

SCHOOL OF SCIENCE AND MATHEMATICS

# Student Research Poster Display

Caputo Hall Lobby

April 26 – May 3, 2011 Caputo Hall Lobby

- BIOLOGY •
- CHEMISTRY •
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Note: The names of Millersville University faculty advisors are designated by an asterisk (\*) in the abstracts.

# BIOLOGY

## **1. Providing an Explanation for an Evolutionary Novelty: the Development of the Turtle Plastron**

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The turtle shell is an evolutionary novelty, and understanding how it is formed will help to explain a major puzzle in macroevolution. The goal of this research was to examine the cells that produce the plastron, or ventral shell, of the turtle, and to study their developmental origin. Previous studies have shown that the bones of the plastron form in a similar manner to facial and skull bones. The flat bones of the skull form through a unique process, in which loosely packed cells convert directly into osteoblasts (bone-forming cells), without first producing cartilage. In addition, the skull bones are produced by a unique population of migrating cells known as cranial neural crest cells. We examined the expression of two genes expressed in cranial neural crest cells. We found that these neural crest markers were expressed in the plastron providing further support for the neural crest origin of the cells that form the bones of the plastron. Our hypothesis is that not only is the early plastron constructed from neural crest cells, similar to those that produce the bones of the face and skull, but it will also express genes involved in bone, but not cartilage, differentiation. To investigate this hypothesis, we are examining the pattern of gene expression in the plastron just as the bones are beginning to form by isolating RNA and performing PCR assays.

## **2. Comparing the Techniques of X-ray Imaging and Alcian-Alizarin Staining: Assessing and Predicting Trends in Bone Growth of Young Turtles**

Martin, David; Cebra-Thomas, Judith A.\*

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Bone growth in young turtles is a dynamic phenomenon that can be visualized with a variety of methods, each of which provides valuable information in understanding this process and making predictions about ensuing growth trends. Turtles are unusual in that the cartilage of the ribs does not convert to bone until several months after hatching. Subsequently, the cells of the dermis aggregate around the rib to form the plates of bones that make up the shell. Here, we present a study of the bone formation process in Red Eared Slider turtles using digital X-ray imaging and alcian-alizeran staining technique with the goal of perfecting X-ray image usage to accurately display and predict bone growth in similar fashion to the staining technique. Digital X-ray imaging services at a local veterinarian clinic were utilized to provide a non-invasive assessment of each turtle specimen. Turtle specimens were also subjected to alcian blue staining to identify regions of cartilage, and then alizarin red staining to identify the regions of bone formation. The staining process was highly sensitive to both cartilage and bone cells, showing defined structural components of each cell type in each specimen. Bone, but not cartilage, could be detected in the X-ray images, which showed the basic outlines of the targeted structures: the ribs and vertebrae. Given the benefits of speed and non-invasiveness, but limitations of resolution, the technique of X-ray imaging presented a general picture of bone formation. The staining process, having the benefits of high specificity and resolution, provided the most accurate picture from which to assess the process of bone growth. There is a correlation between the point at which bones become

distinct on the X-ray and when the conversion from cartilage to bone occurs. The X-ray imaging technique, therefore, shows a promising ability to provide an accurate picture of bone growth in young turtles.

### **3. Winter Colonization of *Hydra* in a South-Eastern Pennsylvania Pond**

Mlynek, Kevin; Miller, Ian (MU 2010); Sparr, Dustin; Hicks, Robbie; Reinking, Larry\*  
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*Hydra* are well-known freshwater cnidarians but surprisingly, little is known about the parameters that govern population size and habitat specificity. In a previous study (Miller, I.P. et al., CPUB 2010) we showed that *Hydra viridissima* displayed a strong preference for shallow pond habitats characterized by dense infralittoral vegetation. This study also found increased population densities in early spring sampling as opposed to summer and fall sampling.

