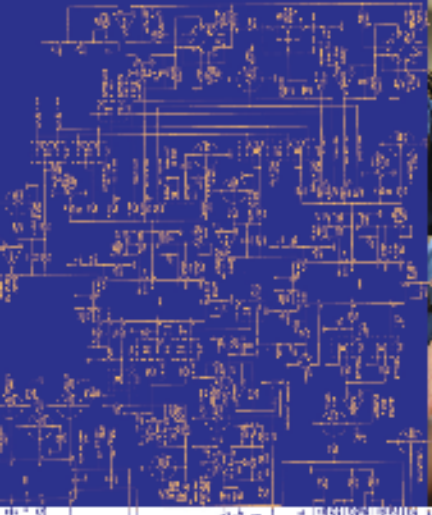
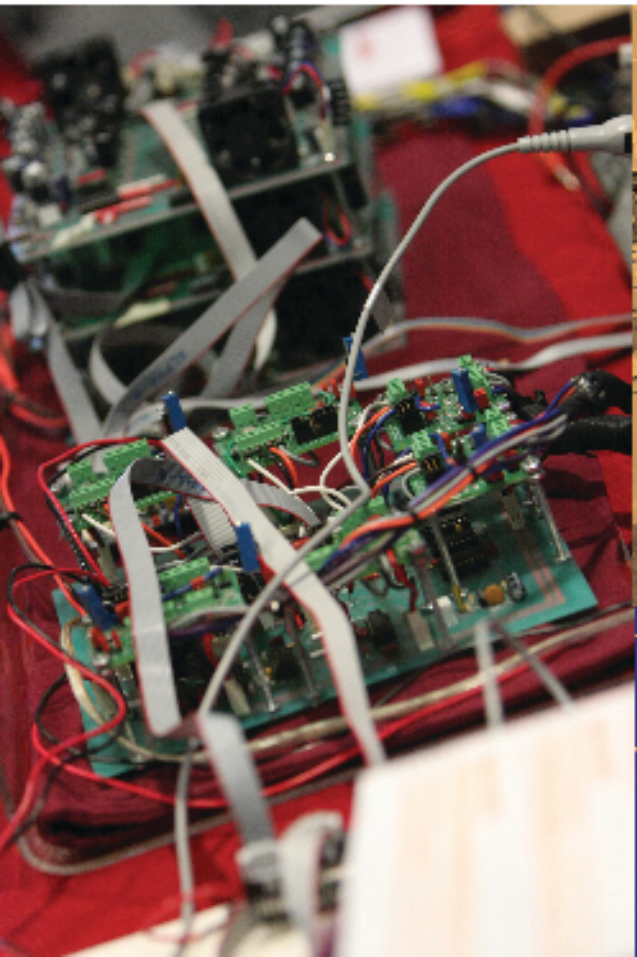
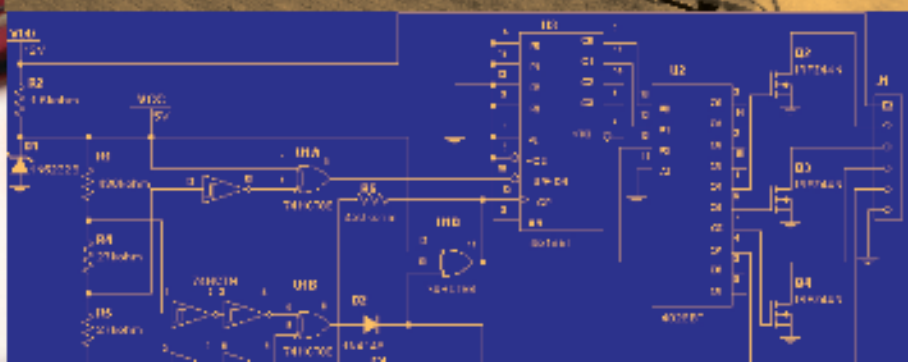


SVSU Science & Engineering Symposium

Pioneer Hall, Friday April 23, 2010

8:30 a.m. - 4:00 p.m.





SVSU Science and Engineering Symposium

Table of Contents

SVSU Science and Engineering Symposium

Program

8:00 a.m.	**Registration**	Pioneer First Floor
9:00 a.m.	**Opening Remarks** Dr. Deborah Huntley, Dean College of SE&T	Pioneer-240
9:05 a.m.	**Keynote Lecture** Dr. Ann Norris Dow Corning Corporation	Pioneer-240
10:00 a.m.	**Poster Session**	Pioneer First Floor
	Independent Research Posters SVSU Greenhouse Posters Chemistry Posters Computer Science Posters Engineering Posters	
12:00 p.m.	**Lunch**	Pioneer First Floor
1:00 p.m.	**Oral Presentations**	
	A. Biology	Pioneer-240
	B. Electrical Engineering	Pioneer-242
	C. Mechanical Engineering – I	Pioneer-243
	D. Mechanical Engineering – II	Pioneer-245
	E. Computer Science	Pioneer-247

Keynote Lecture

Solar Energy-Unleashing the Power of Silicon

Ann Norris, Ph.D.
Dow Corning Corporation

Ann Norris joined Dow Corning in 1980 after receiving a B.S. degree in Chemistry from University of Wisconsin at LaCrosse, and worked in the Ceramics program. She left to pursue a Ph.D. in Materials Engineering Science with an emphasis on polymer characterization at Virginia Polytechnic Institute and State University, she rejoined Dow Corning in 1987. Ann is a Development Scientist in the Solar Business focusing on understanding key optical properties of silicones for solar applications. Over her 25 year career Ann has made contributions at Dow Corning in the areas of fluorosilicone technology, microelectronics packaging materials, photonics, LED packaging materials, and most recently in the Solar Program. Ann has presented multiple papers at external industry meetings, holds multiple patents and has been heavily involved with the development on new products for many of Dow Corning's customers.

Independent Research Posters

P01. Discreet Element Modeling of Transient Heat Flow in a Passive Geothermal Greenhouse
Dr. Chris Schilling and Dr. Brian Thomas

China's so-called vegetable capital, the Shandong province, has a cold climate where the agricultural industry is strongly reliant on greenhouses. This province recently constructed tens of thousands of energy-efficient greenhouses to provide year-round production of fresh produce for China's burgeoning population. These greenhouses are partially subterranean in design, utilizing passive geothermal heating. Discreet element modeling has been applied to the heat diffusion equation to predict spatial- and temporal variations of heat flow through the soil foundation of a model greenhouse based on the Chinese design. Using SciLab software, the methodology allows science and engineering students to predict the annual heating bill as a function of critical parameters including soil type and moisture concentration, seasonal fluctuations in ambient air temperature, and variations in greenhouse architectural design.

