



2003

## Abstracts of Presentations

Colby College

Follow this and additional works at: <http://digitalcommons.colby.edu/ugrs>

---

### Recommended Citation

Colby College, "Abstracts of Presentations" (2003). *Undergraduate Research Symposium*. Paper 53.  
<http://digitalcommons.colby.edu/ugrs/53>

This Abstract is brought to you for free and open access by the Student Research at Digital Commons @ Colby. It has been accepted for inclusion in Undergraduate Research Symposium by an authorized administrator of Digital Commons @ Colby. For more information, please contact [mfkelly@colby.edu](mailto:mfkelly@colby.edu).

# *Colby Undergraduate Research Symposium*

## *May 1 – 2, 2003*

*Colby College, Waterville, Maine*

*Abstracts - Research Symposium*

### **A SEDIMENTOLOGIC AND PLANT TAPHONOMIC EVALUATION OF THE EARLY MIDDLE DEVONIAN TROUT VALLEY FORMATION, MAINE**

**Jonathan Allen ('03), Geology**

The Trout Valley Formation of Emsian-Eifelian age, outcropped in Baxter State Park, Maine, consists of fluvial and coastal deposits preserving early land plants. Massive, crudely bedded conglomerate represents deposits of proximal braided channels on an alluvial fan complex. Lithic sandstone bodies in channel-form geometries represent deposits of river channels draining the Acadian highlands whereas associated siltstones represent overbank deposits, intertidal flats, and tidal channels. Localized lenticular quartz arenites represent nearshore shelf bar deposits that were storm influenced. The majority of plant assemblages preserved mainly in siltstone lithologies are allochthonous and parautochthonous, with only one autochthonous assemblage identified in the sequence. Plant remains are found in both fluvial and estuarine environments with trimerophytes (*Psilophyton*s and *Pertica quadrifaria*) rhyniophytes (*Taeniocrada*) and lycopods (*Drepanophycus* and *Kaulangiophyton*) as the most common plants in estuarine environments near tidal channels. However, they are found also in fluvial settings. The presence of tidal influence suggests that these plants may have been tolerant of brackish conditions. However, the effects of this physical parameter on the growth and colonization of plants in the Middle Devonian is unknown.

### **CHALLENGES TO DEVELOPING IRAQ'S OIL IN THE POST-HUSSEIN ERA: INTERNATIONAL LAW AND LEGACIES OF HUSSEIN'S RULE**

**Nathaniel Arguelles ('03), Government**

This paper examines the multitude of challenges to developing Iraq's oil. First, the complex legacies of Saddam Hussein's twenty-four year rule will shape post-Hussein Iraq and threaten stability, security, and the emergence of a secure legal framework. Stability, security, and the emergence of a secure legal framework are three prerequisites to attracting the international investment that is crucial to developing Iraq's oil. Second, complex legal issues stemming from agreements and contracts between the Hussein regime and various multinational oil companies, as well as the impact of continued United Nations' sanctions, will continue to impede, if not prevent, the full development of Iraq's oil. Development of Iraq's oil reserves will be severely complicated until the complex legacies of Saddam Hussein's rule are fully understood and the multitude of international legal issues resolved.

## **SOUNDING IMAGES, PRAYING TIME**

**Seth Aylmer ('04), Philosophy**

A film in which visual images and are used to trope the psychological and sonic manifestations of time and space in Russian Orthodox theology Gyorgy Ligeti's Concerto for Cello.

## **'SONQOBA SIMUNYE:' BLACK AND WHITE THEATRE UNDER THE APARTHEID REGIME**

**Meade Barlow ('03), Theater and Dance**

'SONQOBA SIMUNYE:' BLACK AND WHITE THEATRE UNDER THE APARTHEID REGIME This essay examines South African theatre under the apartheid regime and its impact on the greater political sphere, particularly during the 1970s. Although apartheid institutions attempted to stifle political protest and unrest, governmental policies actually supported politically committed in South Africa. Four plays are considered: Athol Fugard's Statements After an Arrest Under the Immorality Act (1974), Matselmela Manaka's Egoli (1978), Gibson Kente's Too Late (1975), and the collaborative effort of Mbogeni Ngema, Percy Mtwa, and Barney Simon called Woza Albert! (1980). All four of these plays convey a political message even though they were produced under a government that was working to stifle political theater. Consequently, the essay proceeds to discuss the different methods and techniques employed by the playwrights in order to have their works performed; e.g. the use of native languages not commonly spoken by the White censors. The essay concludes with a discussion of the effect of South African political theater on the greater political environment existent in South Africa at the time.

## **AN EXPLORATION OF THE MINERALOGY ALONG THE ULTRAMAFIC - MAFIC CONTACT OF THE SOUTHERN MOXIE PLUTON, MAINE**

**Christopher J. Becker ('03), Geology**

The Moxie pluton is a large mafic intrusion located in west-central Maine. The pluton is mid to late Devonian in age, intruding into early Devonian silts, shales, and sandstones as part of the Acadian orogeny. As the pluton crystallized, it formed a layered igneous complex extending from olivine-rich ultramafic units in the southwest and terminating in granites and granite-diorites at Kathadin Mountain. The section of the Moxie pluton studied in this report is the contact zone between the ultramafic and mafic units of the southwestern bulge, near Moxie Mountain. Recent development in the region exposed a portion of this contact zone in a series of pits. Work has been done by G.H. Espenshade in studying comparable samples from the Greenville quadrangle. However, little work has been done in the Bingham quadrangle, where this study was conducted. Samples were collected to determine if there is a significant change in composition along the contact zone, and if there is a significant difference in composition between the Greenville and Bingham quadrangles. Rocks were collected from each of the five pits and returned to lab for analysis. Samples were powdered, and analyzed using X-ray diffraction techniques. Thin sections were also made to study the samples using a petrographic microscope and X-ray fluorescence. The southwestern bulb of the Moxie pluton contains magnesium and calcium rich mineral assemblages compared to the remainder of the pluton. No significant compositional variation along the contact was found.

## **ECONOMIC IMPACT OF COLBY COLLEGE ON THE WATERVILLE ECONOMY**

### **Abigail Benjamin ('03), Economics**

In assessing the economic impact of Colby College on the Waterville economy, it is important to consider factors such as faculty, staff, and student spending, government spending on the College and the community, and the affect the College has on local individuals. By conducting two surveys, one pertaining to the students, and the other to faculty, staff, and administration, I will gain valuable information that evaluates spending done by college-related individuals in the local area. Further, I will acquire important information through interviews with local businesses, including retail stores and restaurants, as well as the local government, to determine the involvement with Colby. Using the model outlined in Estimating the Impact of a College or University on the Local Economy, I will quantitatively calculate the gains and losses to the Waterville economy.

## **AUTOMATED EXTRACTION AND ANALYSIS OF PRIMERS FROM SEQUENCE DATA.**

### **Christopher P. Blomberg ('04), Biology**

Sequence analysis is often considered a very tedious experience, although recent programs have been developed to help expedite the process. One of the things that these sequence analysis programs seem to lack is a way to search for and identify the primer regions of the sequence. In some experiments, the primers used are degenerate and accommodate variation in the target sequence. The variability of degenerate primers makes them difficult to locate using standard search methods. The goal of this project is to write a program that will search through a sequence to identify and abstract these primers.

