Upward Bound Math and Science/SEEMS & SEECoS 2007

Team A: Molluscan body size changes following the Cretaceous mass extinction and during episodes of global warming

EMS Faculty: *Timothy Bralower*
EMS Graduate Student(s)*: Jocelyn Sessa, Andrea Kalb*
UBMS Instructor: *Pamela Monk*
Students:
Tianca Berrien, Grade 12, William Penn HS (Phila)
Breana Arrington , Grade 10, Harrisburg HS
Claudia Gabriel, Grade 11, Reading HS
Xavier Rhodes, Grade 12, Selma Early College HS

Students will participate in a hands-on research experience that is focused on discovering how the body size of mollusks (clams and snails) changed during twenty million years of evolution. Participants will learn about ancient life, how organisms become fossils, and the processes of evolution and extinction. Bulk samples of fossil mollusks previously collected from Alabama and Mississippi will be used to understand how prehistoric communities responded to climate change and how they recovered from the mass extinction that killed off the dinosaurs. This extinction caused a catastrophic disturbance in the world's oceans and an estimated 75% of molluscan species went extinct during this event. Several shifts in climate follow this mass extinction, including both long and short periods of global warming. Students will sieve and wash samples to obtain fossils and then measure these fossils using digital calipers to create a dataset of body size through time. Multiple time intervals will be studied, ranging from the first few million years after the Cretaceous mass extinction, to an interval of rapid global warming at 55 million years ago, to twenty million years after the Cretaceous mass extinction. Following data collection, students will analyze their datasets and create presentations describing the results of their research.

Lab locations:

Date	Location	Topic
6/19	½ time in Deike 542, ½ time in 428	Geologic time, how organisms become fossils, Cretaceous mass extinction, Paleogene climate
6/21	Lab Deike 428	Lab orientation and safety, begin to process samples
6/26	Lab Deike 428	Finish processing samples, begin measuring specimens
6/28	Lab Deike 428	Continue measuring specimens
7/3	Lab Deike 428	Continue measuring specimens
7/5	Lab Deike 428	Continue measuring specimens
7/10	Computer lab Deike 337	Review data to determine what samples to focus on next
7/12	Lab Deike 428	Continue measuring specimens
7/17	Lab Deike 428	Continue measuring specimens
7/19	Computer lab Deike 337	Analyze data
7/24	Computer lab 337	Create presentations

Team B: Satellite Meteorology

EMS Faculty: *Drs. George Young and Eugene Clothiaux*
EMS Graduate Student: *Caren Fisher*
UBMS Instructor: *Dan Sharp*
Students:
Syiemah Green, Grade 11, Reading HS
Yohanna Giorgis, SciTech HS (Harrisburg)
Angel Dawson, Grade 11, Reading HS
Carlos Pabon, Grade 12, Reading HS

This project focuses on the use of weather satellite images to determine the height for the fair weather cumulus clouds over the Tibetan plateau. This research is motivated by the long-standing goal of collaborator Dr. Ward Hindman (City College of New York) to be the first person to fly a glider over Mount Everest. To do so he needs thermal updrafts reaching at least 30,000 feet above sea level. Thus, the cumulus cloud base must be at or above that level. Atmospheric soundings are too widely separated in the Tibetan region to provide a definitive answer about the cloud height. Therefore we are turning remote sensing to map the cloud height and determine if thermal soaring will allow Dr. Hindman to achieve his goal.

We will use full color imagery from MODIS polar orbiting weather satellites to identify fair weather cumulus over the Tibetan plateau and to measure the spatial offset between the individual clouds and their shadows. Photogrammetric trigonometry will then be used to compute the cloud height above the terrain. Adding the terrain height obtained using GeoEarth will yield the cloud base height above sea level. By mapping the north-south trend of this quantity across the Tibetan plateau we can determine if a thermal soaring glider flight from Tibet can indeed be used to fly over Mount Everest as Dr. Hindman proposes.

