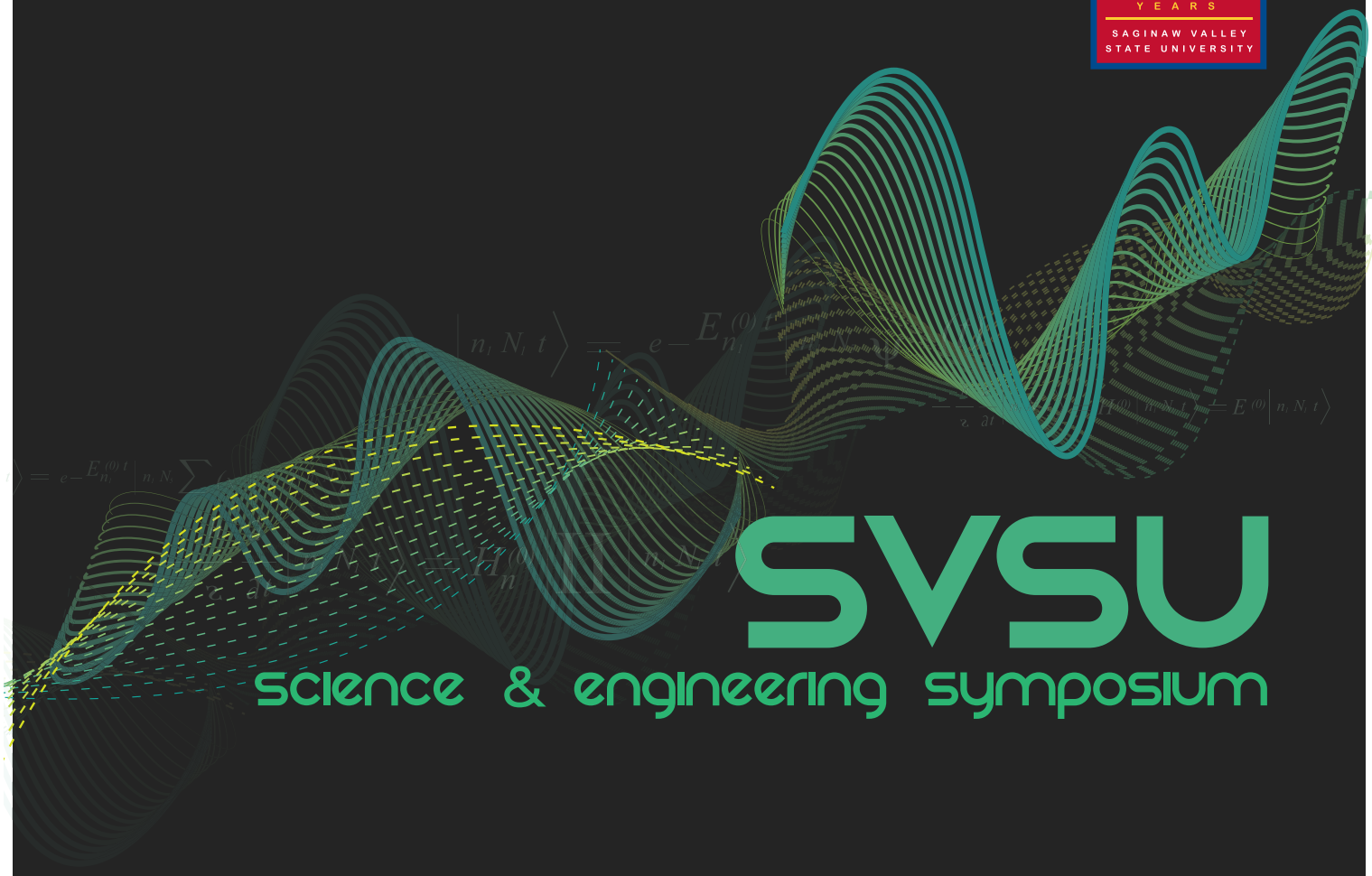
1963 - 2013
50
YEARS
SAGINAW VALLEY
STATE UNIVERSITY



SVSU

science & engineering symposium

pioneer hall
friday, april 26, 2013
8:30 a.m. - 4:30 p.m.

SVSU Science and Engineering Symposium

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SVSU Science and Engineering Symposium

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9:05 a.m.	**Keynote Lecture** Mr. Scott Carmona SVSU Alum, Entrepreneur, Business Owner	Pioneer-240
10:00 a.m.	**Poster Session**	Pioneer First Floor
	Independent Research Posters Chemistry Posters Electrical Engineering Posters Mechanical Engineering Posters	
12:00 p.m.	**Lunch**	Pioneer First Floor
1:00 p.m.	**Oral Presentations**	
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Keynote Lecture

Career Perspective—Lessons Learned
Journey of Life in Business

Speaker: Scott L. Carmona

Scott Carmona is the owner of Sunrise National Distributors, Inc., a Michigan-based, national distributor of aftermarket automotive products, such as tonno covers, running boards, step bars, and hitches with a national distribution center in Flint, Michigan. He is also the owner and Managing Member of several Limited Liability Companies which are in the business of building and leasing warehouse, industrial and commercial space to companies such as Harley Davidson, Nexteer and General Motors. Further, he has been developing commercial real estate for over 25 years which include the recently completed development of a 25 acre, environmentally challenged site in Orlando, Florida where he has built several commercial warehouse buildings including a Charter Middle School.

Prior to Scott's current endeavors, he owned, operated, and provided vision to several companies. Some of which include Cherokee Pools, National Equipment Refurbishes, B&B Engineering, Colonial Instruments (NH), Austin Architectural Products (TX), Scott's Fountain Sales and Service, along with several other businesses and investment companies.