## **PANEL DISCUSSION REGARDING THE INTERSECTIONS OF JUDAISM, FEMINISM AND THE QUEER MOVEMENT**

### **Jaclyn Gilman ('03), Brooke Harris ('03) and Erin Bodner ('03), History**

Recently there has been an increase in discussion surrounding Judaism and its relation to issues pertaining to feminism and sexuality. Traditional Judaism has historically limited discourse involving women and those who identify as queer (defined here in terms of sexuality). The Hebrew Bible has been used by religious fundamentalists, and others who want to protect traditional Judaism, to limit certain practices they deem 'immoral' and a threat to the future of Judaism. Our panel will look specifically at the dilemmas Jewish women and those who identify as queer have faced in regards to traditional Jewish beliefs and practices. What was the role of women in biblical times? What has the Torah and rabbinic law said about the status of women? How has traditional Judaism posed a dilemma for women? This discussion will then be followed by a presentation looking at how the role of Jewish women has been transformed. How has the dilemma regarding women and traditional Judaism been dealt with by particular movements? Does a dilemma still exist today for women within Judaism? The final discussion will look at the way in which sexuality has been historically and culturally framed within Judaism, and how this pertains to current discussions concerning Judaism and queer sexuality. How has traditional Judaism limited the acceptance of queer sexuality as a viable lifestyle? How has Judaism been able to reconcile traditional religious beliefs concerning the 'abomination' of homosexuality with current views regarding the acceptance and inclusion of alternative sexuality and lifestyles within

Judaism? Does a dilemma exist for Jews who identify as queer and want to remain practicing Jews?

### **AN INVESTIGATION OF THE GEOLOGY, GEOCHEMISTRY, AND ENVIRONMENTAL EFFECTS OF THE HARBORSIDE MINE ON CAPE ROSIER, MAINE**

**Stanislav Presolski ('05), Robin Nesbeda ('04), Eric Roy ('04), Lorraine Beane ('04), Brian Foley ('04) and Eleanor Boyce ('03), Geology**

The Harborside Mine on Cape Rosier, Maine was in operation from 1881-1883 and from 1968-1972. Over 800,000 tons of zinc and copper ore were removed while the mine was in operation. When the mining facility was dismantled, a 300' deep, 800' diameter open pit and a ~50' deep, 300'x150' tailings pond were left behind. We have investigated the geology of Cape Rosier and the geochemistry of the mine and the surrounding area with the specific goal of determining the extent and potential of metal cation mobilization into the surrounding environment. We visited the site and measured temperature, pH, ORP, and conductivity in the field. We also collected rock samples, water samples from the open pit (which is currently filled with standing water), and both water and soil samples from the tailings pond. All the samples were brought back to campus and analyzed for elemental composition by using SEM-XRF and/or ICP-AES. We will outline the regional geology of the area, how volcanogenic massive sulfide deposits form, how ore is extracted and processed, and how mines typically affect the environment. We will also present our chemical analyses of the rock, soil, and water samples we collected and describe our interpretations of the environmental impact of the mine.

### **PETROLOGIC INVESTIGATIONS OF THE SLOKO GROUP VOLCANICS, JUNEAU ICEFIELD, NORTHERN BRITISH COLUMBIA**

**Eleanor Boyce ('03), Geology**

Reconnaissance mapping of the F-10 Ridge, Atlin Wilderness Provincial Park, British Columbia, was conducted in August 2002 in order to investigate the southernmost extent of the Sloko Group. These Eocene-age volcanoclastics, tuffs and lavas locally overlie the western edge of the Stikine Terrane, which is bordered by the Coastal Plutonic Complex. To the north of our study area (58°56'05.2" N, 134°07'41.7" W) the Sloko Group is intruded by the Llewellyn Granite, one of several intrusive bodies emplaced during coeval and subsequent magmatic activity. Both volcanic and plutonic units have undergone regional metamorphism, which is reflected by widespread saussuritization, chloritization and hydrothermal brecciation.

### **USING A GEOGRAPHIC INFORMATION SYSTEM (GIS) AS A TOOL FOR LAND USE CHANGE ANALYSIS AT COLBY COLLEGE IN WATERVILLE, MAINE.**

**Sarah Brown ('03), Andrew McKenna-Foster ('04) and Andrew Drummond ('05), Biology**

This project describes a geospatial approach for conducting a time-change analysis on the habitat surrounding Colby College, Waterville, Maine. This approach is particularly suitable for future analysis concerning land management and species conservation. The project combines classification and area analysis with geographic information system (GIS) tools for the manipulation of geographically referenced data. The specific steps for analysis are (1) creation of land use maps from the years 1940, 1956, 1965, 1977 and the 1998 digital orthophoto quad

(DOQ), (2) calculating the area for each land use for the previously mentioned maps, (3) analysis and comparisons of the changes in area over specific time spans (1956-1977-1998), (4) construction of maps representing the results of the analysis. The overall results indicate that the integration of GIS with standard field techniques may serve as a valuable medium for the identification and interpretation of land use change at multiple geographic scales.

## **TIME IN MUSIC AND CONTEMPLATIVE PRACTICES**

### **Alexander Browne ('03), Music**

Recent discoveries in quantum physics and other physical sciences have forced us to reevaluate our long-accepted notions of time, space, and the true nature of things in our world. These new discoveries and the realities that they allow us to construct are very much in tune with the conceptions of time and space that some of the world's great theologies hold and have held since their beginning. In our new reality, defined by theology and now by science, where linear time and stable space are no longer absolute, I will develop a mode of Zen Buddhist musical hearing that will not only change the way you think about Japanese music, but will hopefully act as an example to demonstrate how this new reality can change the way you think about time and space in our world.

## **DATABASE SEARCH FOR N-TUPLE NUCLEOTIDE REPEATS IN THE HUMAN GENOME**

### **Mahdi W. Bseiso ('04), Computer Science**

Nucleotide repeats in non-coding regions have been associated with neurodegenerative diseases, and as such, are of interest to biologists. Since nucleotide sequences are extremely long strings of characters representing these nucleotides (A, C, G, and T), it becomes important to create an automated way of searching these large sequences for subsequences and repeats of these subsequences within a given domain. This project involves two parts: First, creating a program that automates the process of extracting nucleotide sequences for the entire human genome from the Internet and puts them into a local database, and second, creating a user-friendly dynamic web application that allows biologists to search the database of nucleotide sequences for given numbers of repeats of particular sequences. Such a web site eliminates the time-consuming task of manual searching for nucleotide repeats that is still frequently practiced in today's biological laboratories. By modifying the database and changing the data, such a web site can search for any number of repeats of any given nucleotide sequence in any needed sequence, not just the ones that are extracted from the human genome.

## **DNA-BINDING STUDIES OF POTENTIAL ANTICANCER DIRHODIUM ACETATE COMPOUNDS**

### **Amity Burr ('03), Chemistry**

Beginning in the 1970s, researchers began to examine dirhodium acetate compounds as potential antitumor agents. Previous work in other labs has indicated that dirhodium(II) tetraacetate dihydrate (1) is efficacious in killing cancer cells, although the mode of action is as yet undetermined. Although DNA is accepted as the biological target responsible for the activity of some anticancer drugs, evidence for DNA-binding of 1 is unclear. This work investigates the ability of a series of dirhodium acetate compounds to covalently bind to double-stranded DNA.