Results of this project will be provided to Dr. Hindman for incorporation into his flight planning and his future OSTIV (Organisation Scientifique et Technique Internationale du Vol à Voile) publications.

Team C: Why ozone pollution is worse on hot days?

EMS Faculty: *William Brune*
EMS Graduate Student(s): *Jingqiu Mao/Zhong Chen*
UBMS Instructor: *Özlem Zabitgil*
Students:
Tomishia Peggues, Grade 11, Reading HS
Shiane Hemsley, Grade 10, Reading HS
Shanna Scott, Grade 11, ML King HS (Phila)
Demar Graham, Grade 10, ML King HS (Phila)
Erica Stafford, Grade 12, William Penn HS (Phila)

Objective: To find out why ozone pollution is worse on hot days in summer by analyzing air chemistry data taken in the summer of 2006 in Houston, Texas.

***Brief background: ***

Our project examines the summertime air quality and ozone pollution in Houston, Texas, using air chemistry data taken in summer 2006. In urban areas, human activities are considered a major cause of air pollution — both ozone and small particles. The pollution is worse in cities on hot, sunny, summer days because of high reactivity of air pollutants. Last summer, we made measurements of the air chemistry in Houston, Texas. By analyzing these data, the students can answer the question: Why ozone pollution is worse on hot days, especially in big cities like Houston, Texas?

Work to be completed:

The students will learn what causes air pollution and high ozone pollution on hot days in Houston, Texas. They will be shown the roles that sunlight and human activities can play in the formation of ozone pollution. They will analyze data from the summer of 2006 in Houston using some simple computer programs that they will learn how to use.

Team D: Polymers and Materials Science

EMS Faculty*: Ronald C. Hedden*
EMS Graduate Student(s): *Burcu Unal, Daniel Lentz, Harshad Patil*
UBMS Instructor: *Jackie Mills*
Students:
Darinel Ayllon, Grade 12, Kennett HS *Yesenia Cadena, Grade 11, Reading HS*
Damaris Velasquez, Grade 10, Reading HS

Polymers are organic materials that are used in many familiar consumer products, ranging from paints, coatings and adhesives, to plastics, automobile tires and shoe soles. Development of a commercial polymer product requires the cooperation of many people: scientists and engineers, managers, and sales and marketing experts. Product design begins with the research and development phase, where chemists, materials scientists, engineers, and physicists often collaborate, applying the scientific method to develop new materials that have the desired properties. Our SEEMS project introduces the students to the basic scientific methods behind materials science and engineering, with a focus on polymers. We learn the basics of polymer science - what polymers are, how they are made, and why they have the properties that make them special. The students then investigate the properties of some rubber compounds made from a commercial silicone polymer blended with various inorganic additives- including carbon black, cloisite (a clay), and fumed silica. Students fabricate rubber "super balls" using a simple molding process. Balls are then bounce-tested to investigate which additives have the greatest effect on the properties of the rubber. At the end of the experience, students prepare a presentation summarizing their findings and showing how they applied the scientific method to choose the best material for the job.
Lab locations:

Date	**Location**	**Topic**
6/19	8 Steidle Building	Introduction to polymers and materials science
6/21	8 Steidle Building	polymers lecture and start lab experiments
6/26	8 Steidle Building	polymers lecture and lab experiments
6/28	8 Steidle Building	polymers lecture and lab experiments
7/3	8 Steidle Building	polymers lecture and lab experiments
7/5	8 Steidle Building	polymers lecture and lab experiments
7/10	8 Steidle Building	begin presentation and continue lab experiments
7/12	8 Steidle Building	work on presentation and continue lab experiments
7/17	8 Steidle Building	work on presentation and conclude experiments
7/19	8 Steidle Building	complete presentation and revise with teachers
7/24	TBD	practice delivery of presentation