In the current study, *Hydra* colonization rates were monitored from mid October 2010 to late March 2011. Permanent monitoring stations were positioned in a 0.2 hectare pond located in Millersville, PA (Roddy research pond). Six sampling stations were distributed in the pond, with four stations located in the shallow (~1 m) apex and two in the deeper (~2.5 m) dock region. Each station had floating towers with vertical tiers consisting of three settling plates per depth (100mm X 15mm sanded polystyrene Petri lids) located at 25 cm and 50 cm with respect to the water surface. Sampling stations located in the deeper dock region had an additional tier of settling plates located at a depth of 125 cm. These stations were assayed every three weeks for colonization of *H. viridissima*, *H. oligactis*, and *H. americana*. In conjunction with these three week sampling cycles, zooplankton counts and abiotic factors such as temperature, pond level, dissolved oxygen, and pH were monitored.

We found a low level of colonization (<20 total *Hydra* per three weeks) from November to February, whereas in early March colonization had begun to increase (> 100). Low colonization rates during winter sampling seem to be related to the degree of ice cover.

### **4. The Effect of Varying Concentrations of Hyaluronan on Fibroblast Migration and Morphology During Wound Healing**

Sheaffer, Brian<sup>1</sup>; Ehrlich, H.P.<sup>2</sup>; Hoover, John\*

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<sup>2</sup>Department of Surgery, Milton S. Hershey Medical Center, Hershey, Pennsylvania

During wound healing, the migration of fibroblasts through a fibrin clot is a key step to the formation of granulation tissue and the progression of wound repair. Research involving the optimization of this process is of significant interest because its potential clinical application. Hyaluronan (HA), a glycosaminoglycan that is distributed widely throughout the extracellular matrix of connective tissue, has been found to influence cell migration during wound healing. In this study, the morphological characteristics of chick embryonic fibroblasts were monitored during migration through a fibrin matrix under the influence of varying concentrations of exogenous HA (40, 120, and 400 µg/ml). The results suggest that HA promotes increased fibroblast migration through the inhibition of gap junction communication. The results also demonstrate that fibroblasts lengthen perhaps in part through increased actin microfilament distribution and organization. The effect that HA has

on fibroblast migration rates and morphology is of clinical relevance because the faster that fibroblasts migrate into the wounded tissue, the more rapid collagen synthesis and contraction can take place, producing a shorter recovery time for patients. The quantification of fibroblast migration distances under varying concentrations of HA provides a basis for further research into the mechanisms of its effects and possible clinical importance for the optimization of wound healing.

## **5. Using Predator/Prey Population Dynamics to Assess Disease Risk Along an Urbanizing Gradient in Baltimore County, MD**

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<sup>2</sup>Cary Institute of Ecosystem Studies, Millbrook, NY 12545

Urbanization is an increasingly important aspect of human influences on the environment, because of this, it is imperative that we learn as much as we can about the impact it has on natural ecosystems. West Nile Virus (WNV) infection rates over the past decade indicate that a significant increase in disease risk is present in urban environments compared to rural and suburban environments. Our primary interest in this study was to determine the influence of an urbanization gradient on WNV risk by comparing the population dynamics of both WNV vector mosquitoes and their larval predators as a function of this gradient. The study sites were situated along an urban gradient extending from inner city Baltimore to state park land approximately 17 miles from the inner most urban site in Baltimore County, Maryland. Sampling was conducted weekly for mosquito populations and monthly samplings of macroinvertebrate populations in order to compare both mosquito and predator diversity along this land use gradient. Mosquitoes were sampled using a 250 mL mosquito dipper (n = 10 dips weekly and n = 25 dips monthly), and macroinvertebrates were sampled using a D-frame net sweep (n = 5 replicates for each site). The diversity index of both macroinvertebrate and mosquito samples were analyzed using the Simpson-Yule Diversity Index. Data analysis found that urban environments appeared to have lower macroinvertebrate and predator diversity than rural areas. Mosquito diversity did not necessarily change along the urban gradient, although species composition was affected, particularly in the 2009 season. We found that macroinvertebrate diversity and abundance increased from urban to rural sites suggesting that disease risk for WNV may be greater in urban environments because of the higher incidence of WNV bridge mosquito vectors as well as lower numbers of larval mosquito predators in urban compared to rural sites.