Scott was named the Entrepreneur of the year by The Business and Industrial Development Institute of Saginaw Valley State University on May 31st, 1997. On November 5th, 2005, he was named as an Outstanding Alumni for Saginaw Valley State University College of Science, Engineering & Technology. On April 26th, 2006, he was honored by Junior Achievement by being added to the Business Hall of Fame as a Distinguished Laureate. On July 28th, 2011, he was appointed by Governor Rick Snyder to serve an eight year term on the Saginaw Valley State University Board of Control.

A 1981 graduate of Saginaw Valley State University, Scott earned a Bachelor's Degree in Mechanical Engineering and Applied Science. In support of the local community, Mr. Carmona dedicates time and energy as a board member to numerous organizations. They have and continue to include The Bay County Growth Alliance, The Dow Bay Area Family YMCA, Board of Directors of Bay Special Care Hospital, Saginaw Valley State University Board of Fellows, Boy Scouts of America and SEMA PRO WD Business Council.

He has been very active in supporting many organizations with endowment gifts and grants through his philanthropic efforts with a focus on youth and education. Scott and his wife, Nancy, along with their two children, Ryan and Eric, are also active in many local and church activities in support of their community.

Independent Research Posters

P01. Genomic Stability of Induced Pluripotent Stem Cells
Jonathon Foldie (Advisor: Dr. Rosalyn Sweeting)

Recently, it has become possible to produce pluripotent stem cells from differentiated cells using laboratory techniques. However, the usefulness of these induced pluripotent stem cells (IPSCs) as an effective method for therapeutic applications has yet to be fully understood and determined. Specifically, further knowledge is needed with regards to the cells' genomic integrity and stability.

The present investigations are part of a larger study in collaboration with Dr. Julien Rossignol and Dr Gary Dunbar at Central Michigan University and the Field Neurosciences Institute. Dr. Rossignol and his team are studying the efficiency of using IPSCs to repair brain damage in stroke-induced rats. These IPSCs have been derived from rat mesenchymal stem cells and rat tail fibroblast cells using either adenovirus or lentivirus as a vector for gene delivery. In the Biology department at SVSU these rats IPSCs are being for the presence of chromosomal aberrations as evidence of genomic instability, and their potential for tumor formation after transplantation in live animals.

This research is supported by external funding from the Field Neurosciences Institute (SVSU grant 15-128627).

P02. Development of a Photography Studio Management Software Package
CIS 424 Class (Advisor: Dr. Scott James)

This project involved gathering the requirements for a software based photography studio management system. Client information, shoot location information as well as the actual images are managed through the software. Clients are able to create and modify photo packages as well as preview their images using the software system. The class was responsible for the entire analysis, design, implementation, testing and delivery of the software using Microsoft Visual Basic and SQL Server as the underlying technology.

P03. Formula SAE Aerodynamics
Trevor Haight (Advisor: Dr. Brooks Byam)

I chose this independent study to design, test and fabricate an effective aerodynamic package for our Formula SAE Racecar. This aerodynamic package includes an undertray, diffusers, wind tunnels, and sidepods. Testing will be conducted with scale models as well as computer simulation. Overall effectiveness will be determined by the amount of downforce gained over the original car design. The ultimate goal is to go to competition on May 8th with a well designed and fabricated aerodynamic package.

P04. Designing an FSAE Anti-Roll Bar and Chassis
Brandon King (Advisor: Dr. Brooks Byam)

The goal of this course was to design a front anti-roll bar for the current, 2013 competition season, for Cardinal Formula Racing (CFR) car and to also design and draw a solid model of the chassis to be used during the 2014 competition season.

P05. Analysis of Tire Test Data to Influence FSAE Racecar Suspension Setup
John Redwine (Advisor: Dr. Brooks Byam)

Tires have a very large effect on the overall performance of a racing vehicle. All forces that are generated to accelerate and turn the vehicle are generated by the tires. To allow student teams to better understand how the tires generate these forces, the Calspan Tire Research Facility has performed extensive testing on the tires used in FSAE competition. In this project, the lateral force data has been analyzed in order to find the optimum slip angles for the tires in cornering. These slip angles vary depending on the normal load on the tire. This data along with a simple lateral roll model of the car was used to find theoretically optimized ackerman settings and alignment for the car. These theoretical settings will provide an improved starting point for the car's setup that will be improved through dynamic testing of the car.

P06. Thermal Conductivity Measurement of Silica Sand
Chris Grappin and Luke Gembrowski
(Advisors: Dr. M. Yousef Jabbari and Dr. Chris Schilling)

Use of ground source heat pump (GSHP), as a means of cooling/heating buildings, is considered sustainable usage of energy. Reliable and economical design of the GSHP system requires accurate knowledge of thermal properties of the ground that is being used as well as the heat source/sink capacity of it. This experiment is directed toward collecting the needed information first for a well-defined composition and compaction of a soil (sand in this case) before extending it to more complex situations.

P07. Low Cost Vacuum Systems for Physics Lecture Demonstrations
Adam Kaye and Ashley Walsh (Advisor: Dr. Matthew Vannette)

Lecture demonstrations that require vacuum to perform, like variation of the boiling point with pressure or the transmission of sound through air, often rely on rather expensive equipment. Aside from the pump itself, there are requisite vacuum lines, connectors, and electrical feedthroughs all of which are nominally designed for research. We have explored the use of hardware store materials as an alternative for constructing vacuum systems. As proof of concept we have constructed an apparatus that allows for a measurement of the temperature of water in an active vacuum. A simplified version of the setup has been used as a lecture demonstration for introductory physics classes. We present results of simple experiments that illustrate physical concepts typically difficult to convey to students because of other effects.

P08. Numerical Methods for Non-Integer Order Optimal Control Problems in Two Dimensions (Review)

Dr. Ozlem Defterli, International Guest Scholar, Assistant Professor, Department of Mathematics and Computer Science, Cankaya University, Ankara-Turkey

Non-integer order derivatives, so-called fractional derivatives, describe the behavior of a dynamics of non-local phenomena in a more accurate way. It becomes a significant tool to analyze such kind of systems which appears in various application areas.

