

UNDERGRADUATE SCIENCE AND MATH SYMPOSIUM

*Thursday, April 18, 2002
12:00 pm - 5:30 pm*

*Greene Hall
State University of New York
College at Geneseo*

*This Symposium is supported by the Office of
Sponsored Research, SUNY Geneseo.*

Geneseo

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The Departments of Biology, Chemistry, Computer Sciences, Geological Sciences, Mathematics, and Physics and Astronomy of the State University College of Arts and Sciences at Geneseo welcome you to their nineteenth annual Undergraduate Research Symposium. The Symposium offers students the opportunity to give an oral presentation or present a poster on the original research they have carried out in conjunction with Geneseo faculty. This brochure contains the abstracts of their work.

In addition, the Symposium provides an overview of the unique educational opportunities afforded through undergraduate research participation and gives recognition to the remarkable amount of research completed at the College.

2002 Symposium Committee

**Doug Baldwin (Computer Science)
William Brennan, Chair (Geological Sciences)
Charlie Freeman (Physics and Astronomy)
Caroline Haddad (Mathematics)
Duane McPherson (Biology)
Kazu Yokoyama (Chemistry)**

The Symposium Committee would like to thank all of those who have assisted in preparing for the Symposium this year. Many thanks to all of the participating students and faculty who work with them. In particular, we would also like to thank Dr. Doug Harke for all the support he has given this year and in previous years.

ABSTRACTS

AMEY, Suzanne

Department of Biology

THE EFFECTS OF 4-AMINOGUAIACOL AND PHORBOL MYRISTATE ACETATE ON THE EXPRESSION OF RHO GTPASES IN GM 347 MOUSE FIBROBLASTS

(Robert O'Donnell)

Rho GTPases are a family of proteins involved in the regulation and activation of cellular events, including cell-cell adhesion, morphology, motility, gene transcription, growth, death (apoptosis), and cell division. Several studies have demonstrated the requirement for Rho family proteins in the transformation of tumor cells by oncogenic Ras. Although the exact Rho proteins involved in Ras mediation have not been established, many researchers have been looking at the aspects of Rho protein function that contribute to Ras transformation. GM 347 cells, spontaneously transformed mouse fibroblasts, were treated with 4-Aminoguaiaacol (4-AG), an NADPH Oxidase inhibitor, for 2 hours or phorbol 12-myristate 13-acetate (PMA), an activator of protein kinase C, for 1 hour. Control cells were treated with medium for 2 hours or dimethyl sulfoxide for 1 hour. After treatments, cells were harvested and lysed. SDS PAGE was performed using drug treated aliquots, control cell aliquots, and a positive control for Rho GTPase expression. Western Blot analysis with anti-Rho primary Ab and anti-mouse IgG:HRP conjugated secondary Ab revealed that GM 347 cells contain Rho GTPases. Currently, the effects of PMA and 4-AG on Rho content have not been determined. Experimentation is in progress to reveal the quantitative effects of these drugs on Rho GTPase expression in GM 347 mouse fibroblasts, and to determine if 4-AG has an effect on the Rho signaling pathway.

(Oral Presentation)

AUGATIS, Alex

Department of Chemistry

THE SYNTHESIS AND CHARACTERIZATION OF 4-OCTOXY-4'-(CHOLESTERYLOXYCARBONYL)-t-STILLBENE

(Cristina Geiger)

The first objective of this research is to synthesize a Stillbene-cholesterol derivative, 4-octoxy-4'-(cholesteryloxycarbonyl)-t-Stillbene, from the starting compound methyl-4-methylbenzoate. Each step of the synthesis was monitored by using nuclear magnetic resonance (NMR), gas chromatography (GC) and thin layer chromatography (TLC). Once the product was obtained, its gelation ability in different organic solvents was investigated. The photophysical properties of the most stable gels were investigated by absorption and emission spectroscopy. Stilbenes are very sensitive to photoisomerization, therefore all the synthetic and gelation procedures were carried out in the dark.

(Poster Presentation)

BALDWIN, Christine and BRUZA, Mirela

Department of Chemistry

METABOLIC ACTIVATION OF NADPH OXIDASE INHIBITORS

(David Johnson)

NADPH oxidase is an electron transport system in the endothelial cells (EC) which results in the generation of superoxide (O_2^-). The ortho-methoxy - substituted catechols, apocynin (4-hydroxy -3-methoxyaceto phenone) which is isolated from Picrorhiza kurroa, a traditional medicinal plant, and 4-aminoguaiacol (4- amino-2-methoxyphenol) which is synthesized from 4-nitroguaiacol are known NADPH oxidase inhibitors. These compounds inhibit the release of the superoxide anion (O_2^-), by preventing the assembly of a functional NADPH oxidase complex. The chemistry responsible for this inhibitory activity has been investigated. The reaction of apocynin and 4- aminoguaiacol with reactive oxygen species (ROS) and peroxidase yield symmetrical dimers formed through the formation of a 5,5' carbon-carbon bond. These dimers immediately inhibit NADPH oxidase. 4-Aminoguaiacol is a more potent inhibitor of NADPH oxidase than apocynin. The purpose of our research is to explore this difference in activity of these compounds by studying the role that cysteine plays in the inhibition of the dimerization reactions. The dimerization reactions of apocynin and 4-aminoguaiacol with and without cysteine will be compared and contrasted using HPLC analysis.

(Poster Presentation)

BECK, Denise

Department of Physics And Astronomy

THE DECAY OF ATOMIC ISLANDS: A COMPARISON OF CONTINUUM AND SIMULATION MODELS

(James Mclean)

The Gibbs-Thomson effect states that small islands need more atoms surrounding them to be in equilibrium. If a small island, which is surrounded by a high-density of atoms, is placed next to a large island, which is surrounded by a low-density of atoms, then the atoms will diffuse away from the smaller island and surround the larger island to form a state of equilibrium. This helps atoms move out of islands, smoothing out roughness of atoms on a surface. This is particularly useful when dealing with semi-conductors. MBE (Molecular Beam Epitaxy) is commonly used, where epitaxy is the building up of atoms on a surface. A smooth surface is wanted to create a perfect crystal structure. The rate at which atoms smooth themselves out competes with the rate at which they are thrown at the surface to form this smooth surface. A balance between the two is needed to have the smoothest possible surface. Otherwise the atoms will build up, forming lumps instead of dispersing. I have run computer simulations of islands of atoms where the atoms left and returned to the island at random. Then I ran computer simulations of islands of atoms in pits. The atoms diffuse away from the island and end up on the wall of the pit. Then the data was analyzed to determine a relationship between the initial island size and the time needed for complete diffusion. This problem can also be solved using a continuum model. This was developed and compared to the computer simulation. The diffusion equation used was $k \cdot \frac{\partial \mathbf{r}}{\partial t} = \nabla^2 \mathbf{r}$. Where \mathbf{r} is the area of the

island and k is some constant. For our particular model $\frac{\partial \mathbf{r}}{\partial t} \approx 0$. I solved the diffusion equation and

determined a functional form of island size versus time. This should verify that the model used applies to the diffusion equation for a circular island in a circular pit.