# CHEMISTRY

## 6. Efficient Synthesis of 1,1,3-trimethyl-3-phenylindan-4',5-dicarboxylic acid (PIDA): A Green Process

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1,1,3-Trimethyl-3-phenylindan-4',5-dicarboxylic acid, commonly referred to as PIDA, is a polycondensation monomer used in industrial polyester polymerization processes. Although a number of syntheses of PIDA have been reported, a more environmentally friendly and cost effective process is desirable. The updated synthesis represents an efficient four-stage approach from readily available starting materials. The key step in the new reaction scheme is the use of "green" chemistry principles to oxidize the aryl methyl groups in 1,1,3,5-tetramethyl-3-(*p*-methylphenyl)indane to the corresponding dicarboxylic acid moieties of PIDA in the last step. The development of this optimized synthesis of PIDA is the subject of this poster.

## 7. Synthesis of *N*-heterocyclic Carbene Complexes of Rhodium: Catalysts in Transfer Hydrogenation Reactions

Kneebone, Jared L.<sup>1</sup>; Nichol, Gary S.<sup>2</sup>; Anna, Laura J<sup>1\*</sup>; Rajaseelan, Edward<sup>1\*</sup>

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A series of new rhodium(I) imidazole-based *N*-heterocyclic carbene (NHC) complexes [(cod)Rh(NHC)Cl] were prepared with varying wing tip substituents on the NHC. These neutral complexes were synthesized through transmetalation of the NHC from silver(I) complexes. The corresponding new ionic complexes [(cod)Rh(NHC)PPh<sub>3</sub>]<sup>+</sup>BF<sub>4</sub><sup>-</sup> were prepared by treating the neutral complexes with triphenylphosphine and AgBF<sub>4</sub>. All new complexes were characterized by multinuclear NMR spectroscopy and elemental analysis. Furthermore, crystal structures of two of the complexes were determined by single-crystal X-ray diffraction. The new ionic complexes were hypothesized to possess catalytic activity in transfer hydrogenation processes and the application of these complexes is being investigated. Preliminary results have illustrated that each ionic complex affords catalytic transfer hydrogenation of acetophenone with 2-propanol.

## 8. Synthesis of *N*-heterocyclic Carbenes: Catalysts for Green Chemistry

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Transfer hydrogenation is a green alternative to the expensive and hazardous conventional method of hydrogenation. 1,2,4-Triazole demonstrates both promising  $\sigma$ -donor ability and facile *N*-alkylation through reaction with alkyl bromides, and similar triazolylidene ligands have proven to be excellent catalysts in the transfer hydrogenation of C=C, C=O, and C=N. A new series of triazole-based *N*-heterocyclic carbenes (NHCs) was prepared to investigate steric tuning of such catalysts. Their activity as spectator ligands in transfer hydrogenation

catalysts are currently being investigated in iridium and rhodium complexes of the general form  $[(cod)M(NHC)PPh_3]BF_4$ . It is hoped that probing the steric dependence of catalytic activity will lead to better catalysts for this green process.

# COMPUTER SCIENCE

## **9. Millersville University iPhone Application**

Garchinsky, Ryan; Liffick, Blaise\*

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The Millersville University iPhone/iPad application provides quick, easy access to useful links, directories, and schedules available on the universities website. The app integrates the information from the website with the power of iOS development tools to provide a fast way to find what your looking for, without the hassle of looking at a full sized website on a small mobile device. I believe the application will be beneficial to the University in a few ways. One way is getting publicity to clubs, weekly events, athletics, and WIXQ, the Millersville radio station. Another way is the fact that Millersville would be the first state school in PA to have an iPhone app. Millersville would also be one of handful colleges in the country with an app that is compatible with the iPad as well (a universal app). I also believe this app would help promote the Computer Science department as app was developed by a CS student. My focus audience for my independent study was the student, so most of the features you see in the app are geared toward students. In the future, the app could be expanded to have a section for future (or looking) students. This could include a virtual tour and a section of common questions a future student might have. All in all I believe the app will have a great positive impact on Millersville; giving its students (most of which have an iPhone, iPod touch, or iPad) a quick way to check their e-mail or other important information, and being ahead of other state schools, and a lot of other schools in the country in the technology department.