In this presentation, a recent formulation for multi-dimensional fractional optimal control problems will be reviewed together with an approximation scheme used for their numerical solution. The fractional derivatives which are coming from the formulation of the problem are defined in the Riemann-Liouville sense and approximated using Grünwald-Letnikov definition. The performance of the formulation is investigated on an illustrative example in two-dimension.

P09. CFD Modeling of Cardinal Formula Racecar Intake System Restrictor

Logan Shelagowski (Advisor: Dr. Thomas Mahank)

Computational fluid dynamics (CFD) flow modeling software offers a useful tool to analyze and visualize fluid flow during the design process. Simulating fluid flow in a virtual environment reduces the need for physical prototypes that can be costly and time consuming to build. An intake system restrictor was designed and optimized by Cardinal Formula Racing using CFD software. The restrictor was tested for flow over a range of pressures using both CFD and a flow bench. The restrictor gained 4 CFM of flow on average as compared to an earlier restrictor over the range of pressure tested.

P10. Effects of Composition and Sintering Parameters on Ultrasonic Velocities and Elastic Properties of Iron and Bronze Powder Metal Alloys

Dr. Chris Schilling and Dr. Kassiani Kotsidou

Velocities of ultrasonic tension-compression (P) and shear (S) waves were measured in three sets of alloys to calculate Young's Modulus, Shear Modulus, and Poisson Ratio according to elasticity theory. In the first set of experiments, effects of graphite concentration and sinter density were investigated in three bronze-graphite alloys: (i) CT-1000 containing 90.5 Cu and 9.5 Sn; (ii) CTG-1001 containing 90 Cu, 9.5 Sn and 0.5 C; and (iii) CTG-1004 containing 88.3 Cu, 9.2 Sn and 2.5 C. In the second set of experiments, effects of sintering time were investigated in two iron alloys: (i) FN-0208 containing 2.0 Ni and 0.8 C; and (ii) FC-0208 containing 2.0 Cu and 0.8 C. These samples were sintered at 5, 10, 20, 30, and 40 minutes in dissociated ammonia atmosphere, spanning a range of properties from under-sintered to normal sintered to better-than-normal sintered. In a third set of experiments, effects of the concentration of infiltrated copper were investigated in iron alloy FX-1008 containing 8 to 14.9 % Cu and 0.6 to 0.9% C. Empirical relationships between the above measurements, the apparent hardness, the bulk density, and the transverse rupture strength are presented.

Chemistry Research Posters

C01. Rapid Testing of Enterococci via qPCR in Fresh Water Beaches
Dr. Tami L. Sivy, Meaghan VanWert, Dr. David S. Karpovich (SVSU);
Joel Strasz, Barb MacGregor (Bay County Health Department)

Current methods to determine levels of fecal indicator bacteria in waterways rely on plate growth with overnight incubation times. New technology and expertise has allowed for the development of EPA Method A: Enterococci in Water by TaqMan Quantitative Polymerase Chain Reaction (qPCR) Assay. The determination of Enterococcus levels is extremely sensitive and can be analyzed in several hours by the qPCR method, giving the potential for better-informed and timelier beach closings. With a grant awarded to Bay County Health Department from the EPA Great Lakes Restoration Initiative (GRLI) via the Michigan DEQ, a partnership was formed between the Health Department and Saginaw Valley State University in order to set up EPA Method A and begin its application to waterways in Bay County. The results from the first summer of testing, including comparison to current methods, are presented.

C02. Adsorption of Azadirachtin on Cellulose: Preparation of Sustainable Biomaterials
Olivia A. Sieggreen (Advisor: Dr. David S. Karpovich)

Research indicates that the limonoid azadirachtin, a component in the seed oil of the neem tree Azadirachta indica, exhibits insecticidal and fungicidal properties. Neem oil has been directly applied to wood, rope and other cellulosic surfaces as a preservative, but this practice consumes excesss neem oil which has value. Application of the active limonoids without oil would be a less expensive and potentially just as effective. In this work, the adsorption of azadirachtin from a neem oil solution to a cellulose substrate was studied. Thermogravimetric analysis was used to confirm the presence of adsorbed material on a cellulose substrate. HPLC-UV-MS analysis was used to identify and quantify adsorbed components in methanol extracts. Our results indicate that azadirachtin exhibits a thermodynamic preference for adsorption on cellulose substrates and shows Langmuir isotherm behavior.

C03. Chemical Synthesis of Stylissamide X
Cameron Volders (Advisor: Dr. Jennifer Chaytor)

The term cancer and its effects are recognizable world-wide. One of the main issues of cancer is the ability of cancer cells to migrate, referred to as metastasis. Cancer metastasis is accountable for over 90% of cancer deaths. Therefore, anti-cell migration is important to cancer research. In this project, a naturally occurring bioorganic compound Stylissamide X will be synthesized via solid phase peptide synthesis. The biological activity of this compound has been tested and has shown anti-cell migration properties, a property of importance to cancer researchers looking for a new strategy to combat the disease. The project can be split into three phases; the first phase is concerned with synthesizing and confirming the structure of stylissamide X. The presentation will be aimed at the synthetic procedure of Stylissamide X.

C04. A Study of Isoprene Synthase: The Key to Cellular Relief from Toxic MEP and MVA Intermediates?