(Oral Presentation)

BRAMAN, Reed

Department of Chemistry

DESIGN OF A NEW TETRADENTATE LIGAND WITH HARD AND SOFT DONOR SITES

(Dave Geiger)

Complexes exhibiting excited-state properties consistent with a high degree of charge separation are of inherent interest for a number of reasons. One is their potential use in emerging technologies such as the design of molecular-scale electronic devices. Another is their applicability in the design of supramolecular systems for the conversion of light energy into chemical energy. Square planar platinum(II) diimine complexes are known to exhibit properties that make them good candidates for use in such systems. In particular, the long-lived, highly directional nature of their charge-transfer excited states is ideal for electron-hole creation and separation. The coordinative unsaturation of square planar complexes also renders them of interest for sensor applications. We will describe our efforts to synthesize a new tetradentate ligand that has the potential to form square-planar platinum(II) complexes with the desired photophysical and ligand addition properties. We have performed a Schiff base condensation employing 1,2-diaminobenzene with 2-thiophenecarboxaldehyde. The diaminobenzene moiety provides two hard base, electron accepting diimine sites and the sulfur of the two thiophene groups provide two soft base, electron donor sites. Together, the four ligand sites provide the well-established requisite ligand motif for luminescent platinum(II) complexes. The synthetic procedure and characterization will be discussed.

(Poster Presentation)

BURKE, David and DECIANTIS, Joseph

Department of Physics And Astronomy

CALIBRATION OF PLASMA CALORIMETERS

(Charles Freeman)

The Laboratory for Laser Energetics (LLE) at the University of Rochester uses a set of plasma calorimeters to study the plasma energy of laser-irradiated targets. Seventeen of these plasma calorimeters are mounted around the implosion site on the OMEGA target chamber. Each calorimeter consists of two 25 μm thick tantalum foils and a copper reference plate of equivalent thermal mass. A set of type-E thermocouples is used to make three differential temperature measurements (foil 1-reference, foil2-reference, and foil 1-foil 2). We are developing a technique to calibrate the response of these plasma calorimeters using proton beams of several hundred keV from the 2MV Van de Graaff accelerator located at the Geneseo Nuclear Structure Laboratory (GNSL). Using a pair of electrostatic deflector plates, the proton beam is directed toward each of the calorimeter foils. The protons deposit their energy on the calorimeter foil, causing an increase in the foil temperature. The calorimeter thermocouple output signals are sent to a LabVIEW acquisition system for analysis. The beam current is measured directly by sending the charge deposited on the calorimeter through an electrometer. A bias is placed on the calorimeter housing and is used to provide electron suppression. A gold foil is placed in front of the calorimeter foils and is used as a second monitor of the beam current via Rutherford scattering. The results of these calibrations will be discussed.

(Oral Presentation)

CASTLE, Jennifer

Department of Geological Sciences

**TAXONOMIC DIVERSITY OF THE TRILOBITE GENUS PHACOPS IN THE UPPER WINDOM SHALE, SMOKE CREEK BED AND TAUNTON BEDS
(Jeff Over)**

The Smoke Creek Bed and the Taunton beds are strata of the Windom Member of the Moscow Formation, Middle Devonian, in western New York State. The Smoke Creek Bed consists of a medium gray shaly limestone, and is exposed along the stream bed at Fall Brook in Geneseo, New York. At Fall Brook, the Taunton Beds overlie the Smoke Creek Bed, with a possible unconformity between the two beds. The Taunton Beds consist of medium gray calcareous shale with thin beds of limestone. Both the Smoke Creek Bed and Taunton Beds contain a diverse fauna including trilobites, brachipods, crinoids, conodonts, and corals. Based on morphogenetic differences in the genus Phacops, evolution in a time of relative stasis is demonstrated.

(Oral Presentation)

CONSTANTINE, Charles

Department of Chemistry

SYNTHESIS OF NOVEL BIPHENYL-CHOLESTEROL COMPOUNDS

(H. Cristina Geiger)

Organogels is an area of chemistry that has only recently been begun to be aggressively researched. The goal of most studies is to further the understanding of exactly how a gel forms. In order perform such studies, a library of similar compounds must be created. To further the studies of the gelation abilities of biphenyl-cholesterol compounds, we have synthesized a series of biphenyl fatty acids connected to a cholesterol moiety through an ester link. Herein reported are the results of several synthesis schemes, and observations on the formation of gels.

(Oral Presentation)

CRANDALL, Michelle

Department of Biology

HIGH RESOLUTION STUDY OF LATE HOLOCENE POLLEN FLUCTUATIONS, LAKES OF THE CLOUDS, NH

(Ray Spear)

A high-resolution study of pollen fluctuations over the past 5,000 years at Lakes of the Clouds, NH was performed to look for evidence of climatic changes at high elevations. The paleoecological site, Lakes of the Clouds, NH, is 0.43 ha in size, approximately 2.2 m deep and is located 1.7 km southwest of the summit of Mt. Washington at an elevation of 1542 m. Because of the elevation, the vegetation at this site just above tree line is particularly sensitive to even small climatic fluctuations. A loss-on-ignition analysis on subsamples from the 98-2 core taken from this site revealed a significant increase in the percent organic matter from 90-100 cm. In order to understand whether this increase in percent organic matter was related to vegetation change, pollen counts were done every centimeter over the 90-105 cm range. Additional counts were recorded every 5 cm over the 20-110 cm range. Factors that we observed from the pollen counts included variations in pollen types that typically occur in the alpine zone. A decline in Hemlock pollen occurs in virtually all records in the Northeast at 4800 years. This decline also appears to occur in the pollen record at Lakes of the Clouds.

(Poster Presentation)

DANIEL, Brian
Department of Mathematics
SCATTERING THEORY
(Andrzej Kedzierawski)

Wave propagation is an important phenomenon in physical sciences and applied mathematics. The inverse problem of determining an unknown obstacle from the knowledge of an incident wave and the resulting scattering pattern is explored mathematically and solved numerically. We present programs written in Maple that accurately simulate the nature of the scattered wave assuming the knowledge of incident wave and the obstacle.

(Oral Presentation)

DOBLER, Russ
Department of Geological Sciences
SEISMIC STRATIGRAPHY IN WESTERN NEW YORK
(William Brennan)

Reflection seismology is a widely used method of imaging the subsurface in areas underlain by stratified rocks. Seismic energy injected at the surface is used to "take pictures" of layering in the subsurface. The resolution of such seismic images on field seismograms is dependent on the wavelength of the injected energy; shorter wavelengths provide images of higher resolution. For comparison, the visible light used to observe and photograph macroscopic objects consists of electromagnetic radiation with wavelengths of approximately 10^{-7} m. Higher resolution is needed to image sub-microscopic objects. Thus, electron microscopes utilize electromagnetic radiation with wavelengths of approximately 10^{-10} - 10^{-12} m. When physical properties such as seismic velocity and density of subsurface strata are known from borehole measurements, the data can be used to generate synthetic seismograms that are useful aids in interpreting field seismograms. Two synthetic seismograms generated using the physical property data from a single borehole located in western New York are presented as examples. The two images exhibit different resolutions because each was generated using a different waveform. Additional examples from outside the region are also presented.