## **10. Geopod: A Virtual Platform for Geoscience Data Visualization**

Waegel, Ky P.; Root, Michael R.; Crouse, Lindsey M.; Blank, Lindsay R.

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Geopod is an intuitive, interactive Java module that allows users to navigate and probe an immersive 3-D world. Geopod features authentic geophysical data which is based on actual physics, thus exhibiting technical accuracy and scientific soundness. Geopod leverages the Unidata Program Center's open source Java-based visualization software, the Integrated Data Viewer (IDV), to import and render meteorological data.

Geopod provides the user with the unique experience of flying through the data volume, as opposed to the third-person perspective that IDV offers. This intuitive, engaging interaction style is designed to appeal to students and motivate them to explore the data volume and gain a comprehensive understanding of meteorological concepts. Geopod provides a number of useful devices and features to facilitate and enhance this exploration process, while maintaining a clean, easy-to-use interface which is accessible to novices and experts alike.

Navigation features include keyboard and mouse controls, a compass, an autopilot system capable of traversing isosurfaces, and forward and reverse geocoding. User-selected meteorological parameters are continuously updated on customizable display panels, with a particle imaging device for viewing ice crystal formations, a dropsonde device for vertical profiling, and a grid point displayer for viewing the underlying dataset. A noted-locations system allows users to annotate (and later view, edit, or save) parameter values at points of interest.



In addition, a mission subsystem provides instructors with a powerful yet flexible teaching tool. This feature allows educators to create and distribute missions which can include background material and any number of specific objectives, each of which has an assessment or 'quiz' feature which becomes available to students after they have completed a specific set of requirements.

# EARTH SCIENCES

## **11. Type, Frequency, and Magnitude of Solar Events During the Solar Cycle 23-24 Extended Minimum**

Dolarin, E. K.; Falgoust, P. E.; Jacobs, A. D.; Kibbe, A. N.; Clark, Richard D.\*  
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Even as the Sun was experiencing one of the most prominent solar minima in a hundred years, there were several notable events that could modify the way we think of a quiescent Sun. Our study focuses on the solar activity during the Solar Cycle 23-24 solar minimum, and the impact on Earth's atmosphere and near space environment. We employed NOAA's Space Weather Prediction Center Scale to survey the type, frequency, and magnitude of solar storms that occurred during the minimum. The storm types ran the gamut from solar radiation storms and radio blackouts to geomagnetic storms. This survey looks at the frequency distribution that occurred among the solar storm types and magnitudes, and compares this to previous solar minima. Specific effects from the characteristics of the Solar Cycle 23-24 minimum include variability of Total Solar Irradiance (TSI) incident on the Earth's atmosphere, upper atmospheric expansion/compression, satellite drag, galactic energetic particle fluxes and subsequent McMurdo numbers, and coronal hole size and distribution related to the recorded solar wind speeds. Finally we briefly address recent developments in theories that attempt to explain the occurrence of this past solar minimum.

## **12. Lyman Alpha Airglow Observations from SOLSTICE**

Dolarin, E.K.<sup>1</sup>; Snow, M.<sup>2</sup>, Holsclaw, G.<sup>2</sup>, Woods, T.N.<sup>2</sup>  
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<sup>2</sup>Laboratory for Atmospheric and Space Physics (LASP), Boulder, CO

The Solar Stellar Irradiance Comparison Experiment (SOLSTICE) instrument on board the Solar Radiation Climate Experiment (SORCE) spacecraft in low Earth orbit observes stars every orbit for in-flight calibration. It also observes several star-free regions of the sky near the wavelength of Lyman alpha to correct for airglow emission in the stellar measurements. Although the airglow measurements are only taken during the eclipse portion of the orbit, the look directions cover nearly the entire anti-sunward hemisphere. This seven-year record of Lyman alpha airglow observations (2003-2010) shows the response of the Hydrogen geocorona to changes in the solar Lyman alpha irradiance over the solar cycle.