Three compounds, 1= $\text{Rh}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}$ , 2= $[\text{Rh}_2(\text{CH}_3\text{COO})_2(\text{CH}_3\text{CN})_6]_2$ , and 3= $\text{Rh}_2(\text{CF}_3\text{COO})_4 \cdot 2(\text{CH}_3)_2\text{CO}$ , were dissolved in water and incubated with calf thymus DNA at pH 7 and 37 °C over a series of days. Aliquots of each reaction were taken, filtered to remove unbound rhodium compounds, and then analyzed for [DNA] by UV-Vis spectrophotometry and for [Rh] bound by graphite furnace atomic absorption spectroscopy (GFAAS). Binding curves were generated for the three compounds at various compound-to-DNA ratios. These data show the greatest (up to ~100%) and fastest (within 6 hours) DNA-binding for 3, and minimal DNA-binding for 1. DNA-binding data will be presented and discussed in the context of potential mechanisms of anticancer activity.

## **ISOLATION AND CHARACTERIZATION OF MERCURY AND ANTIBIOTIC RESISTANT BACTERIA FROM THE GOVERNOR HILL HATCHERY, AUGUSTA, MAINE**

**Charles V. Strom ('03), Alison G. Killelea ('03) and Anna O. Carlson ('03), Biology**

Over the past decade, rising levels of environmental mercury (Hg) from atmospheric deposition have prompted state and federal advisories to limit the consumption of freshwater fish by humans. High levels of environmental Hg may be a selective pressure for the evolution of microbial Hg resistance. Recent investigations in our lab report a positive correlation between Hg resistance and antibiotic resistance in the microflora of hatchery-reared lake trout (*Salvelinus namaycush*). These fish had no exposure to Hg or antibiotics from feed or water prior to release into hatchery raceway waters. It is suspected that bacterial Hg and antibiotic resistance is acquired upon release into the raceway or surface water. Low levels of Hg in the water, fish muscle tissue, and mature fish feed were detected in an analysis by Frontier Geosciences. In our study, a seven year-old lake trout was collected from the Governor Hill State Fish Hatchery in Augusta, Maine. Bacterial isolates from the GI tract, epithelial mucus layer, gill arches, feed, and raceway water were characterized and tested for the expression of both Hg and antibiotic resistance. Thirty representative Hg-resistant isolates from these sites were selected for molecular characterization. Gram stain reactions, PCR amplification of the 16s ribosomal subunit gene, DGGE, and MIC analyses were performed to characterize the bacterial isolates. Further examination will include documentation of significant patterns of Hg and antibiotic resistance in the identified bacterial species. The classification of Hg and antibiotic resistant microflora will aid in the understanding of how increased environmental contamination with heavy metals may be contributing to the augmentation of the global antibiotic resistance gene reservoir.

## **THE RELATION BETWEEN PHYSICAL QUALITIES AND GAS FLOW THROUGH SNOW.**

**L. Maclagan Cathles ('03), Physics and Astronomy**

Air-snow exchange processes is important for understanding greenhouse gas fluxes, ice core interpretation, and assessing the impact of snow on changes in atmospheric chemistry. Diffusion and advection are processes of primary importance for air-snow exchange, and both processes can and do occur in seasonal snow. Apparatus was developed to allow existing experimental techniques to be used to measure both diffusivity and permeability on a single sample of snow in remote sites with minimal power availability. CO<sub>2</sub> was used as a tracer gas. Adsorption and Absorption of CO<sub>2</sub> in snow was examined through comparison of diffusion of CO<sub>2</sub> to that of

inert SF6. The extent to which diffusivity, permeability, adsorption and absorption occur is controlled by geometrical properties of snow. The structure of snow varies greatly causing wide varieties of physical and chemical transport properties. The potential of the apparatus constructed is demonstrated as well as is the potential of analysis methods for obtaining physical properties from transport properties and vice versa.

## **CROSS-CULTURAL, TECHNOLOGICAL, AND SOCIOPOLITICAL INFLUENCES IN SOUTH AFRICAN KWELA MUSIC**

**Sarah Chapple-Sokol ('04), Anthropology**

South African kwela music, created in the townships in the 1950s, is characterized by traditional African musical elements, by American influences, and, most importantly, by the sound of the pennywhistle. Not only was kwela shaped by cross-cultural, technological, and sociopolitical influences, but it, in turn, actively shaped the surrounding culture. This paper will explore such symbiotic interactions between kwela and society, examining how different social groups within South Africa, and later, internationally, appropriated kwela to perform various types of cultural work. Furthermore, it will demonstrate the complex relationship between technology and kwela, an example of which being how kwela was transformed by its shift from the streets to recording studios. Finally, the paper will include musical examples of kwela that illustrate the aforementioned influences.

## **USING GENETIC ALGORITHMS TO IMPROVE GENE FINDERS**

**Sarah E. Pierce ('03) and David A. Cohen ('04), Computer Science**

With the advent of automated sequencing, there has been an increased need for automation of the otherwise labor-intensive task of analyzing sequence data. The goal of this project is to write a gene-finding program: a computer program that can identify genes in raw sequence data. Several genefinding algorithms already exist, but all falter in one place or another. One portion of our program will use genetic algorithms to predict splice sites (site-based gene finding), and another will predict exonic and intronic regions (content-based gene finding) using periodicity and codon usage. These predictions will be combined to identify potential genes using an established method of determining weights for linear combinations, such as Ordinary Least Squares. We will train and test our program on data sets that have already been used with the genefinder Genscan. This will allow us to compare our program's performance to Genscan's performance.

## **UNWILLING TO EXPLAIN: DECEPTIVENESS IN ROBERT FROST**

**James B. Cowan ('03), English**

When reading Robert Frost, it is tempting to succumb to the sagacious authority of his voice, found in such satisfyingly dignified phrases as "I have been one acquainted with the night" or "Oh, just another kind of outdoor game." The tone of this voice is poignant, palpable, and attractive; and it is not surprising that many readers fondly identify Frost as a confident and unassuming New England poet. However, these readers base their belief upon only a crude glimpse at the surface of Frost's work; and frequently, his poems contain an elusive subtext that reveals a more substantial insight into the human condition. The critic James Potter refers to this duality – Frost as an ostensibly straightforward poet and Frost a subtly complex poet – as the "deceptiveness of Robert Frost." Deceptiveness can involve "saying one thing in terms of



another,” but it also involves establishing the pretense of straightforwardness, and then, through insinuating tone and diction, contradicting or undermining these previous assertions. In other words, deceptiveness is purposely misleading whereas such disingenuousness is adventitious in the process of “saying one thing in terms of another.” And if deceptiveness is misleading, then someone is doing the misleading (the speaker) and someone is being misled (the reader). This gap between what the speaker knows and what the reader knows makes Frost’s deceptive poetry unique, for the speaker informs the reader selectively and with the intention of providing an incomplete clarification.