P02. Quantifying SVSU's Solar Resource
M. Messing and J. McCurley
(Advisors: Dr. Chris Schilling and Dr. C. Edwards of Fulcrum Composites)

Solar radiation was continuously recorded throughout the winter 2010 semester using a microelectronic sensor located at the south exterior of Pioneer Hall. Results were compared with insolation data published by the National Oceanic and Atmospheric Administration. The procedure is intended to help engineering designers quantify the amount of solar energy that is plausibly retrievable at any geographic location. Despite cold winters, the university's cumulative solar asset throughout the winter months is plentiful from the standpoint of designing integrated solar-electric and solar-heating systems.

P03. Vermicomposting with Spent Coffee Grounds
G. Roekle
(Advisors: Prof. Ed. Meisel, Dr. B. Jorgensen, Dr. Chris Schilling, and Dr. Brian Thomas)

A literature review was conducted to determine optimal conditions for vermicomposting with red wiggler worms (Eisinea fetida). Based on this review, experiments were designed to investigate the effect of the concentration of spent coffee grounds on vermicompost quality. Spent coffee grounds were chosen because of their abundance and zero cost – currently they are part of the university waste stream. Over a time period of 12 weeks, 133 pounds of biomass were added to each of three containers, each containing ten pounds of worms. Container one was prepared with a control mixture of shredded paper, lettuce and zero coffee; containers two and three were prepared with shredded paper, lettuce, and varying concentrations of coffee. Soil chemistry was experimentally analyzed thereafter. Cation exchange capacity was at optimum levels, as were carbon-to-nitrogen ratios, and the concentrations of calcium, magnesium, iron, and sulfur. The addition of coffee increased the levels of available nitrogen in the final compost. This study was featured as a cover article in Soil and Mulch Producer News in July of 2009.

P04. Bioplastics from Protein and Polysaccharide Carboxylates: Structure Analysis Using ATR-FTIR

Christopher Alvey, Rafe MacKenzie, Jordan Cotton, and Gretchen Roekle
(Advisors: Dr. David Karpovich and Dr. Chris Schilling)

Due to the inherently impure nature of reactant materials, the structural analysis of agriculture and biofuel waste derived protein/polysaccharide complexes can be difficult. The formation process involves the conversion of the C6 hydroxyl on glucose moieties of the polysaccharide to a carboxyl using oxidation and acylation. This is followed by gel formation upon interaction with soy protein isolate. The gel is then dried to yield a material with high strength relative to control samples. This material is further processed through compression molding (10,000 psi at 125^{o}C) resulting in dimensionally accurate shapes that have tensile strengths approximately 2.5 times those of the starting materials. Using ATR-FTIR spectroscopy, we were able to confirm the conversion of the C6 hydroxyl to a carboxyl using both oxidation and acylation reactions, and we have found spectral evidence for amide formation during heated compression molding steps.

P05. Burning Glycerin in a Commercially Available Oil Furnace: Optimizing Efficiency and Reducing Emissions

Anthony J. Lucio, Cassie J. Patterson, and Iwan Setiawan
(Advisors: Dr. David Karpovich and Dr. Chris Schilling)

Biodiesel is commercially produced using a base catalyzed transesterification reaction between triglyceride oil and methanol. For every 10 gallons of biodiesel produced, 1 gallon of glycerin byproduct is produced. The glycerin byproduct can contain contaminants such as the base catalyst as well as partially reacted mono- and diglycerides. Rather than purifying the glycerin for high value applications, there is wide interest in using it in the crude form as a heating fuel. However, incomplete combustion of glycerin can result in the production of acrolein which is a carcinogen. We have successfully burned glycerin as a co-fuel with fuel oil. Our analysis of stack exhaust gases has shown no significant increase in acrolein with the glycerin co-fuel. In this poster we will present aspects of glycerin combustion related to emissions, efficiency, and practicality.

P06. Spectroscopic Studies of Structural Changes in Soy Protein as a Result of Compression Molding

Kenneth Switala and Rafe MacKenzie (Advisor: Dr. David Karpovich)

Soy protein isolate (SPI) can be used as a component in renewable, biodegradable bioplastics. Previous work used fluorescence spectroscopy to characterize the structural changes that occurred in SPI during bioplastic processing. Band shifts in the fluorescence spectra suggested changes in the interactions between the phenyl moieties of SPI when pressed into a pellet under various temperature conditions. In the current investigation, FTIR-ATR measurements were performed on SPI in an attempt to further characterize conformational changes of the proteins that occur during different stages and methods of processing. FTIR can potentially offer information about changes in the secondary structure of proteins using resolution enhancement and band fitting techniques on spectra.

P07-10. Revitalizing Inner Cities by Integrating Renewable Energy with Greenhouse Agriculture

Term Projects for MGT 680 (Sustainable Business in Energy and the Environment)
(Advisors: Dr. Rhonda Ross and Dr. Chris Schilling)

In February 2010, *Science* magazine reported that the world faces an unprecedented challenge of meeting projected increases in food demand, given record constraints in agricultural and financial resources. At the same time, *Mechanical Engineering* magazine warned of a second challenge that world energy demand is expected to double between now and 2030. Because fossil energy is so vital to the mass production of food, it's no surprise these two industries are forming creative, strategic partnerships to solve two problems at once: rebuilding the energy infrastructure while using less fossil fuel to feed the world. At SVSU, Management 680 students studied the emergence of such partnerships, particularly those in Europe involving the engineering of a new generation of biomass waste-to-energy plants. Such electric power plants are unique, because they're scaled at the township level, they're environmentally friendly, and they can be fueled with many cellulosic wastes (e.g., agriculture residues, paper waste, wood waste). Swedish Biogas Corporation is a classic example of this growth industry: Sweden and the state of Michigan recently provided funding to launch this company's first American subsidiary in Flint, Michigan.

MGT 680 students present a series of posters proposing transformative approaches to revitalize economies of Michigan inner cities, models that integrate greenhouse agriculture with renewable energy systems involving small-scale, European-style, waste-to-energy plants. The following design constraints were imposed:

1. Reduce the city's export of dollars to buy fossil fuel to make electricity.
2. Reduce the city's record expense of waste management.
3. Ensure that environmental emissions are minimized.
4. Set up a viable job training program for the city's growing number of unemployed.
5. How can the facility serve as an anchor to attract more people to live in that community?

Student posters:

P07. N. Alzuabi, J. Huang, and A. Lukowski, "Re-tasking the landfill as a catalyst for economic development."

P08. C. Dzurka, M. Reinert, and S. Seely, "Re-purposing abandoned properties for profitable urban food production having a small carbon footprint."

P09. A. Goebel, T. Lathtrom, and G. Yin, "Camp Future: a model to stimulate youth education with integrated food production / waste re-purposing facilities."

P10. K. Khan, C. Wang, and R. Zajac, "Use of Survivor-type, reality TV, to raise awareness of how people might farm in resource-constrained, cold climates."