## **13. Regional Observations of the Nocturnal Low Level Jet Over the Mid-Atlantic**

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A nocturnal low level jet (LLJ) is commonly observed east of the Appalachians during the warm season. Under high pressure conditions to the Southeast and with the sudden cessation of turbulence around sunset, the wind can accelerate to supergeostrophic speeds in a shallow layer at the top of the nocturnal inversion. These same conditions are known to trap pollutants, precursors to ozone formation, and particulate matter. At night these pollutants and particles are confined to the residual layer and can be transported long distances by the LLJ at night, and mixed down to the surface the next day. Data from multiple profilers east

of the Appalachians (MADIS CAP profiler network) and an acoustic SODAR at Millersville University were used to identify several LLJ occurrences during the warm seasons of 2008 and 2009. This study focused on persistence of LLJ events, those that were observed on at least three consecutive nights by no fewer than three profilers. Surface observations of ozone and particulate matter were used to identify the surface level response to transport and mixing. In addition to the wind profiler and surface measurements, supplementary tools such as HYSPLIT back trajectories and the WRF model are used for a detailed analysis of a notable event that occurred in June 2008. This study uses a regional profiling network to demonstrate the importance of the LLJ on the nocturnal transport of ozone and particulate matter and its influence on daytime surface concentrations.

#### **14. Investigating How Background State Affects the Propagation of the MJO**

Laboy, Kristina L.<sup>1</sup>; Maloney, Eric D.<sup>2</sup>

<sup>1</sup>Department of Earth Sciences, Millersville University, Millersville, PA 17551

<sup>2</sup>Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523

The Madden-Julian Oscillation (MJO) is a cycle of anomalous tropical wind and precipitation that starts in the Indian Ocean and propagates eastward into the Pacific Ocean. Variability is dominated by 30-60 day timescales. The processes that cause the MJO to propagate eastward are not well understood. Maloney et al. (2010) argued that zonal moisture advection is important to the eastward propagation of the MJO, and that advection of anomalous humidity by the background low-level zonal wind is integral to this propagation. Here, NCEP reanalysis winds are used to show that MJO propagation does not speed up when background zonal winds in the warm pool increase. In fact, propagation speed and background low-level zonal winds are significantly negatively correlated. Further, it is shown here that while the strength of intraseasonal zonal moisture advection increases with MJO amplitude, MJO amplitude and zonal moisture advection strength show no significant relationship to MJO propagation speed. Other factors such as surface evaporation anomalies may help mediate MJO propagation speed. Understanding MJO propagation could advance the MJO and tropical cyclone forecasts on weekly timescales.

#### **15. Use of Acoustic Sodar to Detect Wakes from Wind Turbines**

Sagliani, Anthony J.; Charnick, M.; Clark, Richard\*

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Existing acoustic sodar equipment (ScinTec MFAS) used for the determination of the proper hub height of wind turbines at a landfill provided the opportunity to detect wake flow downwind of the constructed turbines. The decision to observe the wake flow was based on the opportunity to collect two different data sets, one prior to the installation and operation of the turbines, and one after the turbines began to generate power. The sodar is located about 750 meters downwind and southeast of two, and soon to be four, 2.5 MW wind turbines with 80 meter hub heights. The hypothesis is that it would be possible to detect the wake field in the turbulence statistics obtained by the sodar, and that this signature could then be removed from measurements where the influence would otherwise complicate the data interpretation for other studies. This poster presents our preliminary findings.