## **ENGAGED BUDDHISM IN THAILAND**

**Michael S. Crawford ('04), Religious Studies**

ENGAGED BUDDHISM IN THAILAND The first noble truth of Buddhism is that all life is suffering. The Buddha taught that suffering arises in many different forms, and that one should work to curb, and eventually end, suffering on both the individual and societal levels. Engaged Buddhism is a system of thought which addresses issues of social justice from a Buddhist perspective. This project looks at some of the ways Buddhism is used to address societal problems in Thailand. It focuses on how the teachings of the Buddha can be utilized to deal with contemporary problems, such as environmental degradation and AIDS.

## **FOURIER TRANSFORMS AND THE AGE OF THE EARTH**

**Lisa DeKeukelaere ('03), Mathematics**

In 1861, William Thomson (Lord Kelvin) used a partial differential equation known as the heat equation and some simple assumptions about the Earth to estimate how old the planet was. His method used the Fourier transform and the convolution product of two functions. We will discuss the basic techniques, use them to solve the heat equation and explain Kelvin's result.

## **SHUSAKU ENDO'S NOVEL SILENCE IS FICTION**

**Jonathan Devers ('05), East-Asian Studies**

Shusaku Endo's novel Silence is fiction. Many would argue that this automatically presents either a biased or untrue picture of reality. Inspired by actual events, and given a historical setting, Silence, as a work of fiction, parallels historical processes. Endo vividly portrays a fictional priest's struggle with the Western presentation of God and the silence of that God in a foreign land. This parallels the actual struggles between foreign and native influences in a time period where Japan sought to isolate itself from the world at large. Not purporting to be pure historical fact, Silence presents a 'verbal image of reality' as perceived by the author.

## **THE EFFECTS OF SELECTION ON THE GENE G6PD IN DROSOPHILA**

**Deborah Doberne ('03), Biology**

Often times there are multiple alleles for a gene, which come from mutations in the nucleotide sequence. The amino acid sequence is left unchanged when the mutation is synonymous and it is affected when the mutation is non-synonymous. Since non-synonymous mutations accumulate in a clock-like manner, the pattern of non-synonymous and synonymous replacements can provide evidence at the molecular level for natural selection. I am looking at evidence for

selection on the gene G6PD between populations of *Drosophila simulans*.

## **THE SELECTION OF NATIVE AND INVASIVE PLANTS BY FRUGIVOROUS BIRDS.**

**Brie A. Drummond** ('03), **Biology**

Invasive species can have drastic effects at all levels of biological organization, influencing individual demographics or morphology, changing population and community dynamics, and altering ecosystem functions. Invasive plants are often spread by birds, which consume and disperse seeds and fruits, and the spread of several of the most aggressive invasive plant species in Maine is attributed to avian dispersal. However, little research has investigated the process of invasive fruit choice by birds in relation to native fruit producers. My project studied the differences in avian fruit selection of invasive and native plants, comparing fruit removal, fruit selection, and fruit energy content of two invasive species, *Lonicera tatarica* and *Rosa multiflora*, and two native species, *Cornus amomum* and *Viburnum opulus*, in central Maine. Fruit removal patterns and energy content demonstrated two different fruiting strategies unrelated to status as invasive or native species. Fruiting strategy of invasive plants may have implications for effects in the fruit/frugivore system.

## **GEOCHEMICAL AND ENVIRONMENTAL STUDIES IN THE BELGRADE LAKES WATERSHED, CENTRAL MAINE**

**Beth Dushman** ('03), **Geology**

Public concern over water quality has prompted an investigation of the hydrogeology, geochemistry, and environmental health of the Belgrade Lakes, a system of seven interconnected lakes in central Maine. The Belgrade Lakes watershed faces problems due to algal blooms and invasive plant species. There are four major groups that study the Belgrade Lakes Region in an attempt to improve the health of the watershed: (1) the Maine Department of Environmental Protection, (2) the Lakes Associations, which are groups of concerned citizens, (3) Conservation and land trust organizations, and (4) independent scientific researchers. While there appear to be overlaps among study interests and goals, the concerns that are driving the research are not the same for all groups. Improving communications and collaboration between the groups in is essential to improving watershed management. Major issues include education on all levels, establishing common goals and expected time scales, whole watershed studies, and improving communications. I am also investigating the surface water chemistry of North Bay, a shallow bay in the northeastern corner of Great Pond (one of the Belgrade Lakes), in order to understand the interaction between the lake and the peripheral wetlands. I have sampled water at 17 sites along the shore of North Bay, and analyzed them for temperature, pH, conductivity, oxidation-reduction potential, dissolved oxygen, alkalinity and cation concentration. We can qualitatively map the bog succession into and around North Bay using the chemistry of the shoreline lake water.

## **LAKE WATER QUALITY AND POSSIBLE REMEDIATION TECHNIQUES FOR WEBBER POND, KENNEBEC COUNTY, MAINE**

**Serena Vayda** ('03), **Paul Mathewson** ('03), **Erin Estey** ('03) and **Melanie Newton** ('03), **Biology**

Students in BI493 conducted a comprehensive watershed study of Webber Pond, Kennebec

County, Maine during the summer and fall of 2002. Physical and chemical parameters were analyzed to determine lake water quality. Webber Pond is a eutrophic lake and algal blooms have been a problem for over 40 years. Mean phosphorus levels were approximately 23 ppb during fall 2002, well above the 15 ppb threshold for algal blooms. The mean transparency in September was  $1.24 \pm 0.14$  m and there was a sharp decline in dissolved oxygen below 6.0 meters. The mean phosphorus concentration in the hypolimnion over the past seven years was high ( $353.76 \pm 33.93$  ppb). Internal nutrient loading is a significant problem, contributing an estimated 26% of the total phosphorus load. Anoxic conditions increase internal nutrient loading and impact the Webber Pond fishery. Reducing the nutrients entering Webber Pond is necessary for successful remediation. Properly maintaining camp roads and buffer strips, preventing shoreline erosion, reducing the impacts of shoreline development including use of fertilizer and phosphorus containing detergents are also important. Presently, annual water drawdowns combined with a flushing rate of 1.58 times per year is helping to reduce the nutrient load. However, there are other techniques that should be considered, including hypolimnetic withdrawal and phosphorus inactivation. Additional action must be taken to improve water quality for lakeshore residents and to protect the native flora and fauna within Webber Pond.

## **MIGHTY BACTERIA: THE ROLE OF MICROORGANISMS IN THE CLEANUP OF THE EXXON VALDEZ OIL SPILL**

**Erin Estey ('03) and David Burke ('03), Biology**

The Exxon Valdez Oil Spill (EVOS) of March 1989 was the largest oil spill in US maritime history. Despite the disastrous effects of the spill on the ecosystem of Prince William Sound, it resulted in the advancement of novel remediation techniques, such as bioremediation. Bioremediation involves the acceleration of the natural oil-degrading processes of bacteria through both bioaugmentation and biostimulation. Studies comparing these two approaches concluded that there is no evidence to support that bioaugmentation increases the efficiency of hydrocarbon breakdown. However, areas on which the rate of oil degradation of native bacterial populations was stimulated with fertilizers were visibly cleaner two to three weeks following treatment with no negative environmental impacts. Based on these results, our response to future oil spills can be carried out in a more efficient and economical manner.