SVSU Greenhouse Posters

G01. Global Worming
Luis Pressel (Advisor: Prof. Ed. Meisel)

Learn how to create, engineer, and integrate a successful vermiculture system at home, at school, or in the community. Practice environmental stewardship, waste reduction, and community outreach. This system will reduce the landfill by 90% and goes above and beyond recycling! The system we are using is a very efficient; in fact other communities are utilizing our system. This has the potential for long term sustainability in plants and soils. Worms not only get rid of biodegradable waste, but are found to be very productive and symbiotically beneficial for other living systems. You will "bee" amazed!

G02. Agriculture of Tomorrow; the Student Perspective
Kyle McCarty, Louise Durussel, and Michael Koglin (Advisor: Prof. E. Meisel)

Michigan's second-largest industry brings in more than $70 billion a year. Worldwide, agriculture is still the most prominent career field. The world population is 6.5 billion people (2010) and is estimated to expand to 9 billion people (2050)! Join the Agriculture and Natural Resources club here at SVSU to explore opportunities, advancements, and entrepreneurial ways to research, develop, and implement solutions to the world's most important career and become "outstanding in this field!"

G03. Long Term Soil Remediation
Alan Bouse (Advisors: Dr. David Karpovich, Prof. Ed. Meisel, and Dr. Bing Yang)

This project determines the feasibility of utilizing a particular bacteria strain and a special mode of soil living organisms to symbiotically break down a particular harmful compound throughout the soil for a long term solution of soil contaminant remediation.

G04. Aquaponics Plus

Jason Haubenstricker and Stan Schlatter (Advisors: Prof. Ed. Meisel and Dr. Chris Schilling)

Aquaponics is a combination of aquaculture and hydroponics that is used to grow vegetables, herbs, and other types of produce. Other systems only produce one type of beneficial consumption, whereas this type of system returns not only nutrients, minerals, and vitamins, but protein (fish) as well, which is important in daily human nutritional requirements. This system replaces the expensive liquid fertilizers by utilizing the nutrient rich water found in a fish tank to supply the needed nutrients to promote plant growth. Plants are grown in special media filled grow beds. The grow beds act as a biofilter and provide a place for the naturally occurring bacteria to break down ammonia waste given off by the fish into nitrates that can be used by plants. The process by which this occurs is called the nitrification cycle. Not only is aquaponics used to grow plants, fish can also be raised and sold to local markets once they have reached a mature size. Regular scientific testing of fish, plants, and water are necessary for optimal success. I have designed, built, and tested a specific "ebb and flow" working system to allow others to learn how this system can be implemented. These systems require little maintenance and are self sufficient, once proper equilibrium is achieved. Aquaponic systems can produce fish and plants for the family and/or community year round, using a greenhouse like we have done at the Saginaw Valley State University Greenhouses.

Chemistry Posters

C01. Elemental Analysis of Medieval Coins
Meaghan VanWert and James Polega (Advisor: Dr. Ron Williams)

Elemental analysis of medieval coins is useful for detecting economic stresses on empires. Common coins from the era are copper/silver alloys. The percentage of silver in the coins should be constant but under economic stresses there is pressure to reduce the silver content to extend the number of coins that can be minted. The analysis of such relics is difficult because under usual circumstances a nondestructive method of analysis must be employed

For this study the feasibility of using a mild acid wash on the coins to clean off the outer surface was tested as a nondestructive means to determine silver/copper ratio. Three Spanish coins from the 1400's were first cleaned using a mild nitric acid solution. The coins were then dissolved in nitric acid and ICP/MS was used to analyze both the wash solutions and the dissolved coins. The results from the wash solution are then compared to the concentration determined for the intact coin.

C02. Physico-chemical Analysis of Reverse Calcium-silica Tubes
Fredy Pratama and Hannah Robinson (Advisor: Dr. Jason Pagano)

Reverse silica gardens consist of hollow tubular structures that form from mechanically held silicate crystals immersed into dilute metal salt solution. We investigate the growth dynamics, structure and composition of these tubes in the context of an experimental model. The experimental paradigm allows for growing tubes in a reproducible fashion based on predetermined reactant concentrations and flow rates. In these experiments, waterglass is injected into large volumes of dilute calcium chloride solution. Thermal analyses of tube fragments indicate the presence of calcium hydroxide. The results from qualitative experiments, FT-IR, and optical microscopy are presented.

C03. Synthesis of Transition Metal-silica Precipitation Tubes
Tom Paquette (Advisor: Dr. Jason Pagano)

Silica gardens, a reaction-precipitation system, involve the growth of tubular structures from metal salt crystals seeded into sodium silicate solutions. In this study, we replace the seed crystal with a seed solution using a flow injection method. Our aim is to probe transition metals as seed solutions in the anticipation of synthesizing uniform, linear tubular structures. Existing experiments have shown distinct growth regimes dependent on reactant concentration. The popping regime is ideal for collecting tube fragments for space-resolved compositional analyses. The walls of tubular specimens from the popping regime have a typical width of 10 μm and are gradient materials. We report the thickness of each layer and the metal-silica zones in tube walls by means of scanning electron microscopy-energy-dispersive X-ray (SEM-EDS). Finally, we report data for the solubility of chloride, nitrate, and sulfate salts of transition-metals as potential seeds.

C04. Development of Method to Measure Lanthionine Ketamine in Urine of Individuals with Down Syndrome

Bryan Reder (Advisor: Dr. Tami Sivy)

It is thought that people suffering from Down syndrome have an increased level of lanthionine ketamine (LK) in their urine. It is known that the gene for cystathionine β-synthase (CBS), found on the 21st chromosome, is 50% over expressed in individuals with Down syndrome. The CBS enzyme is necessary for the conversion of homocysteine to the standard amino acid cysteine and with increased activity appears to disrupt other biochemical pathways that produce essential metabolites as a result of the reduction of homocysteine and increase in cysteine. The decrease of these metabolites is a likely contributor to many of the symptoms of Down syndrome. It is believed that CBS can utilize the higher pools of cysteine as substrate, leading to the production of lanthionine ketamine (LK). The biosynthesis of LK likely coincides with a rise in the concentration of the neurotoxic agent hydrogen sulfide. LK has also been shown to bind to receptors in the brain. We expect individuals with LK to have higher than normal urinary excretions. To pursue this, we are developing an LC-MS method to detect LK in urine samples. Early results suggest that LK can be detected by both its UV absorbance and its mass when derivatized with phenylisothiocyanate (PITC). Further work will include increasing the sensitivity of the method and applying it to actual urine samples, with the goal to determine the levels of LK in the urine of individuals with Down Syndrome.