(Oral Presentation)

ERHARDT, Robert and BALL, Steve
Department of Physics And Astronomy
MACROSCOPIC MANIFESTATIONS OF QUANTIZED CONDUCTANCE
(James Mclean)

The purpose of this project is to demonstrate that conductance through a very small (a few nanometers wide) wire contact is quantized. Our motivation is a macroscopic manifestation of the quantum mechanical properties of electrons in metal. When two wires are held in loose contact and then pulled apart, tiny nanowires form as the two large wires separate. The conductance through this tiny contact is quantized. We have constructed a circuit that is capable of demonstrating this effect. Audience members will be able to run the circuit themselves and see the data taken in real time. Our future goals are to vary the type of metal in contact, and the environment of the contact.

(Poster Presentation)

FLEMING, Matthew

Department of Chemistry

**ARACHIDONIC ACID SIGNALING CONTROLS THE GROWTH AND STABILIZATION OF
THE BRANCHES OF DEVELOPING RETINOTECTAL ARBORS IN ZEBRAFISH DANIO**

(Dr. John T. Schmidt, Univ. At Albany)

During development, retinal ganglion cell axons grow into the brain and form a crude map of the retinal surface on the optic tectum. Visual activity then sharpens this map using the natural correlation in activity between neighboring (but not distant) ganglion cells in the retina. Summation of postsynaptic potentials activates postsynaptic NMDA receptors for calcium entry and leads to the stabilization of correct trial branches in the developing retinal arbors via unknown retrograde signaling pathways. There is an enhanced capacity for long-term potentiation (LTP) of synaptic transmission during the sharpening process, so that LTP may serve as the first stage in sharpening. Protein kinase C (PKC), which is activated by arachidonic acid (AA), is necessary for induction of LTP. The AA-PKC pathway is a likely candidate for the retrograde messenger involved in synaptic development because it also mediates the stimulation of growth by NCAM and L1 surface binding in growth cones before synapses are formed. We have established that blocking NMDA receptors with the selective inhibitor MK801 causes not only larger arbors, but also causes an increase in the rates of addition and deletion of trial branches (branch turnover). Seemingly the signal to stabilize new branches in the arbor has been lost. Blocking PKC with bisindolylmaleimide causes the same dynamic increase in branch turnover, but more strongly prevents the maturation of arbor morphology, producing a more profound effect than blocking NMDA receptors. AA is one of the primary signals for activating PKC and is produced by two separate enzyme pathways: Diacylglycerol (DAG) lipase, which is presynaptic and acts after phospholipase C releases DAG, and Phospholipase A2, which is postsynaptic and activated by cytoplasmic calcium influx through NMDA receptors. In addition, AA can diffuse across the membrane and stimulate phospholipase C to produce more DAG and (via DAG lipase) more AA (a positive feedback pathway). Our results showed that blocking DAG lipase with the specific inhibitor RHC 80267 produced the same characteristics in the developing arbors as did blocking PKC (immature morphology with high branch turnover rates). This indicates that the AA-PKC pathway in the presynaptic cell is important in control of arbor maturation and branch dynamics by via stabilizing of new branches. As these new branches become stable, they can defasciculate further to generate an arbor. Further experiments will test how this presynaptic AA signal is triggered by the postsynaptic calcium entry through NMDA receptors. We will then examine whether this synaptic feedback occurs via postsynaptic production of AA from phospholipase A2 activation by selectively blocking this enzyme.

(Oral Presentation)

FLESZAR, Sara

Department of Chemistry

APOA-I, APOA-II-, AND HDL-FACILITATED CHOLESTEROL EFFLUX

(Lihua Jin)

Atherosclerosis is the narrowing of the arterial wall due to the buildup of lipids. In humans, the risk for atherosclerosis is inversely correlated with the levels of plasma high-density lipoproteins (HDL) because of its active role in removing excess cholesterol from periphery tissues back to the liver for catabolism.

Specifically, HDL and its major lipoprotein components facilitate cholesterol efflux from plasma membranes. The goal of this work was to better understand HDL- and apolipoprotein-facilitated cholesterol efflux, specifically, to find out whether lipid free apoA-I and apoA-II facilitate efflux via the same mechanism as HDL. Small unilamellae vesicles (SUV) of phospholipids and cholesterol were used as model systems for the lipid bilayer of biological membranes. Native polyacrylamide gel electrophoresis (PAGE) was used to detect lipid binding and new lipoprotein particle formation as a result of facilitated lipid efflux. It was observed that both apoA-I and apoA-II formed lipoprotein particles upon binding to SUV and thus promote phospholipid and cholesterol efflux. Increasing cholesterol content in SUV decreased binding of apoA-I to SUV and new particle formation thus lipid efflux. The same trend was observed for apoA-II, but apoA-II was more efficient in promoting cholesterol/phospholipid efflux than apoA-I. On the contrary, increasing cholesterol content in SUV increased apoA-I-HDL binding to SUV and lipid efflux. These results were obtained for SUV prepared with two different phospholipids. These results suggested that apoA-I and apoA-II promote phospholipid and cholesterol efflux via a different mechanism as compared to HDL. Lipid free apoA-I and apoA-II, if present in the plasma, might target mainly the cholesterol poor regions of the plasma membrane, generating cholesterol-poor HDL particles that in turn would target cholesterol-rich domains of the membrane and thus directly facilitate cholesterol efflux. This work also represents the first time that Native PAGE method was used in directly examining lipid efflux. It proved to be a fast, easy, and informative technique that should find more use in the future.

(Poster Presentation)

GALLO, Anthony

Department of Biology

CAGED ACETATE AS A PROBE FOR THE MECHANISM OF CHEMOACCUMULATION IN THE COLONIAL GREEN ALGA ASTREPHOMENE GUBERNACULIFERA.

(Harold Hoops)

A. gubernaculifera responds to acetate with a well-developed chemoaccumulation response. To date we have not been able to determine the mechanism that underlies this accumulation, largely because it is difficult to produce defined changes of acetate concentrations localized in space and time. We are attempting to circumvent these problems by using caged acetate. The process of "caging" the acetate allows the acetate in caged form to be present without having it elicit a response. Upon UV irradiation, the covalent bond between the cage and acetate is hydrolyzed, and free acetate is produced. TLC analysis indicates that the majority of the acetate is released in less than a second. Experiments were conducted with 50ml of solution on a carbon-coated slide. Acetate was released from its organic cage by the UV light source of an epifluorescent Zeiss Axioskope microscope. Colony motility was monitored using a Cohu video camera attached to a PAL VCR for recording and simultaneously through a monitor for frame-by-frame analysis. Long-term irradiations resulted in chemoaccumulation at the site of irradiation. We are presently analyzing the data to determine if we can detect shorter-term colonial responses.