Jordan Killop (Advisor: Dr. Tami Sivy)

Physical vapor deposition was used to prepare amorphous solids of *N,N'*-bis(3-methylphenyl)-*N,N'*-diphenylbenzidine (TPD), a hole-transport material relevant for use in organic light emitting diodes and photovoltaic applications. While holding the substrate temperature constant at 283 K, which is 0.85 T_g of TPD (333 K), deposition rates were varied from 0.45 to 55 nm/s, creating glasses with low fictive temperatures (T_f) and high kinetic stability as determined by differential scanning calorimetry. All fictive temperatures of deposited TPD were found to be lower than the glass transition of the ordinary supercooled liquid glass, with the lowest being 28.4 K below T_g. The lowering of T_f illustrates increased thermodynamic stability of the vapor-deposited glass with the slowest deposition being the most stable. Depositions at the lowest rates were also found to be the most kinetically stable as determined by higher onset temperatures (T_{onset}). When ordinary glasses are aged over 2000 hours, the same effects on the thermodynamic and kinetic stability of the glass are observed. The lowest T_f obtained from vapor-deposited glass was still 18.6 K *below* the T_f of the 2000 hour aged glass. The highest T_{onset} obtained was 12.1 K higher than that of the 2000 hour aged glass. It would take significantly more aging for the aged glass to reach the stability obtained by vapor-deposition. Vapor-deposition is a more time efficient process than aging to produce stable glasses.

C05. Deletion of the yhfR Gene in Bacillus subtilis and Its Effects on Isoprene and Methylbutanol Production

Tyler Beyett (Advisor: Dr. Tami Sivy)

Isoprenoids are produced via the mevalonic acid (MVA) and methylerythritol phosphate (MEP) pathways and are among the most valuable secondary metabolites. Isoprenoids with medicinal value have proven extremely difficult to synthesize and microbial production has been complicated due to cell death as a result of the buildup of toxic precursors in engineered cells. Bacillus subtilis exhibits a greater tolerance towards these toxic precursors than E. coli, possibly due to the presence of the yhfR gene, whose enzymatic product is thought to be responsible the detoxification of pathway intermediates. We replaced the yhfR gene with a spectinomycin resistance cassette, confirmed by qPCR and sequencing, and have analyzed methylbutanol and isoprene production in engineered and wild-type cells. Our research aims to determine whether the enzyme coded for by yhfR plays a role in the conversion of toxic precursors to volatile compounds that can be released into the environment.

C06. Applications of Click Chemistry: Synthesis of Novel Dual Action Antibiotics
Nicole Swope (Advisor: Dr. Stephanie Brouet)

Cefotaxime is a powerful cephalosporin agent that contains favorable properties for antibiotics design, as it has the ability to inhibit bacterial cell wall synthesis in most species. Cefotaxime is furthermore vital for treating plant infections for Gram positive bacteria. A high-yielding methodology known as click chemistry will be performed to link cefotaxime to another antibiotic such as vancomycin, creating a potent dual action drug. An azide group must first be attached to cefotaxime at the C3 position to perform the Huisgen cycloaddition reaction. Iodine azide is a suitable reagent to install the azide through nucleophilic substitution. Despite concerns regarding the toxicity of the triazole structure formed during click chemistry, several antibiotics feature this structure at the C3 position, making it a valid and feasibly desired arrangement.

C07. Studies Toward the Development of Enantioselective Diels-Alder Reactions in Water Using Hydroxamic Acid Ligands
Tim C. Erskine and Derek R. Williams (Advisor: Dr. Stephanie Brouet)

Most Lewis acid enantioselective reactions are performed in organic solvents because water can have an unfavorable racemization effect. However, using organic solvents instead of water can be considered uneconomical. In order to make water a more advantageous solvent, hydroxamic ligands may produce a better degree of enantioselectivity. These ligands are prepared by transforming the carboxylic acid on certain chiral amino acids into a hydrophilic hydroxamic acid. The transformed amino acid is then coordinated to inexpensive copper nitrate to catalyze reactions. High pressure liquid chromatography (HPLC) can be used to compare the enantioselectivity of reactions that use the new type of ligand to reactions that used catalysts without a hydroxamic acid. Ultimately, the HPLC results could be used to determine whether the new type of ligand increases enantioselective induction.

C08. Implications of Hypoxia on the North Branch of the Kawkawlin River
Hannah Voss, Meaghan VanWert, James Polega, Jacob VanHouten,
Dr. Arthur L. Martin, and Dr. David S. Karpovich

The North Branch of the Kawkawlin River is frequently in a state of non-attainment of the Michigan standard for dissolved oxygen (5 mg/L), as documented in the *2007 MDEQ Low D.O. TMDL*. Analysis of this reach during the summers of 2011 and 2012 revealed potentially chronic issues that could affect fish habitat and downstream water quality. Dissolved oxygen levels were typically below 2 mg/L during summer months, which is too low to sustain warm water fish species. This is a seasonal effect, since spring and fall D.O. levels generally meet the standard. Furthermore, benthic invertebrates were chronically nonexistent in the hypoxic reach of the river. On average, water samples from a riparian wetland within the hypoxic reach exhibited unusually low pH ($\leq$7) accompanied by low D.O. (<1 mg/L) with elevated phosphorus and reduced turbidity compared to upstream samples. The hypoxia and low pH in the riparian wetland are consistent with conditions able to reduce sedimentary iron thereby mobilizing bound reactive phosphorus (phosphate-P), which can affect downstream phosphorus levels in both the Kawkawlin River and Saginaw Bay.

C09. Collaborative Stewardship Efforts Lead to Lasting Partnerships in the Saginaw Bay Region

Dr. David Karpovich and Jacob VanHouten

In 2010 with funding from GLISTEN, Saginaw Valley State University and Delta College began collaborating to implement Saginaw Bay Watershed centered service learning into STEM courses. Faculty and students in several academic disciplines partnered with watershed stakeholders such as the Kawkawlin River Watershed Property Owners Association and Bay County Health Department. Service learning was used to address specific needs of the stakeholders which included studying eutrophication and bacteria in the Kawkawlin River. Ultimately the service learning grew from small class activities into larger research projects. The students provided preliminary data that enabled SVSU and Delta College professors to obtain a grant for further river research from the Michigan Department of Environmental Quality. We present here an overview of the successful partnerships, a preview of further work to include Central Michigan University, and a description of the newly formed Saginaw Bay Environmental Science Institute.