C05. Polydiacetylene-Based Liposomes as Biosensors for the Detection of Bacteria

Hannah Robinson and Fredy Pratama (Advisor: Dr. Tami Sivy)

Biosensors for Gram negative bacteria function through the selective binding of a substrate molecule to lipopolysaccharides (LPS) embedded in the outer bacterial membrane. To be of any practical use, the biosensor must signal that the binding event has occurred. This is the proposed function of polydiacetylene-based liposomes. The substrate molecule is incorporated in the liposome structure, and upon binding, the liposome changes color from blue to red. These biosensors have numerous applications, including bacterial detection and diagnostics. It was hypothesized that the polydiacetylene-based liposomes synthesized in this experiment would successfully detect *E. coli* by the observation of a color shift. Polydiacetylene (PDA) sensors were synthesized and derivatized with glycine and phenylalanine, which function as lectins in the liposome structure. The liposome was assembled by sonication of the derivatized PDA sensor, and irradiation with UV light induced polymerization. The color change after the addition of *E. coli* cells and LPS to the liposomes was monitored by UV-visible spectroscopy. It was expected that the liposome solution would appear blue after irradiation with UV light and develop a red color following the addition of *E. coli* cells or LPS. Therefore, the color change would be detected with UV-visible spectroscopy by the observation of a bathochromic shift.

C06. Purification of Glutamate-Oxalacetate Transaminase from Heart Muscle Tissue
Amanda Roache and Linda Meeker (Advisor: Dr. Tami Sivy)

The enzyme purification mechanism of glutamate-oxalacetate transaminase (GOT) in heart muscle tissue is studied. The activity level of cytoplasmic GOT has been shown to increase under conditions leading to gluconeogenesis. Release of GOT in the blood serum results from necrosis and dissolution of cells in affected regions of the myocardium and has been useful in clinical diagnosis of various diseases leading to extensive tissue damage and cell break down. For example, following a heart attack levels of GOT in the blood serum rise from 4 to 10 fold within 24 hours of occurrence. Therefore, GOT determination may be useful for diagnosis of diseases since GOT levels are not elevated in other disorders with similar symptoms of heart attack.

Various fractions will be prepared from heart muscle tissue and activity of GOT in each will be determined by a spectrophotometeric method. An Albumin standard in a BCA protein assay will be used to prepare a standard curve for determination of protein in each fraction. The results from this procedure are predicted to provide a determination of the level of GOT activity in a healthy organism and provide a baseline level of GOT activity for comparison in clinical diagnosis.

C07. Inhibition of Pyruvate Carboxylase by Avidin
Devan Schlund (Advisor: Dr. Tami Sivy)

Pyruvate carboxylase is an enzyme that utilizes a biotin prosthetic group in order to transfer a single carbon group to pyruvate in order to produce oxaloacetate. One well known feature of the biotin cofactor is its extremely high affinity for the protein avidin. The goal of this study is to demonstrate this high affinity of avidin for biotin by showing avidin's ability to inhibit pyruvate carboxylase. To do this, a kinetic study will be conducted on pyruvate carboxylase extracted from chicken liver by means of an enzyme coupled assay. Then, the same kinetic study will be performed in the presence of avidin. It is hypothesized that avidin will bind to the biotin in the active site of this enzyme and thereby decrease its activity by acting as a competitive inhibitor. Differences between the results of the kinetic study involving avidin and the kinetic study not involving avidin will be used in calculating a constant of inhibition for avidin on pyruvate carboxylase. It is expected that avidin will have a very potent inhibiting effect on pyruvate carboxylase.

C08. Biodegradable Plastics from Proteins and Polysaccharide Carboxylates: Processing and Physical Properties
G. Roekle, C. Alvey, and J. Cotton (Advisors: Dr. Chris Schilling and Dr. David Karpovich)

Hypochlorite-oxidized polysaccharides, which originate from co-products of bioethanol fuel production (e.g., corncob, distillers' grain), were reacted with protein co-products of bio-diesel fuel production (e.g., oilseed residue) to produce thermoplastic, biodegradable, wood-like solids. We believe that a wide range of industrial protein- and polysaccharide co-products can be economically transformed into such materials to replace petroleum based plastics in applications including fiberboard, tableware, disposable packaging, plant pots, and furniture. Experiments on the application and performance of moisture-resistant coatings will be presented.

C09. Transformation of Microalgal Chloroplast via Insertion of Soybean *lba* gene

Henry Hsiung, Jacob Malacos, and Marvin Pollum (Advisor: Dr. Tami Sivy)

Hydrogen gas is considered to be one of the best replacements for fossil fuel energy. This is because the combustion of H_2 yields only H_2O and high amounts of energy. Currently there are no sustainable methods for hydrogen production but microalgae may be the answer. While microalgae such as *Chlamydomonas reinhardtii* can already be manipulated to produce large amounts of H_2 by sulfur deprivation, this does not produce H_2 at the highest efficiency. We hypothesize that the insertion of leghemoglobin (*lba*) gene extracted from soybeans will allow for an increase in hydrogen production without sulfur deprivation.

The *lba* gene will be obtained by soybean RNA extraction and reverse transcription coupled with PCR amplification specific to the gene. To be moved into the chloroplast of *C. reinhardtii*, the gene will be inserted into a chloroplast transformation plasmid and introduced into the algae through electroporation. The algae will then be cultivated on a growth medium and their chloroplast DNA will be tested for gene insertion. Actual hydrogen production will be monitored, time permitting.
We expect that successful insertion of the *lba* gene will allow the cell to code for the production of leghemoglobin which has an extremely high affinity for oxygen. This binding of oxygen present will allow for maximized hydrogen gas production without the detrimental effects of sulfur depletion on the algal photosystem. Overall, this will create an optimum cell for hydrogen gas production

C10. Isoprene Synthase as a Possible Relief Mechanism for Dimethylallyl Diphosphate Related Cytotoxicity

Devan Schlund (Advisor: Dr. Tami Sivy)

Previous studies involving the expression of exogenous mevalonic acid (MVA) have resulted in pathway flux dependent cytotoxicity. It has been suggested that this cytotoxicity is caused by an overabundance of dimethylallyl diphosphate (DMAPP), one of the two end products of the MVA pathway. This study aims to pinpoint DMAPP as the cause of MVA pathway related cytotoxicity by coexpressing the isoprene synthase gene, recently isolated from certain species of poplar trees, in E. coli with an exogenous MVA pathway. Since isoprene synthase is an enzyme that converts DMAPP into the volatile isoprene, the expression of this isoprene synthase gene should lower the concentration of intracellular DMAPP produced during high MVA flux, thereby lowering the level of cell death. By measuring and correlating isoprene production, intracellular DMAPP levels, and cytotoxicity, we can determine whether isoprene synthesis can relieve the hypothesized DMAPP toxicity. It is expected that increases in the level of expression of the MVA pathway in these engineered cells will lead to increases in the level of isoprene produced by these cells. Consequently, the increase in isoprene production should cause a decrease in DMAPP concentration, thereby decreasing cytotoxicity and adding weight to the hypothesis of DMAPP being toxic at high intracellular levels.