(Poster Presentation)

GERMANI, Christina
Department of Chemistry
SPECTROSCOPIC STUDIES OF CYTOCHROME-C
(Kazushige Yokoyama)

Cytochrome-c is a protein whose polypeptide chains are folded into specific conformations, which are dependent on the amino acid sequence. It is a four-helix-bundle heme protein that is soluble and has the slowest folding rate of its structural class. Much focus has been directed toward the folding mechanism of this protein though, triggering methods have not been well explored. The electron transfer from a solvent to cytochrome-c is thought to trigger protein folding. Our objective is to investigate how cytochrome -c structures are affected by an electron transferred from a solvent. We have conducted UV-visible absorption spectrum studies of cytochrome-c at a pH of 7 and room temperature condition in order to identify a certain form of the protein. The fluorescence spectra were collected under various excitation wavelengths and we have found that the features of the spectra were drastically changed depending upon the concentration of the solution. We also utilized femtosecond transient transmission spectroscopy technique and found that cytochrome-c exhibits a relatively fast time constant for relaxation of the excited state. However, this time constant did not depend on the concentration of the solution.

(Poster Presentation)

GROSNICK, Gerhard and FITZGERALD, Caitriona
Department of Computer Science
DATA REPLICATION
(Homma Farian and Kirk Anne)

Our research addresses the need for efficient, scalable replication of content across hosts in a local-area network. As network traffic continues to increase, bottlenecks occur due to the high number of users accessing the same server. Replication allows a data set to be automatically copied to multiple servers, therefore, decreasing access time. In our research, we will be studying data replication through the use of Rsync and other tools.

(Poster Presentation)

HALL, Lauren; JULIAN, Meaghan; LESTER, Michael; NIXON, Jacquelyn; PARTRIDGE, Karyn;
REYNOLDS, Aubrey; SCHULTZ, Jessica; SHUMWAY, Allison; and WILCOTT, Matthew
Department of Geological Sciences
THE TRUTH BEHIND THE TROPHY: FRESHMEN GEOLOGISTS EXAMINE POSTER PAPER
WEIGHT
(Phil Boger, Richard Hatheway, William Brennan, Jeffrey Over, Amy Sheldon, and Richard Young)

The Italian marble paper weight awarded to research poster participants in 1999 was analyzed by 10 freshmen geology majors. The paper weight was sliced, thin sectioned, bombarded with electrons, stressed, strained and dissolved in hydrochloric acid. Petrographic analysis of the thin section indicates that the marble is fine-grained crystalline and has a high clay mineral content. The marble is composed of calcite, and the metal plate is aluminum anodized to give the appearance of gold. Stress and strain analysis yielded a uniaxial compressional strength of 13,560 psi, a value weaker than most marbles. Cation analysis of dissolved marble detected Ca++. The marble is weak, fine-grained, and of quality suitable for a paper weight but little else. Although the gold-colored metal plate is aluminum, it is functional and appealing to the eye.

(Poster Presentation)

HARTIGAN, Adam

Department of Biology

APOPTOSIS OF PROSTATE CANCER CELLS INDUCED BY 4-AMINOGLUAICOL

(Robert O'Donnell)

Apoptosis, or programmed cell death, is the suicide of a cell when it is no longer needed or damaged. Cells undergo apoptosis for one of two reasons. One is for proper development; cells are destroyed when they are no longer useful and need to be removed. The second reason is to eliminate cells which pose a threat to an organism. It is this property of apoptosis, which may ultimately lead to the destruction of cancer cells. In preliminary experiments prostate cancer cells exposed to 4-aminoguaicacol for two or three days showed significant cell death over a range of drug concentrations. 4-aminoguaicacol has also been shown to kill prostate cancer cells at a concentration of 1.25mM when incubated for one hour. It is hypothesized that this drug induces apoptosis in prostate cancer cells. To determine if the cells undergo apoptosis in the presence of 4-aminoguaicacol, fluorometric assays are performed on the cells after incubation with the drug. The assay measures the caspase levels found in cells that have undergone apoptosis. The initial data from this study suggests that 4-aminoguaicacol does not induce apoptosis in prostate cancer cells, as no significant levels of caspase proteins were detected after 24 or 48 hours. This conclusion suggests that the prostate cancer cells undergo apoptosis before 24 hours or the cells simply die by necrosis.

(Poster Presentation)

HOLLAND, Ryan

Department of Chemistry

GELATION ABILITY AND PHOTOPHYSICAL STUDIES OF NOVEL BIPHENYL-CHOLESTEROL COMPOUNDS

(H. Cristina Geiger)

Although gels have been known since the 1800's, the study of thermally reversible organogels, obtained from a series of organic liquids and low concentrations of relatively low molecular mass gelators, has been addressed with more enthusiasm only during the last 20 years. The understanding of the formation of gels at the microscopic level, the role of the solvent, the nature of the aggregate structure, etc. is the focus of recent investigations. We want to investigate the influence of the tethered chain between the aromatic chromophore and the cholesterol moiety on the gelation ability. We attempt to determine which are stronger forces during aggregation, are they aromatic -aromatic interactions or the stacking of the cholesterol units? Herein is reported the gelation ability of a series of novel biphenyl-cholesterol compounds, in different organic solvents, their phase transition temperatures, and the nature of aggregates formed.

(Oral Presentation)

HOTTO, Amber

Department of Biology

THE HOLOCENE RECORD FOR CLIMATIC CHANGE AT SPECK POND, MAINE

(Ray Spear)

We have investigated past short term climatic variability using sediment samples taken from Speck Pond (1047m) in the White Mountains of Maine. Speck Pond is 3.64ha in size and has a maximum water depth of 11.2m. The surrounding vegetation consists of conifer forest dominated by fir (*Abies balsamea*) production. The subalpine fir is sensitive to climate variation along the mountain slopes. The 5.68m sediment core from Speck Pond was subsampled every 0.5 cm by colleagues at the University of New Brunswick. Time series analysis on fluctuations in the percent organic matter (LOI) in the sediments showed periodicity, presumably related to climate fluctuations. Chironomid samples taken from the core showed an 8200 year cooling event. Our work focuses on variability in the pollen record of fir over time. A drop in fir pollen produced potentially indicates a climate event. Conifer pollen was counted at depths from 250 to 450 cm every 2 cm, and plotted as a pollen diagram using the computer program TILIA. Fluctuations in the fir pollen record are compared to those of LOI to determine whether there is evidence of climatic fluctuations in the past, and if these fluctuations occur with periodicity.

(Poster Presentation)

JASSAL, Pushpinder

Department of Mathematics

INTERVAL ANALYSIS

(Andrzej Kedzierawski)

We examine the concepts and techniques of interval arithmetic. Interval arithmetic is based on the idea of treating a real number as a new type of number, the interval. We define the basic operations on intervals and explore their mathematical properties. We examine the use of this technique to solve different mathematical problems. For instance, using interval arithmetic, non-linear optimization procedures are implemented in C and Java.

(Oral Presentation)

JOYNT, Michael

Department of Biology

ETHANOL'S EFFECTS ON THE CELLULAR ADHESION OF CCL-131 NEUROBLASTOMA CELLS

(Robert O'Donnell)

Ethanol has been proven to inhibit the adhesion of neurons during development. Cells not exposed to ethanol show increased adhesion to one another as compared to ethanol treated cell lines. Ethanol interacts with the hydrophobic pocket within the L1 molecule, a neural cell surface protein that is imperative to cell-cell adhesions, as well as axon growth, fasciculation, and neural migration. In order to investigate this effect, experiments were begun using CCL-131 cells as a model system. CCL-131 is a neuroblastoma cell line which shows many of the *in vitro* properties of nerve cells. Preliminary experiments showed that these cells could grow in concentrations of ethanol less than 175 mM, and no morphological changes were observed. Experiments are underway to set up a cell adhesion assay for CCL-131 cells and to use it to determine if ethanol can inhibit adhesive properties of these cells. These experiments will provide insight into the relationship, on the cellular level, that alcohol has with fetal alcohol syndrome, and other alcohol related diseases.