C10. Crosslinking of Carboxylated Cellulose with Diamine Compounds

Casey Foley, Kevin Hartman, and Dr. David S. Karpovich

The manufacture of bioplastics is of great interest because of the availability of renewable biomass from agricultural and biofuel industry byproducts. Bioplastic formulations have been made by reacting carboxycellulose with soy protein feedstocks followed by compression molding the solid product into desired shapes. However, soy protein has a very low number of free amines per polymer chain thereby limiting the bonding with the carboxycellulose. We are now exploring the use of small diamine compounds to crosslink carboxycellulose. The reaction of ethylenediamine with carboxycellulose and subsequent compression molding yielded samples with bulk densities of approximately 1.49 g/cm^3; this is a modest increase over bioplastics made with carboxycellulose and soy protein. Tensile strengths are similar to those of soy protein-carboxycellulose bioplastics, ranging from 10.10 to 16.33 MPa. Further analysis of the diamine-carboxycellulose composites includes infrared spectroscopy, Raman spectroscopy, thermogravimetric analysis, and differential scanning calorimetry.

Chemistry Class Project Posters

C11. Sucrose and Lipid Content of Cereals

Sarah Furnier, Kayla Fryzel, and Amber Brown (Advisor: Dr. Tami Sivy)

Using various laboratory techniques, the lipid and sucrose content of four cereals will be determined. The sucrose will be extracted using dialysis with water, and the lipids will be extracted with toluene and water in a 4:1 mixture. The sucrose and lipid content will be determined using a UV/visible spectrophotometer. Lipid content will also be determined using the GC/MS spectrometer and the IR spectrophotometer. For the GC/MS, the lipid extractions were methylated to increase their volatility. The results from the various instruments will be compared to see if they agree. By comparing obtained sucrose and lipid contents to previous literature, we will be able to determine if cereal companies have striven to make their products healthier as many of them advertise, by reducing sugar and fat content. Based on Nutritional Information, Frosted Flakes has the highest sugar content followed by Fruity Pebbles, Wheaties, and then Cheerios. Cheerios has the highest reported fat content followed by Fruity Pebbles, Wheaties, and then Frosted Flakes.

C12. Assay of Familial Genotypes to Determine Incidence of Alzheimer's Disease Risk Factor

Chrissy Biskner and Tim Erskine (Advisor: Dr. Tami Sivy)

There are several risk factors that are known to cause Alzheimer's Disease (AD), however, one that has the most prominence in late onset AD is that of the presence of abnormal apolipoprotein (APOE). There are 6 genotypes, 3 normal and 3 abnormal. The variants containing DNA that codes for ε_4 is a risk factor while the others, ε_2 and ε_3, are not. The purpose of the experiment is to genotype a familial line (Erskine) to determine the presence of APOE ε_4 in the oldest living patriarch of the Erskine family, who does have late stage AD and will be used as a positive control. After determination of the presence of the protein, several descendants' DNA will be analyzed for the abnormal APOE to see if they are at a risk for AD. Yet, APOE ε_4 may not be present in the positive control, which would suggest several other risk factors such as a high fat diet or high cholesterol. Buccal cells will be collected and lysed to extract the DNA used in this experiment. A standard PCR protocol will be followed using APOE primer to amplify ε4. The DNA samples will be compared using electrophoresis on an agarose gel.

C13. Gene Inhibition in C. elegans via the Use of RNAi

Ryan Wedge, Zachery Dewald, and Michael Barrette (Advisor: Dr. Tami Sivy)

RNAi is a recently discovered gene suppression method that has gained notoriety in the medical and scientific worlds due to its unique gene targeting abilities and it has amazing potential to prevent genetic diseases. This experiment will be specifically focused on the inhibition of the expression of the gene dpy-5 in the model organism C. elegans. The gene dpy-5 is associated with proper growth of the nematode during maturation and provides an excellent target to demonstrate RNAi gene inhibition. This inhibition was achieved by isolating the gene sequence of interest and conducting a PCR to amplify said sequence. RNA was synthesized in vitro with respect to this sequence and C. elegans were introduced to dsRNA, where it has been shown to form an RISC complex to inhibit the transcription of specific genes. The C. elegans, once the dpy-5 gene expression is inhibited, are expected to have a phenotypic change that is characteristic of reduction of organism length and an increase in organism width.

C14. Determination of the Nutritional Content of Different Types of Milk

Casey Foley, Tiffany Bell, and Corbin Killam (Advisor: Dr. Tami Sivy)

Milk is a vital source of nutrition for people across the world. The type of milk used varies from person to person. The different types of milk each have different concentrations of the component molecules. The primary milk protein is casein and the primary sugar is lactose. The concentrations of casein, lactose, and also the lipid content of four different milks were sought to be determined. The milks used are skim, goat, 2% reduced fat, and whole. Lactose was crystallized and isolated by vacuum filtration. Lipid content was determined by deriving fatty acids to methyl esters and subsequent analysis by GC-MS. Standard casein solutions between 10 and 50 ppm were prepared and absorbances via UV-vis spectrometry were obtained. Casein content was also qualitatively determined by gel electrophoresis with methylene blue staining. Using these methods, the nutritional content of milk is easily able to be determined.

Electrical Engineering Posters

Senior Design Posters

E01. Hartley Outdoor Education Center Solar Installation
Tyler Mietz, Mike Sprinkles, and Matt Johnson (Advisor: Dr. Russ Clark)

This project consists of the complete installation of a photovoltaic system at the Hartley Outdoor Education Center. This was accomplished throughout the fall semester of 2012 and finished in the winter semester of 2013 by seniors in the electrical engineering program. The purpose of this project is to provide Hartley with a fully functioning, grid connected solar array. This will be used to help offset their energy usage costs and most importantly as an educational tool to the community. It will also help to enrich the academic experience of the three members in areas outside the classroom. The project will conclude with an unveiling on site of the array and with a presentation in April 2013 during the engineering senior symposium.