## **16. Stream Carbon Dioxide Degassing in Watershed 2 at Coweeta Hydrologic Laboratory, North Carolina**

Shadler, Bridget; Price, Jason\*

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We studied the degassing of carbon dioxide (CO<sub>2</sub>) at Coweeta Hydrologic Laboratory. Chemical weathering of silicate bedrock removes CO<sub>2</sub> from the atmosphere and re-equilibrates it in ocean bedrock. To better understand the process, we studied the stream draining Watershed 2 (W2). Calculations were completed in order to understand the loss of dissolved inorganic carbon (DIC) between the stream source and the outlet. DIC produced by the chemical weathering of bedrock in W2 yield flux values that are 250 mol ha<sup>-1</sup> yr<sup>-1</sup> higher than that measured at the outlet. There are three proposed explanations for the loss of DIC between chemical weathering and the outlet. The first is that carbon may be consumed by biomass. A second possibility is that CO<sub>2</sub> degassing of the stream may be occurring. Lastly, carbon may be utilized for in-stream metabolism; however, previous work by Worrall et al. (2005) found that in-stream metabolism in W2 was negligible. There is evidence that degassing may occur because the partial pressure (pCO<sub>2</sub>) of the W2 stream is 10<sup>-3.06</sup> atm, above that of the atmospheric value of 10<sup>-3.5</sup> atm.

In order to determine if the DIC loss is the result of biomass uptake or stream degassing, pH measurements were collected along the stream length during different seasons during baseflow. If the pH measurements increase from source to outlet then it can be concluded that degassing is occurring. However, if pH measurements decrease from source to outlet, it could be the result of biomass uptake instead. The study concluded that during the forest growing season there is sufficient uptake of carbon by the biomass, which causes the stream water to be undersaturated with respect to CO<sub>2</sub>. Regardless of season, CO<sub>2</sub> is degassed from the stream to the atmosphere at turbulent locations. The results demonstrate that a stream draining a watershed with aggrading biomass respire spatially during the growing season, and temporally on seasonal timescales.

## **17. Airborne LIDAR Data Assessment of Wallops Island Virginia**

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The Virginia Eastern Shore/Delmarva Peninsula is an ideal test location for developing adaptive conservation approaches, particularly for migratory birds and their habitats. This work will use existing data including remote sensing LiDAR data (provided by NASA – Wallops Flight Facility) to map current distributions of important coastal habitats, develop vegetation specific algorithms to reduce errors in calculation of elevations during the processing of LiDAR data, detail the likely areas of greatest impact from rising sea levels, quantify the rate of habitat change, and identify areas that may become important wetlands as the coastal systems attempt to migrate inland. These are all essential precursors to the effective management and protection of future coastal habitats of the Delmarva Peninsula under climate change.

We have developed a Digital Surface Model (DSM) from the NASA LiDAR data and accurately mapped the location and elevation of the features in the Assawoman Island area owned by US Fish and Wildlife (USFWS) and the surrounding NASA beaches. We have

conducted a number of field work to map the area listed above using tremble GPS Units and beach profiling equipments. These data will form the core of a database which will be used as the basis for error analysis and algorithm development for identification of ecological habitats and identify adaptation opportunities to mitigate the impacts of climate change.

### **18. Coastal Ocean Circulation Studies off Wallops Island**

Maroulis, Virginia; Kumar, Ajoy\*

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The Wallops Island region is dynamic environment consisting of a Barrier Island Ecosystem complete with a classical Tidal Inlet. The dynamic salt marshes is an ideal environment for many species of plants and animals native to the region. The proximity to the Marine Science Consortium(MSC) has allowed a collection of large amount of oceanographic data from this region. What is lacking however is a coherent scientific analysis of this data set to bring out the unique circulation features of this region. Millersville University is a senior full member of the MSC and it is imperative that Ocean Sciences and Coastal Studies (OSCS) students are exposed to modern data analysis and scientific interpretation of the dynamic environment at Wallops Island. In this study, we will use the data collected from different cruises, assemble them together and analyze the data. We will later combine the results of her analysis with satellite data of temperature, color and surface currents of the region. This exercise will help us to utilize the theory and principles learnt from OSCS courses to then be able to apply these concepts to real oceanographic environments.