Team E: Petroleum Engineering

EMS Faculty: Dr. Zuleima Karpyn
EMS Graduate student: Tawatchai (Don) Petchsingto
UBMS Instructor: *Brandon Emig*
Students:
Stanton Daniels, Grade 11, Harrisburg HS
Cam Ung, Grade 11, Olney HS (Phila)
Dameda Moore, Grade 10, Preparatory Charter School (Phila)
Jameion Taylor, Grade 11, ML King HS (Phila)
Andrea Willoughby, Grade 11, ML King HS (Phila)

Students participating in this summer research experience will conduct hands-on laboratory tests that are fundamental to petroleum engineering, the estimation of oil reserves, and the extraction of hydrocarbons from underground reservoirs. Students participating in this research activity will measure important rock and fluid properties and will be guided through the interpretation of those properties and their application to petroleum engineering problems. More specifically, students will estimate the storage capacity of petroleum reservoir rocks, determine grain size distribution, and quantify the ability of a rock to transmit fluids through its pores. Students participating in this experience will have the opportunity to explore the role of Petroleum and Natural Gas Engineers in our society, under the guidance of a faculty member and an experienced graduate student.

"Petroleum engineers make the world run. Petroleum engineers search the far corners of the earth to find and produce oil and gas supplies. They keep the energy flowing to light and heat our homes. They fuel our transportation system and keep our industries operating. They spark the creation of thousand of products, from medicine and plastics to textiles and cosmetics. And they do all these things with the highest regard for protecting the environment," Society of Petroleum Engineers.

Team F: Forensic Ice Age Vertebrate Paleoecology

EMS Faculty: *Dr. Russell W. Graham*
EMS Graduate Student: *Laurie Eccles*
UBMS Instructor: *Jackie Mills*
Students:
William Smith, Grade 12, Selma Early College HS
Tevin Chambers, Grade 10, Germantown HS (Phila)
Kareem Carter, Grade 10, Germantown HS (Phila)
Elisabet Polanco, Grade 9, Reading HS
Jermaine Williams, Grade 11, ML King HS (Phila)

Overall Goal:

Students will use the scientific method to evaluate the effects of different biases on fossil samples from pit caves. Secondarily, students will employ these results to assess the reliability of their samples for making paleoenvironmental reconstructions.

Research Project Description:

This project is part of on-going research in the biogeography and paleoecology of Ice Age vertebrates from caves in the Black Hills of SD. Students will examine the biases in fossil samples in order to determine their validity in making paleoenvironmental reconstructions. The instructor will give brief "lecturettes" throughout the course discussing sampling strategy, prehistory of the Black Hills, methods of fossil accumulation and paleoenvironmental reconstruction. Participants will be given their own unsorted samples of concentrate derived from excavated sediments. They will pick bones and teeth of small vertebrates out of the concentrate. The instructor and TA will help the students learn how to identify the different bones of the vertebrate skeleton from their own samples. The fossils will be sorted by skeletal element and taxon with facilitation by the TA. Counts of these elements will then be entered into an EXCEL database. Students, assisted by the TA, will then learn to make graphs of the different skeletal elements. Each student will compare his or her graph with the other students to get an idea of variability of samples. The instructor and TA will show the students how to conduct simple Chi-square tests to determine whether certain skeletal elements are either over or under represented. The students will explore the possibility of different sampling biases based upon several scenarios presented by the instructor. These results will allow students to assess whether the bones recovered by excavation and screening represent a random sample of the biota that lived around the cave in the past.