E02. Data Logging Weather Station
Cody Milostan, Mohamed Salameh, and Daniel Wingblad (Advisor: Dr. Russ Clark)

The design is a digital weather station that measures temperature, relative humidity, barometric pressure, wind speed, and wind direction. It takes these linear analog outputs of the sensors and coverts it in to a digital value to be displayed on an lcd screen. It also displays the date and time and the percent chance of rain or snow on the lcd screen. It logs data of the 5 sensors, 6 times a day for 30 days. Data can be read out after 30 days over a USB to a computer's putty terminal. A database was also made in excel to take this data and convert it into graphical representations.

Mechanical Engineering Posters

Senior Design I

M01. Fishing Reel Application of Patented Gear Train
Shayne Bigelow, Devon Funchion, Kyle Knox, and Bryan Kushner
(Advisor: Dr. Brooks Byam)

A senior design for the Mechanical Engineering Department was submitted by Jay Allen, an aspiring entrepreneur. The project was chosen by Shayne Bigelow, Devon Funchion, Kyle Knox and Bryan Kushner. This project involves implementing a patented gear train with an existing fishing reel. The new feature that is engineered may help reveal the potential of this gear train.

M02. Condensation Reduction in Mechanical Ventilation at Covenant Healthcare
Robert Baudoux, Jeremy Bonkowski, and Christian Borchert
(Advisor: Dr. Thomas Mahank)

The Department of Innovation at Covenant Healthcare has commissioned a project with the purpose of designing a breathing circuit for mechanical ventilation which reduces or eliminates condensation from forming within the tubes of the breathing circuit. This senior design project has examined why the moisture is forming and will provide a viable solution to prevent condensation within the breathing circuit. Our approach to this problem has been to examine the current design and determine its weaknesses by applying both theoretical and experimental methods. Our new design will incorporate design changes to improve system performance.

M03. Hailstorm Simulation System
Eric Gildner, Jason Kandal, and Thomas Savage (Advisor: Dr. Brooks Byam)

The Hailstorm Simulation System is being developed for Duro-Last Roofing, Inc. so that they can better test their roofing products. The systems functions include producing ice balls, launching ice balls at terminal velocity, recording data, and incorporating safety features to protect the operator and bystanders of any debris. Elastic bands will be used to generate the potential energy that is required for the ice balls to reach terminal velocity. The carriage that holds the ice balls will slide on an aluminum track which will be mounted on a spear gun. The spear gun will be mounted on an adjustable tripod in order to adjust the angle of the launch. A chronograph will be used to measure and record the terminal velocities of the ice balls.

M04. Kremin Inc. Stone Polishing Adaptor

Jubal Handrich, Mason Heck, and Eric Schroeder (Advisor: Dr. Brooks Byam)

Kremin Incorporated of Saginaw, Michigan was established in 1983 as a machining source that specializes in precision wear details, fixture and gauge assemblies, and small machines. Currently, Kremin Inc. is a dual ISO 9001:2008 and 13485:2003 certified contract manufacturer that serves customers in Aerospace, Defense, Energy, Transportation, and Dimensional Stone. Some services Kremin Inc. provides are machining, production manufacturing, prototyping, and design support services for domestic and international customers.

Kremin Inc. has a need for a stone-polishing adaptor. This adapter is intended to be used with a computer numerical controlled (CNC) machine and must attach to the standard tool holders used in the machine. Currently, companies are polishing stone by hand because the CNC leaves unwanted swirling patterns on the stone/granite. This issue makes current CNC adaptors not viable and opens the door for a new adaptor. The design being developed must fix this issue resulting in stone/granite polishing by machine rather than by hand. This will reduce finishing cost, production cost, and delivery times.

Mechanical Engineering Posters

Senior Design II

M05. Prototype Bag Making Device
John Redwine, Joshua Gittings, and Troy Quenneville (Advisor: Dr. Brooks Byam)

The presentation gives an overview of our design project. The project required us to design and build a prototype bag making device for The Dow Chemical Company. Dow needs a means to showcase the resins they manufacture in their final product form, being a plastic bag. Using low-density polyethylene films in conjunction with both ultrasonic and adhesive welding devices, the design team's system is capable of sealing these films and creating a plastic bag.

M06. Duro-Last Roll Splitter 2.0
Dustin Pogoreski and Derek Lathrop (Advisor: Dr. Thomas Kullgren)

The Duro-Last Roll Splitter 2.0 was designed to allow for the split down of 62" wide 200 yard long rolls of commercial roofing material for further processing by Duro-Last Roofing, Inc. The process currently used at Duro-Last implements procedures that produce large amounts of waste material and require an operator to work around unguarded knife blades. Focused around the reconfiguration of this primitive process, the Duro-Last Roll Splitter 2.0 will greatly reduce the amount of waste material produced during the split down process and increase operator safety, while utilizing components from a previous ineffective design.

Oral Session A: Biology

Room: Pioneer-242

Presentations start at 1:00pm

B01. New Animal Species Discovered in Michigan
Dr. Stephen W. Taber

Several species of insects unknown until now were discovered in western Michigan. They are flies that probably breed in fungi although only the adult males are currently known. They were found by inspection of voluminous material collected from flight interception traps that sample aerial fauna around the clock in swamp and forest from snow-melt until other hunting seasons begin in autumn. Illustrations of the flies are presented and what is known about them is discussed.