C11. Determination of the Affect of Trypsin on Amine Exposure in Soy Protein Isolate
Sarah Lockwood (Advisors: Dr. David Karpovich and Dr. Tami Sivy)

Currently plastics are made from fossil fuels, and there is concern that eventually our fossil fuel supply will dwindle, thus making the production of plastics much more costly, if not impossible. Due to this concern, much focus has been centered upon developing a bioplastic alternative. Our bioplastics are made using natural components, such as the polysaccharide cellulose and soy protein, which combine through interactions between carboxylates of the polysaccharides and amines of the protein, either electrostatically or through the formation of amide bonds. The overall focus of my research has been to determine the amount of amine groups in soy protein isolate. Through developing a method, which involves titrating a soy protein isolate solution with 0.1 M sodium hydroxide, the amount of amines can be determined. This can be done by observing the shift in pH around 8, which is where the amines become deprotonated stoichiometrically by the hydroxide ions. The next aspect of the research is adding trypsin, a proteolytic enzyme, to the soy protein isolate and titrating to see if more amines are exposed. We predict that by producing more amines in the protein, the number of interactions with the carboxylates in the polysaccharides will increase, which will lead to an increase the strength of the bioplastic.

Computer Science Posters

CS01. BioWiki: An Online Research Sharing Solution
Seth Von Wald, Steven Quinn, Michael Snow, and Michael Gustavson
(Advisors: Dr. Il-Hyung Cho and Dr. Alan Freed)

This presentation is about the capstone project we have worked on this year, the goal of which was to provide a website through which the raw data generated for research articles could be shared publicly. The intended audience was articles that were published in biological research publications. Researchers who subscribed to those publications couldn't access the raw data. We designed a website using Drupal, including various community-provided modules and some of our own modifications.

CS02. The Development and Design of a Web-Based Asset Tracking System
CIS 424 Systems Design & Implementation (Advisor: Dr. Scott James)

The CIS 424 capstone project involved developing a web-based custom asset tracking system for the SVSU Information Technology Services Support Center. A custom database was deployed allowing personnel to quickly look up the location, service history, user history and current disposition of tagged computer equipment including computers, printers, monitors and scanners. Data entry to the system can be achieved in the form of keyed entry or through the use of a wireless barcode scanner in scanning the SVSU asset 39 barcode tags. Custom reporting and remote barcode batch processing were also built into the deployed system.

CS03. Video Conferencing Using an IP Camera and a Mobile
Daniel DePelsMaeker, Brian Gomez, and Faisal Al-khatib (Advisor: Dr. Farid Hallouche)

Our approach involves the use of an IP camera, which is setup with remote access so that it can be accessed through the mobile application. The main idea is to write a mobile phone (black berry) application that will access information on an IP camera through internet streaming. This involves many learning tasks, including first the setup of the camera on the network and the configuration of the gateway to be able to have access to the IP camera, using port forwarding. This way, we will ensure that the camera is fully functional on the network.

With regards to implementation, this project consists of writing a network application to run on a black berry mobile phone. The programming tools we use include XML, Java Script, HTML, and CSS. In order to gain the necessary practical skills, we planned several practical tutorials using various programming methods. Also, because this is a fairly new applied field, we are using the black berry's website to help us solve the many problems that we expect in terms of streaming the video feeds to the phone.

CS04. Business Chat System

Michael Gustafson (Advisor: Dr. Farid Hallouche)

The business chat system contains two main components: the server and the client. If this system was used in a business environment, there would be one server and many clients. The server is a CPU and network bandwidth intensive program. The client, on the other hand, is lightweight and consumes very little resources. Both the server and client are written in the Java programming language. Java was primarily chosen for its cross-platform capabilities. This means that the server and client can run on a variety of systems, including Windows, Apple, and Linux. In addition, the choice of Java will allow for possible development on the BlackBerry platform.

Several alternatives were considered in the design of my system. There exist cross-platform mobile libraries, such as PhoneGap and Rhomobile, but these would have limited development to mobile devices only. Java is becoming increasingly popular on mobile devices, as shown by BlackBerry dependence on Java, so it seems that Java will be a good language to develop with.

CS05. Secure FTP Client Server Application

William Gillard and Kim Weirauch (Advisor: Dr. Farid Hallouche)

FTP is a client server architecture used to transfer files between two local or remote machines. FTP uses user-based authentication in transferring files. Secure FTP uses SSL (Secure Socket Layer), SSH (Secure Shell) or even TLS (Transport Layer Security) encryption. Our project's goal is to develop a secure FTP client server application using the C# programming language.

CS06. A Smart Phone Application Development

David Prieur and Justin Stotter (Advisor: Dr. Farid Hallouche)

Mobile networking is the way of the future. The problems our group would like to address involve testing the limits of what is possible on a cellular device. We have been thinking about streaming video, and also about Bluetooth technology management. The project consists of many steps, including the study of the Session Initiation Protocol (SIP) and work in the OSI's application layer using SIP. The goal is be to set up some sort of "smart" phone to be visible by another phone, a PC, or both. On top of that, there should be some communication taking place between the devices, such as file sharing, media streaming, or something like Bluetooth manipulation. In all, we will use SIP to make requests to handle media and users on a mobile device such as a cell phone.

Engineering Posters

Electrical Engineering Posters

The EE projects will also be presented as oral presentations, see page 22 for abstracts.

E01. Final Function Test Stand for Circuit Card Assembly
David Brown (Advisor: Dr. Russ Clark)

E02. ME (My Engergy)-Bike
Paul Graczyk, Adam DeSmet, Larry Ferreira, and Ryan Bender (Advisor: Dr. Russ Clark)

E03. Fire Fighting Robot
Melissa Srebinski, Timothy Kain, Christian Woodall, and Siddharth Joshi
(Advisor: Dr. Russ Clark)

Mechanical Engineering Posters

The ME projects will also be presented as oral presentations, see pages 23-26 for abstracts.

M01. Nexteer Automotive EPS Validation: Rack Rock Test Apparatus
Joe Carr, Jeff Jezowski, and Nick Richert (Advisor: Dr. Joseph Shlien)

M02. Duro-Last Vinyl Rib Development Project
Adam Sieting, Drew Askew, and Jordan Cotton (Advisor: Dr. Brooks Byam)

M03. Designing a FSAE Data Acquisition System
Chris Younk and Paul Andres (Advisor: Dr. Brooks Byam)

M04. Press Roll Lift
Thomas Minkler and Jacob Schlaegel (Advisor: Dr. Brooks Byam)

M05. A Novel Bead Compression Test Apparatus
Shawn Brown and Brian Morgan (Advisor: Dr. Brooks Byam)

M06. Weld Quality Assurance System
Brice Scanlon, Stan Schlatter, and Riyad Hermas (Advisor: Dr. Joseph Shlien)

M07. Vent Cap Feeder Redesign
Sean Jackson, Zackary Kerbleski, and Matthew Thomas (Advisor: Dr. Brooks Byam)

M08. Self Suturing Trocar
John Stencel, Chris Hanna, and Jon McKelip (Advisor: Dr. Brooks Byam)

M09. Automatic Fixture Lock for Crankshaft Oil Hole Drill
Karla Mauch, James Morden, and William Schweitzer (Advisor: Dr. Brooks Byam)

B01. Ultrastructure of the Development of the Mitochondrial Derivatives in *Bittacus stigmaterus*

Brock Humphries (Advisor: Prof. Sally Shepardson)

During the spermatid stage of sperm development, mitochondria undergo an extensive metamorphosis to form two mitochondrial derivatives. Clusters of mitochondria fuse and form a bipartite structure which eventually separates into two halves. These transformed halves elongate and orient themselves on either side of the developing axoneme. The derivatives become a major component of the mature sperm flagellum. The distinct stages of coalescence, bipartite mass (nebenkern), onion, loaf, and mitochondrial derivatives will be discussed, as will the placement of the two mitochondrial derivatives in the mature sperm.