Team G: Petroleum Production Engineering

EMS Faculty: *Professor Luis Ayala*
EMS Graduate Student(s)*: Doruk Alp*
UBMS Instructor: *Brandon Emig*
Students:
Christian Newsome, Grade 11, ML King HS (Phila) *Kwammaine Parson, Grade 10, Germantown HS (Phila)*
Tony Veloz, Grade 10, Reading HS *Jashira Santiago, Grade 10, Reading HS*
Israel Bernal, Grade 12, Kennett HS

Production engineering is the branch of petroleum and natural gas engineering that deals with the extraction of hydrocarbon fluids and their treatment and handling at the surface. Petroleum engineers are employed by multinational petroleum companies for the exploration, development and extraction of underground hydrocarbon deposits. The petroleum and natural gas engineer working in production operations must utilize laboratory data for the quantitative evaluation of reservoir fluid production and for the design and development of processes and equipment to optimize oil and gas production. In this summer experience, the participant will be introduced to the basic concepts of petroleum production and will be exposed to a hands-on laboratory experience about the principles and procedures utilized for oil and gas analysis and fluid flow. The participant will learn how petroleum fluid properties, such as density, API, viscosity, heat of combustion, BS&W, water vapor content, and composition, are measured in the laboratory. Fluid flow experiments will also be conducted. The students will have the opportunity to interact with current undergraduate and graduate students in our program. The experience will provide an opportunity for students to be acquainted with petroleum engineering as a rewarding and exciting professional career.

Lab locations:

Date	**Location**	**Topic**
6/19	22 Deike / 208/209 Hosler	Introductions – Lab Tour -- Brief intro to the equipment
6/21	208/209 Hosler	BS&W determination
6/26	208/209 Hosler	API gravity and density determination
6/28	208/209 Hosler	Viscosity determination
7/3	208/209 Hosler	Water vapor determination
7/5	208/209 Hosler	Heat of Combustion determination
7/10	208/209 Hosler	Separator Calculations
7/12	208/209 Hosler	Separator Calculations
7/17	208/209 Hosler	Final Report Preparation
7/19	208/209 Hosler	Presentation Preparation
7/24	208/209 Hosler	Presentation Rehearsal

Team H: Climate Change in Africa

EMS Faculty: *Robert Crane*
Graduate Student: *Christine Olarte*
UBMS Instructor: *Özlem Zabitgil*
Students:
Joshua Bennett, Grade 11, Selma Early College HS
Tavia Campbell, Grade 11, Penn Wood HS (Phila)
Cheryl White, Grade 10, Germantown HS (Phila)
Keenan Jackson, Grade 11, Germantown HS (Phila)
Emanuela Louis, Grade 10, ML King HS (Phila)

That climate is changing and that human activities are largely responsible is now accepted by most climate scientists and most of the world's governments. There is still considerable uncertainty about what the societal and ecological consequences of these changes will be. However, it is almost certain that the greatest impacts on human societies will be in the less-developed nations, and in Africa in particular.

The participants in this summer experience will receive an introduction to climate change and will learn why nations in Africa are particularly vulnerable. We will also develop a climate change research project where participants will access various government and university climate data sets for selected regions in Africa, and will examine future climate projections in the context of current trends. The objective will be to derive a preliminary estimate of where impacts are likely to be the greatest by examining not only the magnitude of the projected change, but also the nature of the change compared to the present day trends – will the future be a continuation of the changes we are already seeing and adapting to, or will it be very different?

Preliminary Schedule (all meetings will be in 008 Deike):

Date	**Topic**
6/19	Introduction: who's who and what are your interests
6/21	Introduction to global warming and climate change
6/26	Data acquisition
6/28	Data acquisition
7/3	Introduction to climate change
7/5	Why is Africa vulnerable
7/10	Why is Africa vulnerable
7/12	Discussion of individual results
7/17	Refining the analysis
7/19	Synthesizing group results
7/24	Designing the group presentation.