B02. A Case of Hereditary Breast Cancer
Travis Washburn (Advisor: Dr. Rosalyn Sweeting)

A 27 year old patient presented to the Cancer Genetics Clinic because of a significant family history of breast cancer. Four maternal aunts had been diagnosed with breast cancer in their 40's and a maternal grandmother in her 60's. All were deceased except for one maternal aunt. A blood sample was taken from the patient for DNA analysis of *BRCA 1/ 2* as she met National Comprehensive Cancer Network guidelines due to her family history. This included full sequencing and analysis of *BRCA1/2* for five known large rearrangements and other genetic changes (deletions and duplications) associated with Hereditary Breast and Ovarian Cancer Syndrome. The limits of these tests were explained to the patient together the risks associated with a mutation within *BRCA 1/ 2* and the possible differential etiologies due to the family cancer history. The results of these tests were negative. The most informative person to test in the family would have been the surviving aunt with breast cancer. However, genetic testing of the aunt and the patient's mother was not possible due to psychosocial reasons in the family. Other possible genes mutations that could be tested are *TP53*, *CHEK2*, *PALB2*, and *ATM*.

B03. DNA Fingerprinting of Phragmites Australis
Jessica Young (Advisors: Prof. Amanda Ross and Dr. David J. Stanton)

The fresh-water wetland grass, Phragmites australis, commonly known as the common reed, is often seen in large stands long roadside ditches, ponds and lakes. Prior to the mid-1800s, Phragmites was relatively uncommon. Within the last century, Phragmites australis has spread aggressively through North America's waterways and has had a major impact on the Great Lakes ecosystems by causing dramatic declines in native plant populations, altering riparian habitats, and changing nutrient cycles. Established stands of Phragmites australis develop into dense monocultures that extend along shore lines and into shallow standing water areas. These stands prove problematic for animals as well. The grass crowds out fish nurseries, limits water access for nesting and wading waterfowl, and ousts native plants used as food sources. Numerous ecological studies have been performed on Phragmites australis worldwide. However, no genetic data is currently available for P. australis populations in the Saginaw Bay Watershed including the Lake Huron riparian areas.

In order to assess genetic variation, population substructure and patterns of gene flow, samples of Phragmites australis were collected from numerous sites in the Saginaw Bay and greater Lake Huron riparian areas. DNA was extracted from frozen samples and PCR was used in order to amplify the fingerprint loci. The DNA was then analyzed using the CEQ 8000 automated DNA analysis system from Beckman-Coulter. Fragments sizes were determined and genotypes were identified using internal reference standards. Preliminary data analysis examines the number of alleles, observed and expected heterozygosity, population substructure (Fst) and genetic distance (D).

B04. Molecular Markers in Hybridization of American Black Ducks and Mallards
Chantell Toner and Anh Tran (Advisors: Dr. Gail Kantak and Dr. David J. Stanton)

The American Black Duck was once the most abundant duck in North America and a species greatly prized by hunters. However, the geographic range of the American Black Duck currently is shrinking due to habitat loss and to hybridization with the more abundant and widespread Mallard. Identification of hybrids is difficult, making population monitoring and assessment of the hybridization issue problematic. The goal of this research is to identify a suite of molecular markers capable of distinguishing hybrids from the parental species. Progress to date includes building the sample size to 298 feather specimens collected from American Black Ducks, Mallards, and hybrids from 29 states; completion of DNA extractions for all samples; and PCR amplification of known genetic markers for most of these. Preliminary results from analyses of the microsatellite fingerprint data produced so far show differences in allele frequencies and other genetic parameters which may prove useful in identifying hybrids.

B05. DNA Fingerprinting of Saginaw Bay Walleye (Stizostedion vitreum)
Eric Palmer (Advisor: Dr. David J. Stanton)

Saginaw Bay represents a major source of walleye for Lake Huron. Over two million young walleye migrate out of the bay every year. Walleye also serve as top predators in the lake, thus dramatically influencing many other species. The population is heavily managed, since it is of such economic and ecological importance. Recruitment is entirely from spawning beds in rivers flowing into to the bay, however extensive habit destruction and damn construction have had a major impact on these spawning populations. In order to determine spawning site fidelity and to identify the most successful spawning sites, genetic markers are required. Fin clips were collected at the Freeland Walleye festival in the spring of 2012 from fish captured in Saginaw Bay. DNA was extracted from frozen samples and PCR was performed in order to amplify polymorphic fingerprint loci. The PCR products were analyzed by agarose gel electrophoresis. When dye labeled primers become available, fragment sizes will be determined by capillary electrophoresis. Parameters to be investigated include number of alleles per locus, observed (Ho) and expected (He) heterozygosity, population substructure (FST) and genetic distances (D). In the future, samples will also be obtained from spawning populations in rivers.

B06. DNA Fingerprinting of Michigan Tiger Swallowtails (Papilio glaucus)

Travis Washburn (Advisor: Dr. David J. Stanton)

Eastern tiger swallowtails (Papilio glaucus) and Canadian tiger swallowtails (Papilio canadensis) are hybridizing in the northern portion of the lower peninsula of Michigan. The hybrid zone is likely to undergo shifts due to climate change. However, hybrids are difficult to identify morphologically, therefore genetic markers are needed in order to track the hybrid zone. Samples were collected by net from Neweygo county and Saginaw county in the summer of 2012. Museum specimens were also taken from the SVSU collections, which contained specimens dating back to 1970. DNA was extracted from frozen samples and PCR was performed in order to amplify polymorphic fingerprint loci. The PCR products were analyzed using the CEQ 8000 automated DNA analysis system from Beckman-Coulter. Fragments sizes were determined and genotypes were identified using internal reference standards. The parameters investigated included number of alleles, observed (Ho) and expected (He) heterozygosity. The results show that DNA fingerprinting should provide sufficient resolution in order to identify hybrids. In the future, samples will be collected from outside the hybrid zone and mitochondrial DNA will be examined in order to determine the maternal parent in hybridization events.