## **HAMILTONIAN PATHS IN GRAPHS**

**James D. H. Falk ('05), Mathematics**

Lovasz conjectured that a vertex transitive graph has a Hamiltonian path. Many believe that this conjecture is false so it might be possible to find a counterexample. Searching is difficult because most algorithms run in exponential time. This talk uses a new algorithm that runs in linear time but does not promise to find an answer. This algorithm finds a Hamiltonian path in a graph of 4960 vertices in just a few seconds and one in a graph of 124000 vertices in 9 minutes. The talk will illustrate the conjecture, its complexities, and applications of the algorithm to large graphs. A path in a graph that visits every vertex exactly once is called Hamiltonian. If for each pair of vertices there is a symmetry of the graph taking the first vertex to the second then the graph is called vertex transitive.

## **THE WATER-BABIES: CHANGING TEXTUAL MEANINGS THROUGH A STUDY OF ILLUSTRATIONS**

### **Elyssa Ford ('03), International Studies**

During the Victorian era, the publication of children's books reached a new height. Charles Kingsley, a well-known British author and reverend, wrote *The Water-Babies* as one of his few forays into children's literature. Since the original publication in 1863, Kingsley's 'fairytale' underwent a series of transformations. The author's original messages of moral, social, and religious change and virtue evolved as the book went through different publications. Without altering the words themselves, Kingsley's intent changed as the illustrations changed. Linley Sambourne and Jessie Willcox Smith worked as illustrators on two of the most popular editions. Their experiences and specific places in time transformed *The Water-Babies* and its messages. By looking at examples from Sambourne and Smith, it is possible to observe the evolution of a book's meaning long after the death of its author.

### **WILLIAM BLAKE AND POPULAR MUSICAL INTERPRETATIONS OF HIS SONGS OF INNOCENCE AND EXPERIENCE**

#### **Alicia Ford ('03), English**

Blake combined his musical poetry with images to make one of a kind books that were hand colored. Focusing on the *Songs of Innocence* and *Songs of Experience* the effect of the web page is to bring together the color images of Blake's text that he himself made to show the detailed work and combine it with the musical interpretations that have emerged. The web page comes from my research that sought after the musical interpretations that the aforementioned Blake texts gave rise to in "popular culture". The goal is combines the idea of the musical and pictorial text to dispel the normal ideals that poetry is only black text on white paper.

### **YELLOW FEVER IN 19TH CENTURY TEXAS: A CRITICAL STUDY AND A COMPREHENSIVE ANALYSIS**

#### **Elyssa Ford ('03), History**

As inhabitants of the frontier, early Texans faced innumerable trials and tribulations. Plagued by drought, heat, and perhaps above all disease, settlers needed hardy bodies and souls to carry them through their first years in Texas. Malaria, yellow fever, cholera, typhoid fever, and smallpox regularly attacked communities in the 19th century. One disease, however, struck fear deep into the hearts of many--yellow fever. Settling initially in the Gulf Coast region, Texans saw the horrors of yellow fever, year after year. In order to fully appreciate the early settlers fear of yellow fever, the disease itself must be addressed. Part I examines what exactly causes the disease, where it came from, and how it was treated. After gaining an understanding of yellow fever, Part II looks at two specific case studies. Galveston in 1839 and Brownsville in 1882 give a closer view of how people actually reacted to the disease and how these reactions differed depending on the time and place. The map section of Part III provides a visual way to actually see the extent of yellow fever in Texas. By comparing present day maps with those of the 19th century and by examining the fever in Texas versus in the United States, a fuller comprehension of yellow fever's affect on Texas and its settlers is possible. Part IV studies the medical community's response to yellow fever and the eventual rise of public health within the state due to repeated epidemics.

### **BOLIVIAN PUBLIC POLICY IN THE CONTEXT OF THE GLOBAL ECONOMY: IS**

## **THERE ANOTHER VIABLE DEVELOPMENT STRATEGY FOR BOLIVIA?**

### **Courtney Fry ('03), Latin American Studies**

Since the colonial era, Bolivian public policy has consistently benefited the rich over the poor. The resulting inequality has directly contributed to a society with a high concentration of the country's wealth in the hands of a small minority. The government has rarely invested in the poor, including minimal investments in public education and little infrastructure to improve the quality of life of the poor. An unintended effect of centuries of following this development strategy was to deter economic growth and development in the long-run. Although there has been some modest progress toward a more pro-poor stance by the government since the National Revolution in 1952, the residual effects of Bolivia's economic collapse in 1985 have left the country with a tremendous debt overhang that places severe financial constraints on the government's ability to respond to the needs of its citizens. The build up of the effects of Bolivian public policy has led the country to a state of crisis, both economically and socially. Bolivia must now explore alternative development options that reach the majority of its population, the poor. Given the financial situation of the government, however, there is no easy answer. Nancy Birdsall and Augusto de la Torre proposed an alternative development strategy called the Washington Contentious that critiques the strategy followed by the IMF and the World Bank. The Washington Contentious places poverty reduction and equity at the forefront, using these objectives as a means to achieve economic growth. Because this strategy directly addresses the needs of the Bolivian people, I will use it as a framework to explore the possibility of finding a viable alternative development strategy for Bolivia.

## **RACISM IN CUBA: YESTERDAY AND TODAY**

### **Alexandra Gelbard ('03), Anthropology**

This paper examines race in Cuba and the way race is defined by the Cuban people and by societal rules. I conducted fieldwork in Havana, Cuba as well as Santiago de Cuba, two cities located on either side of the country over a three-week period. I conclude that racism is so deeply ingrained within Cuban society that the people of Cuba do not recognize all of the multitude of levels that are a result of its influence. An inherent color consciousness affects all aspects of life, despite the claim that nationalism transcends everything else. While the people of Cuba are first and foremost Cuban, they are still divided into blanco (white), Negro (black) and mesclado (mixed) groups. This categorization, implemented by the government, shows the rampant consciousness of race that is supposedly eradicated by Cuban nationalism. The outside influence of Spain and United States, during their respective occupations of Cuba, implemented systematic procedures for discriminating against people of color that had a detrimental impact upon Cuban society. This discrimination has continued to present-day Cuban society in spite of Castro's public recognition of racism and efforts to address the problems of racism through labor discrimination, education, and segregationist acts. He denies the effect racism has on political and cultural aspects of Cuban society, as well as on the psychology of individuals as evidenced by the use of nicknames and the growing acknowledgement by the younger generations of Cubans that racism is a problem. There can be no solution to "the race issue" in Cuba until Cubans are willing to step back and examine themselves and how racism affects them as individuals and as a society.

## **EARLY ADMISSION: A REDESIGNED ENTRANCE TO THE COLBY CAMPUS**

### **Adam N. Grassi ('03), Art**

It is my feeling that today's visitor to Colby's campus never truly gets the sense of immersion into a separate environment, nor does that visitor feel connected to the Waterville neighborhood surrounding the campus. Instead, he or she feels like an outsider cruising the periphery of an exclusive community. My project confronts this problem using architecture, campus planning, and landscaping in order to create a true entrance that creates in the visitor a sense of involvement while also enhancing and strengthening the fabric of the Colby community.