(Poster Presentation)

LAAKSO, Joseph and TABACZYNISKI, Alaina

Department of Chemistry

INTERACTIONS OF APOA-I WITH SUV OF VARYING PHOSPHOLIPID CONTENT

(Lihua Jin)

Atherosclerosis is a progressive disease that begins as intracellular lipid deposits in the smooth muscle cells of the inner arterial wall, leading to reduced blood flow and eventually cardiovascular diseases (CVDs). In humans, the risk for CVDs is inversely correlated with levels of high-density lipoproteins (HDL), which are actively involved in the mechanism of cholesterol efflux from peripheral tissue cells. Previous experiments in Dr. Jin's lab have shown that apolipoprotein A-I (apoA-I) is the major protein component of HDL. It has also been shown that apo A-I binding to model lipid membranes consisting of egg phosphatidylcholine increases with decreasing cholesterol content. This finding suggests that apoA-I targets membrane domains low in cholesterol, while HDL targets membrane domains high in cholesterol. HDL and lipid-free apoA-I therefore act in concert to regulate the level of phospholipid and cholesterol of cellular membranes. The ATP binding cassette transporter protein 1 (ABC1) has also been found to have a direct interaction with apoA-I. ABC1 is a 'flippase' that catalyzes the flipping of phospholipid molecules from the inner leaflet to the outer leaflet of the plasma membrane, creating membrane domains low in cholesterol. Using small unilamellar vesicles (SUVs) as model membrane systems, we will attempt to see if the results earlier obtained, showing that apoA-I binds preferentially to membrane domains low in cholesterol, holds true for a variety of phospholipids. We have already prepared and purified SUVs containing varying amounts of PS, sphingomyelin, phosphatidylcholine, and cholesterol by ultrasonic processing and size exclusion chromatography. The purified SUVs will then be incubated with apoA-I to examine apoA-I binding abilities to the various SUVs.

(Poster Presentation)

LEFEVER, Tammi

Department of Biology

THE INFLUENCE OF LEAF POSITION ON PETIOLE LENGTH IN SUGAR MAPLE

(George Briggs)

Most plants are presented with a problem of distributing leaves in such a way as to minimize the amount of self-shading. A number of species exhibit "leaf mosaics," with leaves displayed in such a manner that there is little overlap among them. We have been studying this phenomenon in sugar maple (*Acer saccharum* Marshall) with the goal of understanding both the features and the developmental events that result in leaf mosaics. In this study we observed the influence of petiole length in forming leaf mosaics. We found that petiole length varies with the position of the leaf along the branch in ways that reduce the amount of shading that leaves are exposed to. We noted two trends. One was that petiole length is longer in leaves further from the stem apex. Part of this was associated with a general trend of larger leaves in positions further from the tip but the ratio of petiole length to lamina length also increased in leaves further from the stem apex. A second trend we observed was that when pairs of leaves were oriented with one member of the pair above the branch and one member below, the leaf below the branch consistently had a longer petiole than that of the leaf above, reducing the shading by the leaf above. In contrast, when pairs of leaves were oriented "side-by-side" petiole lengths of each member of the pair were comparable. Possible developmental processes that might account for these patterns will be presented.

(Poster Presentation)

LEHANE, James

Department of Geological Sciences

**SCAVENGING REMAINS ON A LATE PLEISTOCENE CAVE BEAR, *URSUS SPELAELUS*
FROM CHISCÁU, ROMANIA**

(D. Jeffrey Over)

An adult male specimen of Ursus spelaelus, the Pleistocene cave bear, was collected from a cave in Chiscáu, Romania. The bear was found articulated and was thought to have died in the place of discovery. Scanning Electron Microscope analyses of the forepaw metatarsals show that contemporary predators likely scavenged the cave bear. Teeth marks on the bone left characteristic marks: piling of bone adjacent to a crescent shaped grooves that range in length from 1 to 2 millimeters, and elongated canal structures that range in length from 0.2 to 0.3 millimeters. These are similar to marks made by modern day scavengers, as shown by small dog and mice marks observed on modern pig bones. These are distinctly different from marks produced by human tools. Two different sizes and types of marks indicate that different scavengers fed on the bear. Wolves, other small canids, and rodents could leave marks of these sizes and form. The bones are largely articulated and posses minimal fracturing, indications that the carcass was not scavenged by larger predators such as hyenas.

(Poster Presentation)

MCCARTHY, Todd

Department of Geological Sciences

STRATIFICATION OF A LOCAL STREAM POOL, MOUNT MORRIS, NEW YORK

(Amy Sheldon)

A small pool in Buck Run Creek, Mount Morris, New York, becomes stratified under certain stream flow conditions. Stratification of such a shallow pool in a flowing stream is unusual because the stream water is subject to mixing. A previous study (Vacco, 2001) characterized the aqueous chemistry of the surface and bottom waters within the shallow pool and presented a hypothesis to explain the mechanism for stratification development. The purpose of this study is to determine if algae present within the pool affects the water chemistry and to examine the degree to which the pool is stratified during periods of high and low stream flow. In addition, the results of this study will determine the time required for stratification to be re-established after large rain events flush the pool.

(Poster Presentation)

MIRABELLO, Matthew

Department of Biology

DIFFERENCE IN PERCENT COLOR OF DORSAL PATTERNS AT METAMORPHOSIS DUE TO TADPOLE RAISING ENVIRONMENT OF *DENDROBATES AURATUS* AND *DENDROBATES TINCTORIUS*

(Greg Hartvigsen and George Briggs)

For *D. auratus*, tadpole diet and influence by raising with conspecifics were varied simultaneously by comparing four test groups for two different diets and for group versus singly raised tadpoles. For *D. tinctorius* the diet was kept the same for all experiments. The dorsal patterns above the orbits, for *D. auratus*, and the entire dorsal area enclosed by yellow pigment, for *D. tinctorius*, were recorded by scanning the frogs using an inverted flat-bed scanner. The percent cover by color was then calculated using IT, a PC imaging tool. For *D. auratus*, using an ANOVA, the percent cover by color of the dorsal pattern over the orbits is significantly different between tadpoles raised in groups and tadpoles raised singly ($F=10.91233$, $df=(1,30)$, $p=.002$). There was no statistical significant difference between dorsal eye pattern for the two different diets ($F=.634$, $df=1$, $p=.432$). For *D. tinctorius* it was found that tadpole rearing environment did not influence the percent yellow of the dorsal pattern ($t=-.967$, $df= 10$, $p= 0.36$).

(Poster Presentation)

MIRABELLO, Matthew

Department of Biology

ANALYSIS OF ION EXCHANGE CAPACITY OF SPHAGNUM MOSS USING PH AND ATOMIC ABSORPTION SPECTROSCOPY.