B02. DNA Fingerprinting of Michigan Migratory Waterfowl: American Black Duck and Mallards

Leslie Muggelberg and Christi Raines (Advisors: Dr. Gail Kantak and Dr. David Stanton)

Migratory waterfowl are an important component of wetland ecosystems and an important recreational resource in Michigan. The geographic ranges of the American Black Duck and Mallard overlap extensively. However, the range of the American Black Duck currently is shrinking due to habitat loss and possible hybridization with Mallards. The long-term viability of American Black Duck populations depends in part on the degree of genetic variation found in the populations. This in turn depends on demographic parameters and details of the breeding structure. In order to assess genetic diversity and the degree of interspecific hybridization, DNA fingerprinting was performed. DNA was extracted from feathers using a Qiagen DNeasy kit. Templates were amplified by PCR using primers to highly polymorphic loci. Products were checked on agarose gels and then sized to determine genotype using the Beckman Coulter CEQ 8000 genetic analysis system. The parameters evaluated include number of alleles, observed and expected heterozygosity, and genetic differentiation between species. The results also have important implications for management strategies involving Michigan migratory waterfowl.

B03. DNA Fingerprinting of Great Lakes Zebra Mussels (*Dreissena polymorpha*)
Adeline Bauer (Advisor: Dr. David Stanton)

Zebra mussels are an invasive species introduced into the Great Lakes from Europe in 1986. Since then, they have spread aggressively throughout the eastern United States and have had a significant impact on Great Lakes ecology and biodiversity. Samples have been taken from many sites throughout the Great Lakes in order to assess genetic diversity and population substructure in Michigan. Tissue from over one thousand samples has been frozen over the past five years, including specimens from the Great Lakes, as well as inland lakes and rivers. DNA was extracted from frozen samples and PCR was used in order to amplify five polymorphic loci. The PCR products were checked on agarose gels and analyzed using the CEQ 8000 automated DNA analysis system from Beckman-Coulter. Fragments sizes were determined and genotypes identified using internal reference standards. The parameters investigated include number of alleles per locus, observed and expected heterozygosity, population substructure and genetic distance. The preliminary results reveal a great amount of genetic variation in Great Lakes Zebra mussels. Future studies will concentrate on gene flow and genetic divergence between populations. The results have important implications for bioremediation efforts in the Great Lakes.

B04. A New Crane Fly Species (Diptera: Tipulidae) From Michigan
Dr. Stephen Taber

A new species of insect was discovered in Michigan in 2009. It is a crane fly of the type commonly known as a "mosquito eater" though mosquito eaters never eat mosquitoes. The new species has been named ***Tricyphona michiganensis*** and occurs in birch-aspen-red maple woods in the west of the Lower Peninsula. Adult males and females are known but the eggs, larvae, and pupae remain to be found.

B05. Insect Mitochondrial Gene Order
Adeline Bauer (Advisor: Dr. David Stanton)

Mitochondrial gene content and gene order are highly conserved in animals. Indeed, most arthropods share a similar gene order and most crustaceans and insects have an identical gene order. However, some variation in mitochondrial gene order has been detected within certain insect groups such as Orthoptera. Since such variation is rare, rearrangements can serve as valuable markers for phylogenetic reconstruction in the groups where they are found. In order to screen for variation in mitochondria gene order, we have designed and constructed PCR primers that anneal to conserved regions within insect mitochondrial DNA. These primers allow for the amplification of five gene junctions that collectively contain seventeen of the twenty two mitochondrial tRNA genes, including junctions known to be hot spots for gene rearrangement events in insects. By screening for size variation, we can detect possible gene rearrangements which can then be confirmed by DNA sequencing. So far, we have detected size variation at one junction for bumblebees, cicada killers and cicadas. The phylogenetic utility of these variants is being assessed by screening other members of these groups. We are also screening many Orthoptera species, in order to determine the distribution of the gene order variation observed in previous studies.

B06. Investigating the Effectiveness of Active-and Cooperative-Learning Strategies in the Biological Sciences: Are They Equally Beneficial to Non-Majors and Biology Majors Alike? Preliminary Findings.
Prof. Amanda J. Ross

After investigating multiple peer-reviewed sources, it is apparent that various active- and cooperative-learning approaches to teaching complex topics in the biological sciences at the introductory collegiate level are effective strategies when compared to strictly traditional lecture-based methods. However, whether these non-traditional approaches are equally effective at teaching similar topics to non-majors versus science majors is not well documented. This project will determine if there are any statistically significant differences in the pretest and posttest examination and evaluation scores in two undergraduate biology classes: Biology 105A, a general education course for non-science majors, and Biology 111A, an introductory course designed for students pursuing a degree in the health or science fields. The first portion of this project took place during the fall of 2009 academic semester. This phase incorporated two cooperative-learning projects into the classroom and evaluated the influence these projects had on overall comprehension and appreciation for learning. An upcoming semester will utilize traditional lecture-style teaching approaches to the same topics and, again, will evaluate overall understanding and satisfaction. By comparing the effectiveness of different teaching and learning strategies, we may develop a better understanding of how active- and cooperative-learning methods may affect overall achievement, regardless of students' academic majors.

B07. The Association of CD72 Polymorphism with Inherited Breast Cancer
Katie Tausch (Advisor: Dr. Bing Yang)

CD72 is a transmembrane protein expressed on B lymphocytes as well as epithelial cells. It has been shown to be involved in B cell activation and regulation. We tested its association with breast cancer as the result of inherited mutations. The patients had the breast cancer due to the mutation in BRCA1 or BRCA 2 mutation. Polymorphisms have been detected in Intron 8 of the CD72 gene, including either one or two repeats of thirteen nucleotides in one region of the gene and a four nucleotide deletion of CACT in another region of the gene. The association of the two polymorphisms with the breast cancer was investigated. DNA was extracted from breast cancer tissue in 39 individuals and was amplified using PCR. The samples were genotyped to estimate linkage disequilibrium. The two loci were found to be in strong linkage disequilibrium and the polymorphism in these two regions of the gene is not associated with the inherited breast cancer.