### **ALTERNATIVE CURRENCIES: THEIR SOCIAL AND ECONOMIC CONTRIBUTION TO COMMUNITIES**

#### **Vanessa L. J. Haleco ('03), Economics**

Communities throughout the U.S. and the world have started establishing their own local currencies. As a step away from the policies that surround U.S. money, these smaller, alternative currencies provide communities with independence from the U.S. banking system while strengthening their social environment. This examination will explore how a local currency creates a mini-economy among its participants as well as reveal the fundamental differences between the Dollar and these alternative currencies.

### **MEDIA AND THE USE OF ENGLISH IN TANZANIA**

#### **Erin Hanrahan ('03), English**

Following its independence in the early 1960's, the Tanzanian government launched a nationalist campaign to unify the diverse ethnic groups comprising the new country. Increasingly, Kiswahili became central to this campaign, as the government recognized linguistic unity as a prerequisite to social cohesion. In the last decade, the Tanzanian government's socialist regime has faltered, and the advent of capitalism has been accompanied by changing political, social, and linguistics practices. Without government sponsorship to advance the cause of Kiswahili, what is the language's future in the face of an evolving global economy? The Tanzanian media's situational use of Kiswahili and English offers compelling insight into the language's possible future in East Africa.

### **SECONDARY STRUCTURE PROTEIN FOLDING IN SILICO**

#### **Andrew G. Harnett ('03) and Evan P. McGee ('03), Biology**

Prediction of secondary structure in proteins is vital to the understanding of how proteins function within the body. The folding of the primary structure into the secondary, which occurs in the milliseconds after translation of the primary protein chain, is currently poorly understood. While the physical model of the folding is given by the interactions of atoms in the peptide chain, there is no way to quickly and accurately model the secondary structure folding. Current methods involve inferring structure from different proteins with similar peptide sequences, and free energy models that are extremely computationally expensive. We hope to improve on the current model by integration of a genetic algorithm into the folding process. The genetic algorithm is a machine learning model that mimics the biological system of reproduction. It represents the problem of an inaccurate fold as a bitstring, and can mutate or crossover portions of the bitstring in order to locate a more accurate fold. This can then be extrapolated and used with

the original folding program to generate more general, accurate folds.

## **TAKING NOTE(S): DISCOVERIES IN RECEPTION HISTORY THROUGH MUSICAL REVIEWS OF THE BEETHOVEN VIOLIN CONCERTO**

**Victoria C. Hayes** ('04), Music

Ludwig Van Beethoven's Violin Concerto in D Major, Opus 61, has maintained almost unparalleled status among performers and musical critics since its premiere in 1806. Although almost 200 years have passed since its introduction, performers and critics alike have grappled with a number of questions about the concerto. While some of these center around the actual notes, others concern ideas outside the musical work. This paper examines different critical responses to and changing historical perspectives on the concerto in an attempt to uncover reasons for the lasting success and historical significance of Beethoven's Violin Concerto. Ultimately, it will suggest that the work remains interesting because it can sustain a variety of interpretations across a wide range of historical circumstances.

## **HIDDEN DIVINITY IN MUSIC: GYORGY LIGETI'S CONCERTO FOR CELLO AND ORCHESTRA**

**Kate Heidemann** ('04), Music

In Katherine Costello-Hirata's master's thesis, a study of Gyorgy Ligeti's 'Lux aeterna', Cello Concerto and Continuum, she creates a visual of the Cello Concerto's pitch space. By creating a graph that measures off seven octaves in increments of semitones (or half-steps) on the vertical axis against time in terms of measure number on the horizontal axis, she creates a way in which each pitch and its specific duration can be visualized. Using the visualization of the sonorities in the Cello Concerto as a foundation, a series of observations about the structure of the pitch space can be made. The symmetrical unfolding and expansion of pitch combined with the particular chronological placements of events provide a structure whose measurements hold significant importance, not only in terms of the piece in and of itself, but also when removed from this musical context. By making note of symmetrical expansion and equal divisions, as well as a special appearance of the Golden Section, a meaningful structure of the Concerto is revealed. However, this structure is not unique to this Concerto, for it also makes an appearance in a strikingly similar way in the iconography of Russian Orthodoxy, the iconostasis in particular. The fact that the deliberate nature of this correlation is highly unlikely should lead one to venture some thoughts about how aesthetic choices, whether in an expression of self or religion, may be stemming from the same source of inspiration.

## **COMPARATIVE COUNTERFACTUALS: A SYNTHESIS**

**Kristen M. Heim** ('03), Sociology

This project compares, contrasts, and critically evaluates two methods of socio-historical analysis: Mills methods and counterfactuals. I find that neither method is alone sufficient to generate valid causal inferences and propose a mixed model incorporating elements of both. In the paper I apply my model to existing works by Theda Skocpol and Maurice Zeitlin as well as to my own work on Cambodian genocide.

## **ENVIRONMENTAL REGULATION AND ITS EFFECT ON TECHNICAL CHANGE**

## **FOR ELECTRIC UTILITIES**

### **Benjamin S. Hoffman ('03), Economics**

Since the revolution in environmental awareness starting with luminaries such as Rachel Carson, the Federal Government has continually regulated the emissions of all sorts of pollutants. One of the most targeted industries has been the electric utility industry, as this industry is both naturally heavily polluting and relatively easy to regulate, considering most of its pollution is localized at the source. My paper attempts to quantify the impact of these regulations on the industry by examining how the regulations impacted technical change. Generally, one would expect the imposition of regulations to retard the industry's ability to become more efficient because money they could be using to improve efficiency now has to be used towards compliance with these regulations. However, there are many that subscribe to the Porter hypothesis, which basically suggests that these regulations will improve a plant's production efficiency because in the long run, firms will have a greater incentive to innovate and devise new production strategies in order to reduce the costs of compliance with these regulations as well as spur them to look in areas that previously were ignored.

## **THE LAST PROTEST SINGERS?: MUSICAL MEANING IN THE INDIGO GIRLS' 'OUR DELIVERANCE'**

### **Kate Hughes ('03), Music**

The Indigo Girls are among the most political singers of our time. Yet Amy Ray and Emily Saliers write music that is intentionally polyvalent, so that their music can be interpreted differently by both the mainstream culture and by the various subcultures that identify with them. They must balance their desires to be a voice for the feminist/lesbian subculture and to transmit their political and social ideals with their wish to appeal to a wide audience. In their song Our Deliverance, Ray and Saliers struggle with these conflicting goals, using both music and lyrics to transmit multiple meanings to their audiences. This analysis will focus on Ray and Saliers' unique ability to appeal to a broad audience while still remaining true to themselves.

## **FINDING EVIDENCE OF SELECTION FOR THE BRCA1 TUMOR SUPPRESSOR GENE**

### **Christopher C. Sotzing ('04) and Michelle J. Keady ('03), Biology**

The purpose of this study is to look for evidence of selection in the BRCA1 gene in humans. First a dataset will be obtained using either a popset or by creating our own using a blast search. This dataset will be aligned using clustalw. To detect evidence of selection the Tajima's D test will be implemented in a java program so that the calculations will not have to be done by hand. Once we have figured out which nucleotides selection is acting upon we can then pinpoint which amino acid that codon is coding for and interpret how that might affect the proteins function.