Team I: Plant Pigments

ECoS Faculty: Jackie Bortiatynski
ECoS Undergraduate Student(s): Sarah Strass
UBMS Instructor: *Craig Keiser (on call)*
Students:
Elvira Gabriel, Grade 11, Reading HS *Hao Nguyen, Grade 10, Central HS (Phila)*
Brytelle Walton, Grade 12, Reading HS

Research Description:

The project focuses on the isolation of plant pigments: chlorophylls, carotenoids, and favinoids, released during the steaming of green and yellow vegetables. Students will explore the affect of cooking conditions, i.e. acidity, and cooking times, on the release of these important nutrients. The students will choose one green and one yellow vegetable for the study as well as a set of cooking conditions. Then paper, thin layer and column chromatography techniques will be taught in preparation for the isolation of chlorophylls, carotenoids, and flavinoids from their vegetable samples. After the students have mastered the chromatography techniques these nutrients will be isolated from their steamed vegetables. The fractions of chlorophylls, flavinoids, and carotenoids will be quantified using visible spectrophotometry. The methods developed by this project will be used to develop an undergraduate laboratory experiment for students in the introductory organic laboratory course. The following goals have been established for this project: (1) to gain an understanding of the function and basic structure of some pigments in fruits and vegetables; (2) to demonstrate how structural differences can be exploited to separate compounds; (3) to learn the basic techniques of chromatography to separate compounds; (4) to learn how to use basic color spectrophotometry to quantify compounds in solution; and (5) to utilize the scientific method to explore a chemical problem.

Lab locations:

Date	***Location***	***Lab objective***
Jun 19	22 Deike	Safety Lesson
Jun 21	105 Whitmore	Introduction to chlorophylls, carotenoids, favinoids-what makes them colorful, why are they important nutrients, and how can their structures be utilized to design a chromatographic isolation technique.
Jun 26	105 Whitmore	Learn to search literature and references
Jun 28	105 Whitmore	Cook vegetables
Jul 03	105 Whitmore	Extraction and isolation of pigments
Jul 05	105 Whitmore	Paper and Thin Layer Chromatography, introduction to technique and theory
Jul 10	105 Whitmore	Column Chromatography of isolated nutrients
Jul 12	105 Whitmore	Column Chromatography of isolated nutrients
Jul 17	105 Whitmore	Preparation of Visible Standards and Spec 20 Analysis
Jul 19	105 Whitmore	Review Data and Conclusions
Jul 24	105 Whitmore	Preparation of Presentations
Jul 25	HUB	*SEECoS Presentations*
Jul 26	HUB	*SEECoS Presentations*

Team J: Astronomical Clocks in the Sky

ECoS Faculty: *Drs. Mercedes Richards and Kristin Miller*
UBMS Instructor: Craig Keiser
Students:
Jessica Wilkinson, Grade 12, Reading HS
Olivia Arrington, Grade 10, Germantown HS (Phila)
Ashton Butts, Grade 12, ML King HS (Phila)
Priscilla Garcia, Grade 11, Reading HS
Ashley Randall, Grade 12, Central HS (Phila)

Research Description:

Astronomical clocks have existed since the dawn of time. Ancient peoples measured time using the positions of the Sun (to define the day and the year) and the Moon (to define the month). However, many other objects in the sky behave like clocks. Some stars pulsate (expand and contract) regularly with cycles that are only minutes long; others take years to complete one cycle. In addition, all stars rotate like the Earth, with periods that range from milliseconds to months. Some of these stars are rapidly rotating neutron stars called pulsars. Binary star systems contain two stars that mutually orbit with regular cyclical periods of days to thousands of years. So, a variety of clocks are found throughout the sky. In this project, we will use a well-known pulsar called Cen X-3 to learn (1) how to discover if the light from a star varies with a regular period, (2) how to determine the value of that period accurately, and (3) how to get information about the size of the objects involved and the scale of the system.