(George Briggs)

Sphagnum moss has long been studied for its ion exchange capacity, or ability to hold nutrients in deficient environments. Here we analyze a basic protocol for measuring this in lab, and applications for use as a laboratory teaching tool. A glass column of sphagnum moss was set up with linear mass density of sphagnum moss of 0.12 g/cm (dry weight). It was rinsed and unloaded of native cations using .100 L H₂SO₄(aq) (pH 3), then loaded with .100 L of 1 pMg Mg SO₄. A .100 L aliquot of distilled water was poured through the column five times, the pH recorded with a pH meter and a .010 L fraction was removed for later analysis. The volume was brought back to .100 L and the pH brought to 3.03 and the cycle continued. The Mg concentration in the fractions was analyzed using atomic absorption spectroscopy, and entered into Excel. The ratio of Mg eluted to H⁺ taken up was .46+.02; this was very close to the expected ratio of 0.500. The amount of galacturonic acid sites, which chelate Mg²⁺, was calculated to be 1.66 *10⁻⁴ moles per g of dry sphagnum. This experiment allowed us to see the limits of ion exchange capacity with respect to pH. Students can use this technique in lab to better understand ion-exchange capacity by analyzing Mg content by measuring the mass of dehydrated fractions (in the absence of atomic absorption).

(Poster Presentation)

MROZ, Renee

Department of Biology

STIMULATION OF NADPH OXIDASE USING THE HL-60 CELL LINE AND FMLP

(Robert O'Donnell)

NADPH oxidase is part of the electron transport chain complex and is found in the plasma membrane of some mammalian cells. It is responsible for the production of superoxide anions. Superoxide anions in excess have been known to cause cells to build up plaque on the lining of the artery wall, thereby leading to atherosclerosis (heart disease). In this study, two stimulators of NADPH oxidase were used. The peptide fMLP(N-formyl-methionyl-leucyl-phenylaline) is a bacteria derived product, reported to induce assembly of NADPH oxidase and cause the production of superoxids anions in neutrophils. PMA (phenol myristate acetate) is a well known tumor promoter and activator of cells through the protein kinase C signal pathway. The objective of this research is to test the stimulatory ability of fMLP on HL-60 cells and to determine if it can be used as a model for an oxidative burst in these cells. Preliminary studies reveal that fMLP can stimulate an oxidative burst in HL-60 cells, as well as PMA. Studies are now underway to determine if the drug 4-aminoguaiacol is able to inhibit fMLP effects on free radical production in the same way it does with PMA.

(Poster Presentation)

PENKE, Nicole and WHIPPLE, Kathy

Department of Chemistry

DYNAMICS AND STRUCTURE OF ALBUMIN-CONGO RED DYE COMPLEX

(Kazushige Yokoyama)

Aggregation and structural transformation can be associated with certain diseases such as Alzheimers. We are looking at similarities between albumin and structurally comparable proteins that are involved with these diseases. This may give insight into their folding pattern and the development of the disease. Since certain binding is considered to lead to protein aggregation, the aggregated form of Albumin was investigated by using a Congo Red dye (CR), a probe to detect binding, through spectroscopic methods. The CR solution was mixed with Albumin denatured under various conditions such as (1) under presence of detergent or (2) addition of denaturing agent (i.e., guanidine hydrochloride) or (3) treating albumin at 80oC. The effect of denaturing was found more sensitive in the CD and fluorescence measurements. These spectroscopic results will be used to clarify a possible binding site of dye to albumin as well as the denatured structure of albumin. In addition to the steady state measurements, the femtosecond transient transmission was conducted, and the effect of heat treatment in relaxation dynamics of complex was studied.

(Poster Presentation)

PIWOWAR, Alan

Department of Chemistry

AB INITIO STUDY OF A SALICYLATE COMPLEX ON A TITANIUM DIOXIDE SURFACE

(Kazushige Yokoyama)

Salicylic acid is a well-known compound used in a variety of pollutants such as pesticides, herbicides and disinfectants. This species is known to absorb on the surface of TiO₂ to form a salicylate complex. The light-induced oxidation of the salicylate in the presence of titanium dioxide particles is used to decompose this complex and the understanding of this reaction intermediate is of great concern in order to clarify the degradation mechanism. The goal of our research is to determine the structures of the surface complex which could be closely related to the intermediate of this photodegradation reaction. Our aim is to characterize the adsorbed complex by performing ab initio calculations at the Hartree-Fock level. We have been investigating the angle between the aromatic ring plane versus the TiO₂ surface plane (parallel or perpendicular) and the effect of the distance between the oxygen atom of the salicylate and the titanium atom (adsorption site). Our preliminary results show that the optimum position of the salicylate is significantly affected by interaction between the hydrogen atoms of the aromatic ring on the salicylate and the Ti-O₂ surface.

(Poster Presentation)

PYTLAK, Melissa

Department of Biology

INTERSPECIES COMPETITION IN TWO VARIETIES OF FAST GROWING PLANTS

(George Briggs)

The environment in which a plant grows can have an impact on its growth and development. This research focused on interspecies competition and its effects on fast plants. Fast plants have been bred to complete their life cycle rapidly. The two varieties used were *Brassica rapa* 'Wisconsin Fast Plant' and *Raphanus sativus* 'Rapid Radish.' A common ecological idea is that fast growing plants (r-species) will be poorer competitors than slow growing species (K-species). Seeds were planted in a series of five different treatments, with ten plants per pot: 10 seeds of Fast Plant (no Radish), 10 seeds of Radish (no Fast Plant), 5 seeds of each, and 9 to 1. The yield of each plant was calculated by seed production. Radish was the stronger competitor based on seed yield. It outperformed the Fast Plant in mixed-species pots. It had the lowest average yield for the intraspecies treatment. The Fast Plant fared poorly in competition with the Radish, but did extremely well in the intraspecies treatment. In this case, the Fast Plant was the r-species and the Radish was the K species. This supports the ecological idea that K-species are better competitors.

(Poster Presentation)

RENAK, Jennifer

Department of Biology

4-AMINOGLUAICOL: FRIEND OR FOE?

(Robert O'Donnell)

Previous experiments with 4-aminoguaicolic acid, a derivative of apocynin, have shown a high percentage of both cytotoxicity and free radical inhibition using human neutrophils. Questions arose as to whether free radical inhibition resulted from drug interaction with NADPH oxidase, or if cytotoxicity depleted cell concentration making it appear that less free radicals were produced. Human leukemia (HL-60) cells were used to test this theory. Cells were treated with different concentrations of 4-aminoguaicolic acid, washed, and then tested for free radical inhibition with the dihydrofluorescein assay. Statistical analysis using SSPS was performed on each experiment. Initial results suggest that inhibition occurs in drug treated cells. Examination of viability demonstrates that cell death also occurs. Experiments are underway to determine if the percent cell death is comparable to the loss of free radical production. This will be important in determining the use of this drug as a potential NADPH oxidase inhibitor if its inhibitory ability can be separated from its cytotoxicity.