# MATHEMATICS

## **19. Discriminant Models in Graduation Prediction and Amblyopia Referral**

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Discriminant analysis is used in cooperation with the Office of Institutional Research at Millersville University and the Family Eye Group of Lancaster. Discriminant analysis uses continuous independent variable predictors to assign group membership to experimental units. For the Millersville University analysis, the experimental units were 17,482 students from census records spanning sixteen years. Predictor variables included SAT scores, high school class rank, race, gender, and membership in the PACE program. Group membership involved three classifications for students: graduated or did not, graduated in the same or a different department, and graduated in four years or between four and six years. Subclassifications were performed for separate time periods and for different majors. High school class rank was the most consistent predictor variable and the strongest in most analyses. Gender, race, and membership in PACE were also frequently selected variables in several discriminant models. With the Family Eye Group, the experimental units are young children, most under twelve years old. Predictor variables were eye characteristics measured at the initial visit, which were used to predict the presence or absence of an eye condition called amblyopia. The goal of this discriminant analysis was create a model to reduce the number of cases of amblyopia that were not initially referred. Using our model the number of false negatives (patients who had amblyopia that were classified as not having the condition) decreased from 51 to 16 of the 331 cases of amblyopia (15% to 5%).

# NURSING

## **20. Family, Health, and Food: A Glimpse at Life in the Gambia**

Kinard, Kari; Palmer, Ginny\*

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Family, health, and food are simple terms, but defined differently throughout different areas of the world. These terms were explored during a community analysis performed in Ndungu Kebbeh, a village in the West African country known as The Gambia. In preparation for the analysis, a review of literature was performed on The Gambia to help isolate topics that affects every day life and health in The Gambia. The three topics were 1) family and social roles in society, 2) access to health care and perception of health, and 3) nutrition and dietary practices. These topics were then explored during a two-week trip. During this time, this scholar lived in the village and interacted daily with the Gambians by asking questions and observing their lifestyle. At the conclusion of the trip, this scholar's personal observations, which were recorded through journaling, were then compared to the findings in the literature. The findings revealed that in The Gambia, extended family and sense of community is the central focus for life. In this patriarchal society, family dynamics, health care decisions, and nutritional practices are decided based on how it will affect the entire extended family and community. Living in The Gambia is about putting others above yourself.

# PHYSICS

## **21. Studying Seebeck Effect**

Oellig, Michael (MU 2010); Goksu, Mehmet \*

Department of Physics, Millersville University, Millersville, PA 17551

We studied thermoelectric characteristics of thermocouples and measured Seebeck coefficients of n-type and p-type of Silicon at different doping concentration in the temperature range of 295 and 315 K. We observed similar Seebeck coefficients and temperature dependence for the same kind of silicon materials. We also measured electrical conductivity of the semiconductor materials and then determined charge carrier density and ZT factor that is used as a measure of enhancement of the thermoelectric properties of semiconductor materials.

## **22. The Construction of an Open Cavity Helium Neon Laser**

Potterfield, Zachary A.; Dushkina, Natalia\*

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The following research is directed towards the construction of a two Brewster open cavity helium neon laser. A two Brewster open cavity laser is being built for the optics lab in order to demonstrate various laser experiments. An additional portable laser was built for the Physic Demo team in order to showcase the fascinating world of gas lasers to local schools.

## **23. Holography for High School Students**

Simkins, Matthew; Dushkina, Natalia\*

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The subject of our research was holography.. As a Physics education major, I wanted to bring holograms into my classroom at Manheim Township High School to show the students what a hologram looks like and give them a basic understanding of how a hologram is made and why we see what we see. We first used a basic hologram kit produced by Litiholo to make small plate holograms of some ordinary objects. I then produced a video of those holograms that explained the basic concepts holography in student language. I included this video and the physical holograms with my waves and optics unit. We also set out to devise a method to make transmission holograms in the optics lab using a Helium Neon Laser.



