tubulence

**Abstract** in my experimentation i utilized a series of window screens and wooden vanes to reduce the turbulence in an open circuit wind tunnel. this process was done at three different wind speeds and with several array arrangements.

**Bibliography** tbc

**Category PH P31** Rockin' the House: Reducing Vibrations in a Home Theater

**Abstract**

Can a basement be created that will absorb the vibrations made by a speaker system? Longitudinal waves created by speakers can produce movements if the loudness is great enough. Some people like these vibrations, while others find them distracting and disruptive. Audiophiles are constantly creating and buying new materials to correct problems just like this. Materials like AcoustiCrete™ can help reduce vibrations and increase sound insulation. This brings the question, “What practical insulation material inside of a wall will reduce the most vibrations in a home theater?”

To do this, a “basement” setup is required; this can be created by making a two chamber room. The first chamber lies between a square concrete wall and a middle, drywall, wall. The second chamber is the square area created by the drywall. A strong wire strung atop the setup will hold the speaker for part of the project. The box should house a speaker hooked up to a tuner, with some form of note-tuning device attached. Using Data Studio® and a decibel meter, measurements can be taken of the different vibrations and decibel readings while the speakers are playing, including the different insulations inside the first chamber. This is tested with the speaker on the wire versus off of it.

Using the collected data, it was found that fiberglass insulation is the best at absorbing the vibrations caused by the speaker. On the other hand, blow-in insulation reduces leaked sound the most. Standard deviation and coefficient of friction tests show that there was a high precision for the decibel readings, and a low precision for the accelerometer. This means that more should be done to increase the precision of this experiment. This experiment can be used by people looking to buy homes with an emphasis on home theaters.

**Bibliography**

Acoustical Solutions, Inc. | Supplier of Soundproofing and Noise Control Products. Web. 21 Feb. 2011. <<http://www.acousticalsolutions.com/>>.

"Destructive Wave Interference." Zona Land Education, Home. Web. 21 Feb. 2011.

<<http://zonalandeducation.com/mstm/physics/waves/interference/destructiveInterference/InterferenceExplanation3.html>>.

Giancoli, Douglas C. Physics for Scientists and Engineers. 3rd ed. Upper Saddle River, N.J: Pearson/Prentice Hall, 2008. Print.

Griffith, W. Thomas. The Physics of Everyday Phenomena: a Conceptual Introduction to Physics. 3rd ed. Boston: McGraw-Hill, 2001. Print.

Marshall, Paula, and John Riha. Basements: Your Guide to Planning and Remodeling. Des Moines, IA: Better Homes and Gardens, 1999. Print.

"Overview of Sound Waves - Succeed in Understanding Physics: School for Champions." School for Champions: Online Lessons for Those Seeking Success. Web. 21 Feb. 2011. <<http://www.school-for-champions.com/science/sound.htm>>.

"Past Projects." Upload & Share PowerPoint Presentations and Documents. Web. 21 Feb. 2011.  
<<http://www.slideshare.net/joliver311/Past-Projects-1131385>>.

"Seismograph." LEO - Lehigh Earth Observatory. Web. 21 Feb. 2011.  
<<http://www.leo.lehigh.edu/projects/seismic/seismograph.html>>.

Spence, William P. Insulating, Sealing & Ventilating Your House. New York, NY: Sterling Pub., 2006. Print.

Thumma, Stephan. Personal interview. 4 Jan. 2011.

"What Is a Seismograph?" The Tech Museum | Welcome. Web. 21 Feb. 2011. <[http://www.thetech.org/exhibits\\_events/online/quakes/seismo/](http://www.thetech.org/exhibits_events/online/quakes/seismo/)>.