Lab locations:

Date	***Location***	***Lab objective***
Jun 19	22 Deike	Lab Safety Session
Jun 21	Wartik	Introduction to Light Curves, Power Spectra, & Periodicities
Jun 26	Wartik	Making a light curve
Jun 28	Wartik	Fine tuning the light curve of a star or star system
Jul 03	Wartik	Calculating a Power Spectrum, a tool to identify an accurate period of variation
Jul 05	Wartik	Interpreting the power spectrum; calculation of pulsar speed
Jul 10	Wartik	Calculating the size of the pulsar's orbit
Jul 12	Wartik	Calculating the luminosity of the pulsar
Jul 17	Wartik	Discussion of results
Jul 19	Wartik	Prepare reports and presentation files
Jul 24	Wartik	Review all the reports and presentation files
Jul 25	HUB	*SEECoS Presentations*
Jul 26	HUB	*SEECoS Presentations*

Team K: Biodiesel From Vegetable Oil

ECoS Faculty: *Jackie Bortiatynski*
ECoS Undergraduate Student(s): *Megan Kolarz*
UBMS Instructor: *Eric Speight*
Students:
Maldonado Daley, Grade 10, ML King HS (Phila) *David Bunion, Grade 12, ML King HS (Phila)*
Paulina Casteneda, Grade 12, Kennett HS

Research Description:

The project focuses on the generation and characterization of biodiesel synthesized from used vegetable oil. Students will choose a source of vegetable oil and carry out two saponification reactions under different conditions in an attempt to optimize the amount of biodiesel produced. The students will need to titrate the oil prior to saponification to determine the correct amount of base for the conversion to biodiesel. The saponified products will be isolated and the crude biodiesel will be characterized by viscometry, and gas chromatography/mass spectrometry. If too much base is used the dominant product will be soap and very little biodiesel will be generated. The goals of this project are: (1) to understand the composition of vegetable oils; (2) to understand how biodiesel is created; (3) to learn how to saponify an oil; (4) to learn how to do an acid/base titration; (5) to learn how to measure viscosity and understand the significance of this physical property in terms of fuel design; and (6) to understand how GC/MS can be used to characterize a reaction mixture.

Lab locations:

Date	***Location***	***Lab objective***
Jun 19	22 Deike	Safety Lesson
Jun 21	105 Whitmore	Introduction to biodiesel. Where does it come from and how is it made? Why is it a useful fuel?
Jun 26	105 Whitmore	Learn to search literature and references
Jun 28	105 Whitmore	Prepare all glassware and titrate oil
Jul 03	105 Whitmore	Saponification 1 of selected oil
Jul 05	105 Whitmore	Isolate fatty acid methyl esters, (biodiesel), Saponification 2 of selected oil
Jul 10	105 Whitmore	Isolate fatty acid methyl esters from Saponification 2 and Begin viscosity measurements
Jul 12	105 Whitmore	Continue viscosity measurements and begin GC analysis of fatty acid methyl esters
Jul 17	105 Whitmore	Identify biodiesel components by GC/MS
Jul 19	105 Whitmore	Examination of Data, Preparation of Posters
Jul 24	105 Whitmore	Review Data and Conclusions
Jul 25	HUB	*SEECoS Presentations*
Jul 26	HUB	*SEECoS Presentations*

Team L: The Supernova as a Cosmic Recycling Center

ECoS Faculty: *Drs. Mercedes Richards and Kristin Miller*
UBMS Instructor: *Craig Keiser*
Students:
Mark Bount, Grade 10, William Penn HS (Phila)
Yanet Zavala Lopez, Grade 11, Kennett HS
Sonia Vasquez, Grade 11, SciTech HS (Harrisburg)
Blaze Campbell, Grade 12, Reading HS
Elizabeth Brooks, Grade 11, Reading HS

Research Description:

Supernovae represent some of the largest and most impressive explosions (called outbursts) in the sky. These events can be produced by single stars that have created many chemical elements in the core of the star, and they can also be produced in a binary star system when gas is transferred from one star to another. When the outburst occurs, the chemically processed gas is dispersed into the interstellar medium (the spaces between stars). The newly enriched gas is then recycled to make new stars; and the cycle continues. Often, the outburst leaves behind a strange compact object. The very center of the star does not disappear, but forms a new object called a neutron star. It has a size of about 10 km, and a mass greater than the Sun's mass, so it has a very high density. One thimbleful of its material would weigh as much as 10 million full sized African elephants. This compact object usually spins on its axis ten to a hundred times per second, and is called a pulsar. This rapidly rotating star was believed to be pulsating but we now understand that the bursts of light occur whenever the rotation axis points in our direction. As the pulsar slows down over the centuries, it adds electrons and other charged particles to the interstellar gas and provides the energy that we see radiating towards us today from all parts of the supernova remnant. In this project, we will examine the creation and expansion of a supernova called Cas A, which is located in the constellation of Cassiopeia.