B07. DNA Fingerprinting of Zebra Mussels (Dreissena polymorpha) from Michigan Inland Lakes

Ginga Kimbro, Kayla Fryzel, and Shannon Duby (Advisor: Dr. David J. Stanton)

Zebra mussels are an invasive species introduced into the Great Lakes from Europe in 1986. Since then, they have spread aggressively throughout the United States and they have had a dramatic effect on water quality and biodiversity. Genetic studies of invasive species are critical in determining the viability and potential ecological impact of these populations. In order to assess genetic variation, population substructure and patterns of gene flow, samples were collected from several inland lakes in the Michigan. These populations were compared to sites in Lake Michigan and Lake Huron in order to establish if source populations could be identified. DNA was extracted from frozen samples and PCR was performed in order to amplify polymorphic fingerprint loci. The PCR products were analyzed using the CEQ 8000 automated DNA analysis system from Beckman-Coulter. Fragments sizes were determined and genotypes were identified using internal reference standards. The parameters investigated included number of alleles, observed (Ho) and expected (He) heterozygosity, population substructure (FST) and genetic distances (D) between populations. The results show that most inland lakes have received migrants from many different locations, but predominately from southern Lake Michigan. Most likely, gene flow due to human transport is also occurring between inland lakes.

B08. A Preliminary Report on the Effects of Prenatal Exposure to Styrene in Rats (Rattus norvegicus)

Nancy Lackey, Madison Lackey, Jennifer Mielke, Thomas Taugher, and Anh Tran
(Advisor: Dr. Gary M. Lange)

The neuroendocrine system plays a vital role in the success of an organism as well as in the ecological and evolutionary aspects of competition and survival. Because the neuroendocrine system is one of the most sensitive systems in the body, only trace amounts of exogenous compounds have the potential to profoundly affect this system and consequentially, disrupt communication within the organism. These potential effects are often exacerbated if the exposure occurs during early development of the organism when both the neural circuitry and glandular development are most rapid. Compounds such as these are referred to as endocrine disrupting chemicals.

Styrene is a compound widely used in plastics manufacturing, and occupational exposures to styrene have been studied using traditional toxicity testing methods, raising some concerns. In this presentation, we discuss initial findings from our lab in our examination of the potential for occupational level exposures to styrene to affect growth, development, and behavior on rats prenatally exposed to this compound. Additionally, we are examining if maternal and/or paternal exposure prior to mating may shape the process of fertilization, and hence shape which offspring develop. This idea of the shaping of the reproductive environment due to exogenous chemical exposures is related to the ecological concept of sperm competition theory.

Our evaluation is measured in several ways: statistical analysis of variance in sex ratios, analysis of coat color ratios, measures of various rodent typical tasks including maze running behaviors, reproductive behaviors, and neuromuscular behaviors, and an examination of potential epigenetic effects due to endocrine disruption. Finally, we conclude with histological analysis of tissues to examine cellular, tissue, and organ system effects.

Findings from this study will increase understanding of the potential for styrene to act as an endocrine disruptor in the body and can further shape the array of biomedical concerns for human occupational exposure to this compound that workers in the plastics industry may face.

Oral Session B: Electrical Engineering Senior Design — Room: Pioneer-240

Presentations start at 1:00pm (see Page 13 for abstracts)

E01. Hartley Outdoor Education Center Solar Installation
Tyler Mietz, Mike Sprinkles, and Matt Johnson (Advisor: Dr. Russ Clark)

E02. Data Logging Weather Station
Cody Milostan, Mohamed Salameh, and Daniel Wingblad (Advisor: Dr. Russ Clark)

Oral Session C: Mechanical Engineering Senior Design I — Room: Pioneer-243

Presentations are 30 minutes each, starting at 1:00pm (see Pages 14-15 for abstracts)

M01. Fishing Reel Application of Patented Gear Train
Shayne Bigelow, Devon Funchion, Kyle Knox, and Bryan Kushner
(Advisor: Dr. Brooks Byam)

M02. Condensation Reduction in Mechanical Ventilation at Covenant Healthcare
Robert Baudoux, Jeremy Bonkowski, and Christian Borchert (Advisor: Dr. Thomas Mahank)

M03. Hailstorm Simulation System
Eric Gildner, Jason Kandal, and Thomas Savage (Advisor: Dr. Brooks Byam)

M04. Kremin Inc. Stone Polishing Adaptor
Jubal Handrich, Mason Heck, and Eric Schroeder (Advisor: Dr. Brooks Byam)

Oral Session D: Mechanical Engineering Senior Design II — Room: Pioneer-245

Presentations are 30 minutes each, starting at 1:00pm (see Page 16 for abstracts)

M05. Prototype Bag Making Device
John Redwine, Joshua Gittings, and Troy Quenneville (Advisor: Dr. Brooks Byam)

M06. Duro-Last Roll Splitter 2.0
Dustin Pogoreski and Derek Lathrop (Advisor: Dr. Thomas Kullgren)

Oral Session E: Physics

Room: Pioneer-247

Presentation starts at 1:00pm

Ph01. Contactless Resistivity via an LC Oscillator

Daniel Weller (Advisor: Dr. Matthew Vannette)

An inductor-capacitor LC oscillator is used to measure the frequency shift associated with the presence of a metal sample in the inductor. The sample's presence changes the inductance and is observed by a change in the circuit's resonant frequency. The inductance change is related proportionally to the material's magnetic susceptibility. Metallic samples with nonmagnetic signature are used to study the resistivity's contribution to susceptibility. Sample and apparatus geometry relate susceptibility to an observed change in resonant frequency. In principle, measured frequency shifts quantify resistivity's contribution to a material's magnetic susceptibility and may be useful for future studies with this technique at high frequencies. We demonstrate how to determine the geometric dependence of a particular experimental apparatus. This will permit measurements of magnetic susceptibility in absolute units at higher frequencies and allow for comparisons with more conventional means.