B08. Effects of Prenatal Exposure to the Plasticizer Diisononyl Phthalate on the Development and Behavior of Neonatal and Juvenile Female Rats (*Rattus norvegicus)*
Kaitlin DuCharme*, Brenton Fetting*, Oleg Kinachtchouk, Ryan Phillips, and Elizabeth Wall (Advisor: Dr. Gary Lange)

Phthalates are a commonly used plasticizing agents used in the manufacturing of a wide array of products including enteric coatings on medications, lubricants, binders, glues, surfactants and a myriad of other common uses. The general public is most commonly exposed to phthalates through the use of common plastic items, such as plastic drink wear or plastic packaging. Several phthalate forms exist, and in the different forms, several have been shown to display endocrine disrupting properties, including alteration in gonadal function and development, and more notably, changes in muscular system development. Diisononyl phthalate (DINP) is a major plasticizing agent used in the manufacture of polyvinyl chloride (PVC) plastics. Prior work in our laboratory suggests the effects of DINP appear to be sexually dimorphic at environmentally relevant exposures. Effects were noticed in neuromuscular function in females. In the present work, pregnant Norway rats (*Rattus norvegicus*) were exposed daily to environmentally relevant levels of diisononyl phthalate. The female pups from these litters were examined at birth and their weight, anogenital statistic, ability to nurse, and righting responses were measured and compared with a control population. As juveniles, exposed and control animals were tested via elevated plus maze, rotarod, grip strength meter, and open field tests to compare behavioral and muscular development between control and exposed populations of females. Data are compared to previously collected physiological and behavioral data. The results of this study may be indicative of how plasticizing agents, such as DINP, alter the success of the mammalian physiological systems, leading to further potential study of long term generational effects.

B09. A Study of the Effects of Developmental Pentachlorophenol Exposure on the Adult Locomotor Behavior in Fruit Flies (*Drosophila melanogaster)*
Tyler Beyett (Advisor: Dr. Gary Lange)

Pentachlorophenol (PCP) has been use since the 1930s in many different biocidal roles. Since the 1980s, PCP has been primarily used as a wood preservative. Recent research has begun to call into question the safety of PCP treated lumber for workers and in the environment. There is evidence that PCP leaches significantly out of the wood and can contaminate local water sources especially in climates with high precipitation and/or soils that hold and retain water readily. Previous work in our lab has shown that PcP exposure has been shown to delay development in fruitflies and has been shown to alter pupation heights. In the present study we report on the developmental effects of PCP specifically on locomotor behavior of adult fruit flies. Our current working theory is based upon an inference that PCP may act as an antagonist on ecdysone receptors related to growth and development.

B10. Effects of Lead Acetate on the Growth, Development, and Fecundity of Different Strains of Fruit Fly (*Drosophila melanogaster)*

Renee` S. Moretz*, Jessica A. Short*, and Tyler Beyett (Advisor: Dr. Gary Lange)

Lead acetate is a chemical compound that has been widely used in manufacturing and commercial activities for decades. The use of this chemical is especially prominent in the textile industry where it is used as an agent in the inks that dye a variety of fabrics. Historically lead acetate has been used as a drying component in paints and varnishes where as in the modern day, residues of this compound remain in many forms including hair dyes and many cosmetics. The use of many different forms of lead along with other heavy metals has been banned due to known effects on cognitive ability. Some of these neurological effects are suspected a result of endocrine disruption. Specifically, lead acetate has been shown to cross the placenta *in utero*, leading to profound developmental effects in the offspring of exposed, pregnant mammals. Current theories suggest lead acetate may be a contributor to altering immunogenicity of various nervous system proteins, a likely pathway for endocrine disruption. In this study we will use a fruit fly (*Drosophila melanogaster)* model to determine the effects of this compound on growth, development and fecundity. Results are examined in comparison to various strains of fruit flies with known genetic mutations relevant to neuroscience and endocrinology.

B11. Effects of Diisononyl Phthalate on Development and Behavior of the Fruit Fly (*Drosophila melanogaster)*

Nick Halaby*, Matthew Holden*, James Payne, and Travis Washburn
(Advisor: Dr. Gary Lange)

Phthalates are a commonly used plasticizing agent used in the manufacturing of a wide array of products including lubricants, binders, glues, and surfactants. The general public is most commonly exposed to phthalates through the use of everyday items, such as plastic drink wear or plastic packaging. Several phthalate forms exist, and in the different forms, several have been shown to display endocrine disrupting properties, including alteration in gonadal function and development. Diisononyl phthalate (DINP) is a major plasticizing agent used in the manufacture of polyvinyl chloride (PVC) plastics. In this study we will use a fruit fly (*Drosophila melanogaster)* model to determine the effects of this compound on neural growth, development and fecundity. Behavioral and locomotor tests are reported for larval, pupae, and adult flies following DINP exposure. Results are examined in comparison to mutant strains of fruit flies relevant to neuroscience.

Oral Session B: Electrical Engineering **Room: Pioneer-242**

--From EE Senior Design

E01. Final Function Test Stand for Circuit Card Assembly

David Brown (Advisor: Dr. Russ Clark)

For a senior design project Delphi / Nexteer was interested in having a test stand to program, calibrate and test circuit cards that are controllers for electric power steering. The project was implemented using GPIB power supplies, NI output equipment, CAN protocols and LABview software.

E02. ME (My Engergy)-Bike

Paul Graczyk, Adam DeSmet, Larry Ferreira, and Ryan Bender (Advisor: Dr. Russ Clark)

With the overwhelming increase in personal electronic devices such as MP3 players and cell phones, there is a need to provide power to maintain this equipment. The constant uses of these portable devices demand that they be re-charged on a daily basis, requiring an ongoing supply of batteries and sources of energy to power these devices. Providing means to charge these portable devices that are as portable as the devices themselves would serve as an ideal way to supply these demands.

It is our intention that a person on a standard bicycle will be able to connect a maximum of two portable MP3 players, cell phones, and/or GPS units to a docking station on the bicycle which will power the device(s). The completed bicycle will allow for portable electronic devices to be charged while the bike is in motion or in a stationary position. The bicycle wheels will rotate a generator to produce power which will be used to charge a battery. This battery will, in turn, provide power to charge these various electronic devices. This design will allow for devices to be charged when initially attached, without the need to generate power by cycling. The battery will then be re-charged through the power generated by the rotating wheels. The captured energy developed by riding the bicycle will be converted to power the personal devices.

E03. Fire Fighting Robot

Alexander Clarke, Craig Birchmeier, Brian Tessin, and Fred Terwilliger
(Advisor: Dr. Russ Clark)

We designed an autonomous robot which will navigate through a maze in order to extinguish a fire (candle). The purpose of this project was to design, build, compete and win at Trinity College's Annual Fire Fighting Robot Competition. The competition took place April 10th and 11th at Trinity College in Connecticut.