## **CHILD LABOR AND CORPORATE AMERICA, IS THERE A CAUSAL RELATIONSHIP?**

### **Amanda Kellar ('03), Sociology**

Child labor has become an important topic in both academia and governmental policy in the past couple of decades. However, little research has examined the affects that multinational corporate



involvement in a developing country's economy has on the child labor rates in that country. Direct foreign investment was used as an indicator of multinational corporate involvement and other indicators such as primary school enrollment and poverty were statistically manipulated to see if they had a causal relationship with child labor rates. India and Brazil were picked to study child labor determinants more closely as they are both very unique countries. India's caste system cannot be put into a statistical analysis and it is therefore important to study it more closely and Brazil is on the verge between being a developing country and joining the more developed countries. It was important to look more closely at these two countries both because they are unique and because statistics do not always tell the whole story. It is also important to see if the statistical analysis matches up with the more in-depth case studies conducted of India and Brazil.

### **BIODIESEL FUEL AND THE ELECTRIC AUTOMOBILE: THE SOCIAL, TECHNICAL, AND ENVIRONMENTAL ARGUMENTS.**

**Jessica A. Kellett ('04) and Julia C. Steele ('03), *Science, Technology, and Society***

Oil clearly plays a role geopolitics; it is the capstone of modern industrial economies and lifestyles. In his book *Hubbert's Peak*, Deffeyes predicts that oil production will 'peak' in approximately 5 years. Combusted oil also accounts for the majority of lower and upper atmospheric pollution, also known as smog and global warming, posing harm to both health and the environment. Economists, politicians, environmentalists, social workers, and concerned citizens across the world are calling for an end to the use of petroleum. 60% of the petroleum consumed in the U.S. occurs through automobile transportation on commutes, deliveries, and leisure drives. Therefore, the implications of this physical transition has huge social, political, and economic consequences. The question is, can industrial societies transition to a new mobile energy source without drastic changes in their day to day norms? Our research examines two alternative forms of energy: Biodiesel, an alternative fuel, and Electricity, a rapidly evolving technology in automobiles. A substantial number of people have transitioned to either of these alternatives, but neither source could be made available to the masses without lots of time, drastic political and economic change, or a dramatic alteration in consumption and transportation. Besides their physical and technical differences, hybrid-electric technology and biodiesel imply different types of transitions away from petroleum. More than anything, these shifts pose a social challenge to communities, governments, and businesses, especially in the country where oil is consumed in excess and abundance above all others: the U.S.

### **THE COMMODIFICATION OF LIFE AND WATER IN NORTHERN LUZON, PHILIPPINES**

**Emily Posner ('04) and Jessica Kellett ('04), *Latin American Studies***

Jessica Kellett and Emily Posner spent the month of January interning with the Cordillera People's Alliance (CPA) in Baguio City, Philippines. The CPA is a broad based grass-roots organization working to address issues where cultural and environmental degradation overlap. For three weeks, Emily and Jessica worked on a campaign involving mining pollution. Our specific goal was to train local farmers with the skills to independently test the river where the mining company releases its effluents. The second portion of our trip centered on the San Roque Dam, the largest multi-purpose dam in South-East Asia. The San Roque has been funded and constructed by a multi-national consortium, lead by Japanese and US companies. Our

presentation aims to identify the players involved in these two particular situations and share the stories of that the local citizenry imparted to us during our travels.

## **EARLY MINORITY STUDENTS OF COLBY COLLEGE**

### **Melvin K. Ladera ('03), History**

Recently, “diversity” has become a word that has created various issues for our growing Colby community. The experience of a minority at a small liberal arts college is always unique and complex. I have compiled biographies on over a dozen of Colby College’s earliest minority students, most of which attended Colby during the first half of the Twentieth Century. Many of these figures were the only representatives of their race during their time at Colby. How did they cope? What became of them? Many of these Colby graduates went on to make a difference in the world. They strived through adversity and worked hard to achieve their goals in a society where they as easily accepted. We can learn a lot from these inspirational pioneers.

## **A HYDROGEOCHEMICAL ANALYSIS OF A CONTAMINATED INDUSTRIAL SITE**

### **Amy Lansdale ('03), Geology**

Groundwater pollution is an increasing concern in many areas of the country. Many site-specific studies are conducted in response to this concern to gain a better understanding of hydrogeochemical systems. This study investigates an industrial site in mid-coast Maine that has a history of contamination. Simple flow calculations and mass transport calculations in combination with numerical modeling in Modflow® provide a comprehensive hydrogeochemical characterization of the site. Simple flow calculations indicate flux values for each unit (in fill  $2.0 \times 10^{-5}$  m<sup>2</sup>/s is the highest, decreasing to  $1.2 \times 10^{-13}$  m<sup>2</sup>/s in the clay). Water-quality data showed detection of arsenic, 1, 1, 1 trichloroethane, hexachlorobenzene, and pentachlorophenol at levels above the U.S. Environmental Protection Agency’s maximum contamination limits (MCLs) in several of the six monitoring wells installed in the site. Mass transport calculations indicate that despite retardation, the 1,1,1 trichloroethane moves through all layers at a rate that is two orders of magnitude higher than any of the other contaminants. Numerical modeling of the site provides support for these calculations. I will make recommendations, based on this study for remediation and further study in the area.

## **THE EFFECT OF MALE-MALE INTERACTION ON CALLING BEHAVIOR IN THE BRAZILIAN TREEFROG, *SCINAX PERPUSILLUS***

### **Kelly Martin ('03), Felipe Bandoni de Oliveira, Kristin Larson ('03) and Heather Reid ('03), Biology**

Male frogs typically use acoustic signals during reproductive activity, which results in increased female attraction and competition with other males. In some species, males establish territories that contain egg-laying sites important to females. These territories may be limited so that male-male competition is especially energetic, and females may assess males by the quality of their calls. In this study, we examined the effect of male population density on calling behavior among individual males in a Brazilian treefrog, *Scinax perpusillus*, from two different populations. This species lives in and calls from bromeliads in the Atlantic Rainforest of Southeastern Brazil; populations at the Boracéia Ecological Research Station and Intervales State Park, both located in Southeastern Brazil, live in slightly different ecological conditions that affect male distribution

within the habitat. Individual males were recorded for 30 minutes as they called from bromeliads, and the number of neighboring males concurrently calling was noted. Recordings were digitized and the calling rate, number of notes per call, and inter-call and inter-note intervals were measured. Males tended to increase the number of notes per call when more neighboring males were calling, and differences between call properties of the two populations suggest that they are two distinct species. This study provides important information contributing to the proper classification of the species in these two areas of Brazil.

## **MECHANISM OF HYDROGEN PEROXIDE DETECTION IN NATURAL WATERS**

### **Erik Lisk ('03), Chemistry**

Hydrogen Peroxide (H<sub>2</sub>O<sub>2</sub>) is a ubiquitous oxidant in natural waters that has been directly linked to the iron oxidation cycle. A chemiluminescence (CL) method of detection has been developed and adapted to Flow Injection Analysis (FIA) system. While the method is very sensitive, the full mechanism of CL technique has not been completely described. Description of the CL mechanism and characterization of the intermediates are important for a full chemical understanding of the system. Once the parameters that control the analytical chemistry are established, optimization of the instrument for improved accuracy and detection limits becomes possible. Computer modeling and decay rate analysis were used to further describe the reactions of the CL technique including the rates of reactions. Liquid Chromatography-Mass Spectrometry was used to characterize reagents and identify intermediates. This work has enabled new experimental parameters to be established for detection of H<sub>2</sub>O<sub>2</sub> in natural waters by the CL-FIA method.