(Poster Presentation)

SCHULTZ, Kevin and DELSIGNORE, Mike

Department of Chemistry

THE SYNTHESIS AND STABILITY STUDIES OF 4-AMINOGLUAICOL

(David Johnson)

NADPH oxidase is an electron transport system in the endothelial cells (EC) that is involved in the generation of superoxide (O_2^-). 4-Aminoguaicolic acid (4-amino-2-methoxyphenol), an ortho-methoxy-substituted catechol, is a known NADPH oxidase inhibitor. This compound inhibits the release of the superoxide anion (O_2^-), by preventing the assembly of a functional NADPH oxidase complex. The synthesis of 4-aminoguaicolic acid via the hydrazine reduction of 4-nitroguaicolic acid is reported. 4-Aminoguaicolic acid oxidizes readily while in an aqueous solution. The purpose of our research is to explore the stability of 4-aminoguaicolic acid in aqueous solution in an attempt to better understand the oxidation process as a function of time. Various methods have been employed to monitor the oxidation reaction including 1H NMR, UV/Vis and HPLC spectroscopy.

(Poster Presentation)

SPAZIANI, Amy

Department of Geological Sciences

AGE OF THE MIDDLESEX SHALE, SONYEA GROUP, UPPER DEVONIAN, WESTERN NEW YORK STATE

(Jeff Over)

The Middlesex Shale is a pyritic black shale at the base of the Sonyea Group, located above the West River Shale and below the Pultney or the Cashaqua shales in western New York State. The Middlesex represents a major Frasnian transgression in the late Devonian. The conodonts *Ancyrodella africana*, *Ancyrodella gigas*, *Mesotaxis ovalis*, and *Palmatolepis transitans* were all recovered in the Middlesex Shale from outcrops and drill cores taken from the Genesee River Valley. They are indicative of uppermost Montagne Noire Zone 4 to Zone 5, thus narrowly constraining the time of transgression.

(Poster Presentation)

STANISZEWSKI, Aaron

Department of Chemistry

THE EFFECT OF PERIPHERAL SUBSTITUENTS ON HEME PROTEIN MODEL

COMPOUNDS

(David Geiger)

Heme proteins perform a myriad of different functions. Examples include oxygen transportation and storage (hemoglobin and myoglobin), electron transfer (cytochromes), and remediation of toxic substances (cytochrome P450). The common feature of the heme proteins is an iron ion coordinated to an aromatic, tetrapyrrole macrocyclic ligand (the heme group). The chemistry of the heme group can be modulated by the protein via a number of different mechanisms. In particular, the protein supplies axial ligands and amino acid residues that may be involved in hydrogen bonding with the axial ligands or the heme group itself. Subtler influences include the presence of hydrophobic residues in close proximity that may be involved in through-space interactions that alter the heme pi system. We have synthesized iron porphyrins with various peripheral substituents and are exploring the effect of substitution on the redox chemistry and axial ligand binding. Cyclic voltammetry is used to measure the reduction of the iron(III) to iron(II) and iron(II) to iron(I) as a function of ligand concentration. The potentials show a marked dependence on axial ligand coordination that can be used to determine the binding constants. We will discuss the synthesis of the iron porphyrins and the electrochemical data obtained to date.

(Poster Presentation)

VATHANODORN, Yada

Department of Biology

BEHAVIORAL DETECTION OF OSMOLARITY BY THE TOAD, BUFO COGNATUS

(Duane McPherson)

Toads do not drink water orally, but instead hydrate themselves by osmotic absorption of water through the ventral portion of their skin. As a result, toads must be able to distinguish palatable water sources. In other words, the toads must be able to determine if the water with which they are in contact is hypoosmotic or hyperosmotic. Previous research has indicated that toads are indeed able to perceive the sodium content of a solution. There is also some evidence that toads might be able to distinguish between solutions of different osmolarity. In our research we have set up an experiment to test both of these hypotheses using the Great Plains toads, Bufo cognatus. Toads were either dehydrated to eighty percent of their normal body weight or were superhydrated by partial submergence in water. The toads were then placed in a behavioral choice experiment that tested their acceptance or rejection of hyperosmotic solutions of sodium chloride and mannitol in comparison to a hypoosmotic solution (distilled water). The behaviors were quantified by scoring the toads' position on a five point scale (0=fully off the solution, 5=fully on) and by scoring their posture on a seven point scale (0=fully upright (7=fully prostrate). A video system was set up in order to enable us to observe the toads' behaviors without disturbing them. Preliminary results of our research indicate that the water-deprived toads are able to distinguish both the salinity and the osmolarity of a solution. This research is significant because very little is known about environmental osmoreception by animals. Future research in this area will seek to determine how animals are able to distinguish solutions of variable osmolarity.

(Oral Presentation)

WEISS, Kathryn

Department of Biology

PRIMARY CULTURE OF RAT CEREBRAL ASTROCYTES

(Robert O'Donnell)

Neurogenesis has been shown to occur in certain areas of the adult rat brain, the subventricular area and the hippocampus (Palmer et al., 2000). Numerous studies (Gage et al., 1995; Young et al., 2000) have shown that neurons can be grown in vitro and grafted back into the adult rat hippocampus and retina. This experiment was conducted to better understand the glial environment of the developing neurons and to purify a primary culture of astrocytes. Primary tissue was removed from the cerebral cortex of 2 day old neonatal rats. The tissue was grown as explants and from a cell suspension in 25cm² culture flasks. The resulting cultures showed a great diversity of cell types and survived repeated secondary passages. After 12 days the flasks were shaken to dislodge the oligodendrocyte layer from the other cell layers. The culture was grown and then shaken again, , in an attempt to isolate an enriched culture of astrocytes. The remaining cells were grown in chamber slides to confluence, then fixed in methanol so that the cell types could be determined. The slides were stained using an anti-GFAP antibody, which labels intermediate filaments of astrocytes, and visualized using fluorescence- or peroxide-conjugated immunohistochemistry. The results of immunofluorescence showed staining in a large percentage of the cells. In contrast, preliminary peroxidase staining has shown only moderate staining. The eventual goals of these experiments are to isolate a stem cell population from rat brain which would have the potential for therapeutic grafting.

(Oral Presentation)

ZINNI, Bethany

Department of Geological Sciences

AERIAL DISPERSAL OF SALT FROM A LOCAL SALT MINE, WESTERN NEW YORK

(Amy Sheldon)

The objective of this study is to determine the amount, distribution and composition of air-borne sediment down-wind from the American Rock Salt's Hampton Corners site on Route 63, Geneseo, NY. Premature wilting of trees in a pasture directly across Route 63 from the mine suggests the influence of wind-blown salt in the area. Air-borne sediment samples are being collected using an original method, developed as a part of this study. Soil samples are being collected from the site in order to determine the amount of salt being deposited on the ground. The contribution of sediment from road salting will also be evaluated in the vicinity of the affected area. All data will be compared to readings from a control site. Wind and climate data are also being collected to determine the forces acting on this specific area.