Oral Session C: Mechanical Engineering – I

Room: Pioneer-243

--From ME Senior Design I

M01. Nexteer Automotive EPS Validation: Rack Rock Test Apparatus

Joe Carr, Jeff Jezowski, and Nick Richert (Advisor: Dr. Joseph Shlien)

The Nexteer Automotive rack rock test apparatus will allow Nexteer to efficiently test the lash within a rack and pinion electric power steering gear. With this information, Nexteer engineers will be able to determine if the gear will degrade throughout its life in regards to NVH (Noise, Vibration, and Harshness). Our design will improve the time, cost, and ergonomics that are currently an issue with this test while additionally providing a significant increase in the value of the test data through high accuracy testing equipment.

M02. Duro-Last Vinyl Rib Development Project

Adam Sieting, Drew Askew, and Jordan Cotton (Advisor: Dr. Brooks Byam)

Duro-Last Roofing, Inc. has a need for a decorative rib product that will attach to their existing vinyl roofing material. This rib will imitate the rib on sheet metal roofing and provide a more aesthetically pleasing surface. Currently, Duro-Last purchases this rib from a supplier, but it is not cost effective and Duro-Last would like some added features and design flexibility. The new system is envisioned as a two-piece system to maximize cost efficiency with a cavity along the length of the rib for an LED light strip to be installed. This new system will be the first of its kind available and create a new line of products establishing Duro-Last as the leading innovator in this type of roofing technology.

M03. Designing a FSAE Data Acquisition System

Chris Younk and Paul Andres (Advisor: Dr. Brooks Byam)

Cardinal Formula Racing currently has no means of obtaining many pieces of information critical to redesigning and tuning their race car. By designing a data acquisition system, the team will be able to monitor the effects of tuning as well as the performance of individual drivers. This will ensure optimal tuning and a means of error isolation and correction that will drive the team to the top of their competition. The design incorporates multiple sensors for information pertaining to the suspension, engine, steering, and controls as well as the ability to map the track the vehicle takes via GPS.

M04. Press Roll Lift

Thomas Minkler and Jacob Schlaegel (Advisor: Dr. Brooks Byam)

The design group was given a task by Plastatech Engineering Ltd. to redesign a press roll lift. This company specializes in roofing membranes and architectural fabrics. The assembly process of the roofing material requires three sheets of material to be laminated together by high temperature and pressure to make the final product. The process requires a press roll to guide the sheets to be laminated together. The press roll is subject to high temperatures which can cause deformation and plasticizer build-up requiring it to be replaced over time. Due to the weight and dimensions of the press roll a lift is needed to install and uninstall the roll. A redesign of this system is being considered because of safety, time, and overall convenience. The current procedure for installing the press roll consists of two different systems. The first system is used to transport the roll to and from the area of install. The second system hoists the roll up into position. This system consists of two manual cranks that are attached to each end of the roll by cables. The cranks are manually turned simultaneously by two operators until the correct height is reached and the bolts can be installed on both ends to secure the roll. The process is slow and inconvenient and requires the operators to enter the laminating framework, which is potentially unsafe.

M05. A Novel Bead Compression Test Apparatus
Shawn Brown and Brian Morgan (Advisor: Dr. Brooks Byam)

Our senior design project was to make a laboratory test apparatus for The Dow Chemical Company. This apparatus would perform compression testing on spherical bead specimens that varied in diameter from 0.5mm to 2mm. Temperature control between room temp and 450°F was a necessary feature, as well as an accessory that allowed for the capture of the bead geometry at any point during the compression test. We designed a stainless steel conduction heated fixture setup that would attach to an Instron frame and also control temperature at the same time. To capture the bead geometry during the compression test, we set up a microscope and data capture software system that would take high resolution images of the beads while it was being crushed. By knowing the original diameter of the beads, and the number of pixels across the bead diameter before the test start, a simple conversion could be done from pixels on the images to micometers on the bead specimens that would determine the new bead geometry. Having global time recorded on the compression software and on the imagery at the same time allowed for the linking of the compression data to the images. The project met the objectives set forth by the client.

M06. Weld Quality Assurance System
Brice Scanlon, Stan Schlatter, and Riyad Hermas (Advisor: Dr. Joseph Shlien)

The purpose of this presentation is to convey the complete design, fabrication, and testing process of the Weld Quality Assurance System. The project is a result of Duro-Last's response to work related injuries that result from the current process of tearing sample welds. This device will eliminate these injuries and therefore save the company money and preserve its reputation as a safe working environment. In addition, the device will make the weld quality tests done on the production floor and in the quality lab comparable which assures that high quality roofing material is produced.

M07. Vent Cap Feeder Redesign
Sean Jackson, Zackary Kerbleski, and Matthew Thomas (Advisor: Dr. Brooks Byam)

This project entails the redesign, fabrication and implementation of a mechanical engineering senior design project. This group of students has been working with Duro-Last® Roofing Inc. at their Saginaw, MI facility to successfully redesign a part feeder system used on their vent cap assembly machine. The presentation will cover the design process, results and outcome of the project.

M08. Self Suturing Trocar

John Stencel, Chris Hanna, and Jon McKelip (Advisor: Dr. Brooks Byam)

A Trocar is used during minimally invasive surgeries as a pathway into the body for surgical equipment. We have designed and built prototypes of a new Trocar that will be able to deploy a suturing stitch inside the patient. In a typical 2 hour minimally invasive surgery, the surgeon will spend up to a half an hour suturing the three to five Trocar incisions. A Self Suturing Trocar will be able to suture all of the incisions in fewer than 10 minutes minimizing surgery time and the amount of time the patient is under anesthetics. The push in the medical field is to eventually have all surgeries become minimally invasive and the Self Suturing Trocar could eventually see wide spread use.

M09. Automatic Fixture Lock for Crankshaft Oil Hole Drill

Karla Mauch, James Morden, and William Schweitzer (Advisor: Dr. Brooks Byam)

Increased speed and automation in manufacturing processes has long been a goal of the automotive manufacturing industry. One area where this effort has been focused is reducing the changeover time between manufacturing different parts. In changeover procedure for Ingersoll CM Systems' (ICMS) Agile Oil Hole Drill involves moving the tailstock that holds one end of the crankshaft and steadyrest that holds the middle of the crankshaft along a linear axis to accommodate crankshafts of different lengths. This project is the creation of a machine positionable tailstock and steadyrest to replace manually positioned versions on the ICMS machine. This project documents the design, fabrication, assembly, and testing of a tailstock that is locked by spring force and is unlocked by the forward motion of the drill base and positioned by the left and right motion of that base. This automated fixture lock is beneficial to ICMS's customers because the Agile Oil Hole drill will never have to stop to wait for an operator to change the position of the fixtures, reducing changeover time and the labor required to operate the machine.

Solar System Warming

Rochelle Hand (Advisor: Dr. Morteza Marzjarani)

The study of our planets has always been fascinating. We have been blessed with a wealth of information made available to us due to the advances in technology. NASA Telescope facilities, Hubble Telescope are just a few examples of such data producing and manmade machines. In this study I would like to collect data regarding different planets, and apply some data mining tools to discover any hidden patters in these data sets. My research will focus on the idea of solar system warming and how it relates to the idea of global warming and climate change.