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Millersville University  
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# SUPPLEMENT

## STUDENT RESEARCH POSTER DISPLAY

April 26 - May 3, 2011

### CHEMISTRY

#### **24. Biotin Functionalized Biodegradable Polymer Micro- and Nanoparticles for Targeted Drug Delivery**

Smith, Joshua B.; Mbindyo, Jeremiah K.N.\*

Department of Chemistry, Millersville University, Millersville PA 17551.

The use of biodegradable polymer micro- and nanoparticles in drug delivery systems is an area of great research interest. If suitably functionalized with targeting ligands, the micro- and nanoparticles can deliver drugs to specific tissue in which the cognate receptor is over expressed. Polylactic acid, (PLA) is one of a limited number of biodegradable polymers that are approved by the Food and Drug Administration for clinical applications. However, PLA lacks high density reactive surface groups that are needed for conjugation of ligand molecules in targeted drug delivery.

Layer by layer self assembly was used to introduce -NH<sub>2</sub> groups on the surface of PLA micro- and nanoparticles. The -NH<sub>2</sub> groups were then used to covalent attach biotin on the surface through amide linkage. Studies using streptavidin bound horse radish peroxidase show that the surface attached biotin remains biochemically active. Folic acid, which targets the folate receptor that is over expressed in some tumors was also successfully attached covalently on the surface of the micro- and nanoparticles. The results show that layer by layer self assembly provides a convenient route to multivalent attachment of targeting ligands on biodegradable micro- and nanoparticles.

#### **25. Catalytic Activity of Metal Nanostructures in the Reduction of P-nitrophenol with Sodium Borohydride**

Dixon, Andrew R.; Mbindyo, Jeremiah K. N.\*

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Metallic nanostructures are of great interest as heterogeneous catalysts due to their high surface area compared to bulk metals. In addition, mixed metal nanocatalysts may provide higher catalytic activity compared to single metal catalysts. The reduction of p-nitrophenol by sodium borohydride catalyzed by electrochemically deposited metal nanowires was studied with a goal of comparing the catalytic activity of single and multimetal nanowires. The metal nanowires were prepared by electrochemical deposition in alumina membrane templates. At an applied potential of -900 mV vs. a Ag/AgCl reference electrode, nickel was found to plate at a rate of 33 nm min<sup>-1</sup> while Au plated at 67 nm min<sup>-1</sup>. Platinum was found to deposit at a rate of 33 nm min<sup>-1</sup> at an applied potential of -250 mV. The rate of reduction of p-nitrophenol to p-aminophenol was found to be 2.5 mol hr<sup>-1</sup>kg<sup>-1</sup> for nickel nanowires, 0.18 mol hr<sup>-1</sup>kg<sup>-1</sup> for platinum nanowires, and 0.34 mol hr<sup>-1</sup>kg<sup>-1</sup> for gold nanowires.

# PHYSICS

## **26. Bicycle Stability**

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This study presents an analysis of bicycle stability. Part of this research involves demonstrating the assumption that we can consider an object's motion as two separate pieces, translational and rotational. We created an air table to compare translational and rotational velocities of a compact disk as it moves across the table. While initially at rest, a single unbalanced force is applied to the end of the disk to give the CD a translational and rotational motion. Markers were placed at the center of mass and the edge of the CD that were then tracked in Logger Pro to find the linear and rotational velocity of the CD. The ratio of linear to rotational velocity is found with calculations and with experiments. The expected value is  $.030 \pm .001$  while the experimental value is  $.032 \pm .001$ .

## **27. An Analysis of the Forces Acting on a Sphere in an Airstream**

Stone, Evan; Dooley, John\*

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A dramatic high school physics demonstration is the balancing of a lightweight ball in a stream of air, because even if the airstream is at an angle (up to between 30 - 45 degrees) the ball will not fall out. This research investigates the causes behind this phenomenon, by measuring the speed of air flowing around a ping pong ball. A "hot-wire" anemometer constructed from a standard 150 Watt light bulb's filament, is used to measure the relative speed of the air in the airstream. These speed measurements support the theory that the lift the ball must be experiencing is associated with the way the air curls around the ball.