Lab locations:

Date	***Location***	***Lab objective***
Jun 19	22 Deike	Lab Safety Session
Jun 21	Wartik	Introduction to chemical processing in stars and supernovae
Jun 26	Wartik	Understanding pixels
Jun 28	Wartik	Calculating the date of creation and distance to supernova Cas A
Jul 03	Wartik	Calculating the size of the supernova
Jul 05	Wartik	Making a supernova light curve
Jul 10	Wartik	Calculating the brightness profile of the supernova
Jul 12	Wartik	Creating energy spectra of the supernova
Jul 17	Wartik	Discussion of results
Jul 19	Wartik	Prepare reports and presentation files
Jul 24	Wartik	Review all the reports and presentation files
Jul 25	HUB	*SEECoS Presentations*
Jul 26	HUB	*SEECoS Presentations*

Team M: Statistics and the Financial Markets

ECoS Faculty: *Dr. Donald Richards*
UBMS Instructor: *Eric Speight*
Students:
Vanay Joynes, Grade 10, Lankenau HS (Phila)
O'Shane O'Meally, Grade 11, ML King HS (Phila)
Siaisha Sherman, Grade 12, William Penn HS (Phila)
Fanta Love, Grade 11, Girard Academic Music Program (Phila)

Research Description:

Elementary statistical methods will be used to analyze portfolio selection methods in the financial markets. Concepts of regression analysis, expected value, standard deviation, and the Central Limit Theorem will be utilized in the study of strategies for selecting stock portfolios. Computer simulations of stock portfolios will be used to illustrate the expected outcomes of repeated plays of various strategies.

Lab locations:

Date	***Location***	***Lab objective***
Jun 19	22 Deike	Lab Safety Session
Jun 21	Wartik	Introduction to portfolio selection methods
Jun 26	Wartik	Learn how to construct portfolios
Jun 28	Wartik	Start research using Internet-available data bases
Jul 03	Wartik	Student construction of portfolios
Jul 05	Wartik	Statistical methods in the financial markets
Jul 10	Wartik	Probability theory in the financial markets
Jul 12	Business Bldg.	Real-time observation of a financial trading room
Jul 17	Business Bldg	Real-time simulation of financial trading strategies
Jul 19	Wartik	Prepare reports and presentation files
Jul 24	Wartik	Review all the reports and presentation files
Jul 25	HUB	*SEECoS Presentations*
Jul 26	HUB	*SEECoS Presentations*

Team N: Interpretation of Field Observations Collected at Ancient Archaeological Sites in Southern Egypt

EMS Faculty: *Dr. Shelton Alexander, Professor Emeritus of Geophysics*
EMS Graduate Student:
UBMS Instructor: *Dan Sharp*
Students:
Frances Ruiz, Grade 10, Reading HS *Karimah Brooks, Grade 12, Reading HS*
Antuanne Allen, Grade 10, Harrisburg HS

Objective: The objective is to interpret a subset of a large body of field observations made during the past several years at the ancient Temple-Town site, Hierakonpolis, in southern Egypt to better understand the current shallow groundwater conditions that threaten buried structures and artifacts within the Temple-Town's walled perimeter.