(Poster Presentation)

ZULLO, Amanda

Department of Biology

FACTORS OF DRUG RESISTANT 4-AMINOGLUAICOL CELLS

(Robert O'Donnell)

Beginning in the fall of 2000, I investigated whether HTB-4 cells, a human bladder cancer cell line, could become resistant to 4-aminoguaicol's (4-AG) cytotoxic effects on their growth. Escalating doses of 4-AG were added each week and a resistant population was isolated. The chromosomal make-up of the resistant cells were compared and found to have significantly less chromosomes than the parent population. In the genetic background of cancer, evidence indicates that the environment surrounding the tumor plays a role in the progression of the cancer. This semester the role of apoptosis and cell attachment in 4-AG resistant cells was investigated. Whether or not cells become more resistant to 4-AG due to cell attachment and cell to cell interaction was investigated by using Ca++ free medium. Preliminary results indicate that cells are not more susceptible to drug when in the absence of Ca++. By determining factors that lead to the development of drug resistance, more effective therapeutic approaches could be developed.

(Oral Presentation)

Abstracts Submitted after Deadline

CLEMENTS, Jake and WONG, Cindy
Department of Computer Science
TRIM 3D
(Doug Baldwin)

Trim3D is a program that interactively visualizes particles in three dimensions. It was designed to handle a specific form of visualization; we soon realized that many additional forms of visualization could be added. We redesigned the program with an extensible architecture to allow us to easily adapt the program to display, read, and write new types of data. We hope to show that our architecture is adaptable to all types of particle visualization.

We used object-oriented programming to define classes for core visualization tasks (displaying, reading, and writing). We created subclasses that are specific to the visualizations the previous architecture could handle. This showed that the new design is at least as powerful as the old one. Presently, we are adding new subclasses to support a new type of visualization. This simply requires a few new subclasses that are customized to the core visualization tasks for the new data format.

We will display the new visualizations to demonstrate the extensibility of our program's architecture. Others have expressed interest in adapting this program to yet other visualizations which will be the subject of future work on Trim3D.

(Poster Presentation)

DE PERSIS, Corinne, RUDZINSKI, Scott, and TEO, Tracy
Department of Biology
E-CADHERIN REGULATION OF SQUAMOUS EPITHELIAL CARCINOMAS CELLS BY
STEROID HORMONES
(Jani E. Lewis)

Cadherins are transmembrane proteins that facilitate cell adhesion. The downregulation of these proteins have been found to be associated with invasive carcinomas. E-cadherin is one such cadherin protein. Dexamethasone, a synthetic glucocorticoid, has been found to downregulate the expression of these proteins in the cell line A431 which was derived from a human squamous epithelial carcinoma. The A431 cells typically downregulate the cadherin proteins in 6-12 days. A subpopulation of A431 cells, A2P2, down-regulate at a faster rate of 4-6 days. We are interested in the effects of the steroid hormones hydrocortisone, progesterone, and estrogen on E-cadherin expression in A431 and A2P2 cell lines. All four of these steroids were tested at different concentrations to observe their effects on the expression of E-cadherin.

(Poster Presentation)

HOFFMASTER, Richard

Department of Biology

**ELUCIDATING THE MECHANISM OF E-CADHERIN DOWNREGULATION BY DEX IN A431
(Jani Lewis)**

The loss of cell adhesion is a critical step in the formation of malignant cancers. *E-cadherin* is a transmembrane protein important in the formation of cellular junctions in squamous epithelial tissue. In *A431*, a squamous epithelial cell line, we have shown that the glucocorticoid analogue *dexamethasone* downregulates E-cadherin. However, the A431 cell line is a heterogeneous mixture of cells which react differently to dexamethasone (dex). A subpopulation of the A431 cell line has been isolated which does not downregulate E-cadherin in the presence of dex (*A431DR*). Conversely, another subpopulation of A431, *A431D*, no longer expresses E-cadherin as a result of dex treatment. In order to better understand the mechanism by which dex downregulates E-cadherin expression, we will determine if a dominant factor exists in A431DR cells which inhibits the downregulation of E-cadherin by dex. We hypothesize that upon fusing A431DR cells with A431D cells we will see a regeneration of the ability to express E-cadherin, and that treatment of the resulting hybrid with dex will have no effect on E-cadherin expression.

(Poster Presentation)

JONES, Matthew

Department of Geological Sciences

GEOLOGIC MAPPING OF THE MT. MORRIS QUADRANGLE

(D. Jeffrey Over)

A detailed geological map of the Mount Morris Quadrangle has not been compiled or published by the New York State geological Survey. Through study of rock units found in outcrops, and gamma ray log information, a geological map of this area is currently being made. Use of Global Positioning Systems (GPS) and specialized computer software, will allow precise locations of these rock layers to be correlated and mapped. This data can be superimposed over an existing topographic map to produce an accurate geological map to be submitted for publication.

(Poster Presentation)

KRAUS, Bryan, SLOWIK, Timothy and JASSAL, Pushpinder

Department of Computer Science

OBJECT ORIENTED SOFTWARE SIMULATION OF AN IMAGE AND GRAPHICS

COMPUTATIONAL RAM WITH A NEW ARITHMETIC LOGIC SCHEME

(Rong Lin)

Creating a simulation of the processor architecture will allow the logic correctness and estimated speed of the circuit design to be tested without actually creating the processor in hardware. This work focuses on creating a parallel object oriented software system to simulate the operation of an image and graphics microprocessor (called computational RAM) with a powerful parallel arithmetic logic scheme. The microprocessor has a computational capability for accelerating 3-D volume data process in high-end visualization applications, including medical imaging and others in science and technology.

The processor-in-memory design calls for a large number of identical processing elements, each capable of performing multiple basic arithmetic operations. The arithmetic scheme has the following distinct features: (1) Small-multipliers are used as building blocks. (2) Multipliers are reconfigurable to deal with the following wider sense merged arithmetic operations in parallel: a family of multiplications: 8x8-b, 16x16-b, 32x 32, vector x vector, matrix x vector, and a family of 8 to 32 b basic arithmetic operations including addition, subtraction and comparison. (3) It is excellent on hardware/software performance. The processor can be used as the core for directly processing either an image page of 64 x 64 pixels or for rendering a volume block of 8x16x32 voxels. Our preliminary C++ simulations on the arithmetic unit have shown a significant reduction of the number of required instructions for each basic arithmetic operation and an optimal or near optimal processing speed for the target applications.

Funded in part by National Science Foundation (NSF) and New York State Office of Advanced Science, Technology & Academic Research (NYSTAR).

(Poster Presentation)

RUSTAY, Julie and DEGAETANO, Danielle

Department of Chemistry

HOW MANY MITOCHONDRIAL DNA MOLECULES EXIST PER CELL?

USE OF REAL-TIME PCR TO ANSWER AN AGE-OLD QUESTION

(Wendy Pogozelski)

DNA is found in both the nucleus and in the mitochondria of cells. The mitochondrial form (mtDNA) has historically received less attention, but is being found to contribute significantly to aging and disease. While it is well-established that cells have multiple copies of this DNA, the actual number of mtDNA molecules per cell has been difficult to measure. We have been developing a new method to determine the number of copies of mtDNA per cell, employing a new technology called Real-time Polymerase Chain Reaction (PCR), also known as the 5'-Nuclease Assay. Here, using cells derived from an individual diagnosed with the mitochondrial-based disease Pearson's Syndrome, as well as a plasmid standard, and using a Real-Time Thermalcycler, we show that this technique can be used to quantify mitochondrial DNA in a cellular extract.

(Poster Presentation)