Background: Human occupation at the Hierakonpolis site dates back at least to 3800 BC and is historically very significant in that the Narmer Palette, found in a buried chamber by the British in 1898 and now on display in the Egyptian Museum in Cairo, has inscriptions indicating that the earliest Pharoahs who established the country of Egypt were living there approximately 2000 BC. Other evidence indicates that the site was continuously occupied from 3800 BC until Roman times or later. Groundwater levels have risen because of nearby irrigation from 4-5 m depth in 1898 to within approximately 1.5 m from the surface presently, making the deeper-buried portions of the site structures inaccessible to further excavation unless a means of dewatering (at least locally) can be found. A Penn State team of four Professors along with undergraduate and graduate students have collected a very large body of hydrological, geophysical, geological and archaeological field observations during the past several years in order to characterize the groundwater flow system, further investigate the buried structures and artifacts that remain beneath the site and develop strategies to allow further excavation. Repeated measurements, including multispectral satellite images, have also been obtained to determine changes in groundwater conditions, and these show that the problem is worsening with time, in part because of a new large irrigation project started in the adjacent wadi just south of the Hierakonpolis site.

Work to Be Completed:

1. Review the interdisciplinary GIS database that has been collected to date and the findings from analyses already completed.
2. Choose a subset of field observations that address some aspect of the site conditions (e.g. spatial and temporal changes in groundwater level, shallow seismic imaging profiles to define subsurface features beneath the site, location of seismically anomalous shallow zones above the water table containing previously undiscovered artifacts, correlation of borehole cores with hydrogeologic and seismic imaging observations).
3. Carry out data processing and analyses necessary to interpret the subset of data selected.
4. Interpret the results in terms of current conditions beneath the site and trends (if any) with time.
5. Incorporate the results into the integrated GIS database on Hierakonpolis.

Team O: Summer Research Experience on the basics of thermodynamics, phase transformations and diffusion

EMS Faculty:*Professor Zi-Kui Liu*
EMS Graduate Student(s): *Hui Zhang, Swetha Ganeshan*
UBMS Instructor: *Pam Monk*
Students:
Ryan Robinson, Grade 12, Lankenau HS (Phila)
Hakeem Jackson, Grade 11, Lankenau HS (Phila)
Marleen Polanco, Grade 10, Reading HS
Shanae Henry, Grade 10, Lankenau HS (Phila)

Thermodynamics is a powerful branch of science that finds its application in a wide variety of areas. It is concerned with the behavior of matter, where matter is anything that occupies space and this matter which is the subject of thermodynamics is called a 'system'. In materials science and engineering, thermodynamics is usually applied to systems involving chemical reactions and is conventionally represented through equilibrium phase diagrams that can be reliably measured experimentally. The main aim of applied thermodynamics is therefore to establish a relationship which exists between an equilibrium state of a given system and the factors that influence the system. [1]. In the present workshop, students will be first introduced to the basics of thermodynamics, following which they will be asked to perform a diffusion couple experiment, thus getting acquainted with the laboratory atmosphere. The experimental research work includes analysis of samples using an optical microscope and SEM, identifying phases and their compositions. The current research experience will help students understand the basic concepts of phase transformations and diffusion, and gain hands-on experience with some of the very advanced characterization techniques which will further enable them to obtain a strong foundation as they step into a professional life.

Lab locations:

Date	Location	Topic
6/19	109, STEIDLE	Introduction of the whole experiments
6/21	21, STEIDLE	Polishing samples
6/26	212, STEIDLE	Put samples into furnace
6/28	109, STEIDLE	Learn how to search references
7/3	20 A, STEIDLE	Learn how to use optical microscopy
7/5	109, STEIDLE	Learn how to use thermo-calc
7/10	212, STEIDLE	Get samples out of furnace and mount samples
7/12	21, 22, STEIDLE	Polish samples again and use optical microscopy
7/17	109, STEIDLE	Prepare reports and presentation files
7/19	109, STEIDLE	Review all the reports and presentation files
7/24	109, STEIDLE	Final Presentations

[1] Mats Hillert, *Phase Equilibria and Phase Diagrams and Phase Transformations*, 1998, pg 1.