## **THE PILGRIMAGE TO THE SACRO MONTE AT VARALLO: A JOURNEY IN PERSONAL DEVOTION**

### **Kate Lydecker ('03), Art**

The Sacro Monte at Varallo, a northern Italian pilgrimage site, was established in the late 15th Century as an alternative to the perilous trip to Palestine. Situated atop a mountain rising 500 feet above the Mastallone River, the Sacro Monte consists of over fifty chapels housing realistic tableaux of events in the life of Christ. I will discuss the influence of Franciscan theology, which placed an increased importance on the humanity of Christ, as well as the use of devotional material, which encouraged an intimate and personal journey for the pilgrim at Varallo.

## **SAMPLING AND THE DEATH OF MECHANICAL REPRODUCTION**

### **Robert D. MacBain ('04), Music**

Sampling has traditionally been viewed with suspicion in terms of its authenticity because of its reliance on reappropriation of existing music and speech. This paper will argue affirmatively for the value of sampling as a means of authentic musical expression by examining some of the key issues surrounding sampling and confronting both the musical and cultural implications of sampling raised in Walter Benjamin's essay, 'The Work of Art in the Age of Mechanical Reproduction'. The music and aesthetic claims of DJ Spooky, a.k.a. Paul Miller, will then be invoked as concrete evidence of the realization of these implications. Using these examples, the paper will demonstrate that sampling both reflects and constructs aspects of post-modern culture. By its nature, sampling accepts culture as fragmented, yet it is also capable of actively fusing

these fragments into a cohesive whole. Finally, the paper will suggest that current musical discourse should be revised in order to accommodate the implications of sampling.

### **ISOLATION AND CHARACTERIZATION OF MERCURY RESISTANT BACTERIA FROM TROUT AND SEDIMENT SAMPLES OF THE GOVERNOR HILL FISH HATCHERY IN AUGUSTA, ME.**

**Nicholas O. Markham ('04), Biology**

Atmospheric deposition of mercury, generated primarily from the burning of fossil fuels in other parts of the continent, has resulted in increasing levels of mercury in Maine waterways and animal tissue. In an effort to investigate the nature and extent of mercury's presence in the Maine environment, this research focused on a unique microbial environment, the indigenous microflora of the gastrointestinal (GI) tract of hatchery-grown lake trout, *Salvelinus namaycush*. Because of elevated mercury concentrations, bacteria have adapted mercury resistant mechanisms for protection against this heavy metal. A positive correlation between microbial mercury resistance and antibiotic resistance has been observed by previous studies in this and other laboratories. The effects of horizontal gene transfer were investigated by microbiological and molecular approaches to determine if antibiotic resistance genes are being transferred to sediment bacteria within the hatchery system. 16S rDNA genes of 36 mercury resistant bacterial isolates from the hatchery environment were amplified by PCR and characterized using denaturant gradient gel electrophoresis (DGGE). Minimum inhibitory concentrations (MICs) of antibiotics were also examined in order to determine a geographical relationship between antibiotic resistance and location within the hatchery system of sediment bacteria. Future research will include DNA sequencing to determine the identity of these bacteria and the presence of mercury and antibiotic resistance genes.

### **THE DIVERSITY AND CONSERVATION OF THE WORLD'S MAMMAL SPECIES**

**Erin C. Estey ('03) and Paul D. Mathewson ('03), Biology**

The 29 orders of living mammals occur in a variety of habitats; approximately 97.5% of the species occupy terrestrial while only 2.5% inhabit marine environments. Wilson and Reeder's new edition of Mammal Species of the World (2002) identifies 140 families, 1,169 genera, and 5,022 living and recently extinct species. 600 new species have been described since the last edition (1993). Approximately 34% of those new species are in the order Chiroptera. The Ethiopian realm possesses the most diverse fauna in the Old World and 23% of all described species (92% endemic). The richest diversity of mammals in the New World occurs in the Neotropical realm with 25% of the world's species (84% endemic). Approximately 22% of all mammal species are critically endangered, endangered, or vulnerable. Thirteen orders contain species that require immediate conservation action. Major threats to global biodiversity include habitat destruction, overexploitation, invasive species, and disease. Many species are at risk and warrant conservation strategies in the remaining 16 orders. Field surveys to obtain accurate distribution and conservation status data are urgently needed. Worldwide adoption of standard field methods would facilitate the design of effective conservation action plans.

### **THE PRIMARY IMMUNE RESPONSE OF LANDLOCKED SALMON (*SALMO SALAR*) TO THE PROTEIN ANTIGEN DNP-KLH**

### **Elizabeth Mayhall ('03), Biology**

Fish immunology has received increasing attention because of the biologic and economic benefits offered by fish. Salmonids, such as Landlocked salmon (*Salmo salar*), are of primary importance to aquaculture where fish health must be maintained to maximize productivity. Recurrent infections in fish farms and hatcheries have resulted in the demand for vaccine development. By characterizing the immune response in salmon, more efficacious vaccines can be developed and the homology between the human and fish immune systems will be better understood. Landlocked salmon were intraperitoneally immunized with hapten dinitrophenyl-conjugated to keyhole limpet haemocyanin (DNP-KLH) to study the primary B lymphocyte response in the head kidney and spleen by ELISPOT, serum ELISA and immunohistochemical analyses. The number of specific antibody secreting cells as measured by ELISPOT significantly increased compared to controls in the head kidney 14 days post immunization, but no significant increase was observed in the head kidney on day 7 or in the spleen on day 7 or day 14 post immunization. The anti-DNP serum ELISA showed that serum antibody secreting cell levels did not correlate with lymphoid tissue levels. Immunohistochemical analysis showed an increased number of melanomacrophage centers in the head kidney compared to the spleen and reduced compartmentalization compared to human lymphoid organs. B lymphocytes were more apparent in the spleen than head kidney. The protein antigen appears to elicit an immune response in salmon and serves as a possible substrate for better characterization of the salmon immune response.

### **ANALYSIS OF LAND USE PATTERNS AND LAKE WATER QUALITY IN CENTRAL MAINE USING REMOTE SENSING AND A GEOGRAPHIC INFORMATION SYSTEM (GIS)**

#### **William S. McCloy ('03) and Lauren E. Bliss ('03), Biology**

Over the past few decades, increasing human populations in central Maine have caused changes in land use patterns and have also had the potential to change the amount of forest fragmentation. Quantifying these land use changes and forest fragmentation allows researchers to evaluate habitat conditions for many species with specific ranges and niche requirements, and also assess the effects fragmentation has on nutrient loading in nearby water bodies. We will use a Geographic Information System (GIS) and satellite remote sensing imagery to analyze land uses, forest fragmentation trends, and photosynthetic activity in lakes within the Belgrade Lakes and China Lakes region of central Maine. Digital USGS Landsat satellite images from September 1976 and 1999 will be used in our study. The image analysis capabilities of ArcView®3.2 GIS software allows the unsupervised ISODATA classification of the individual 57 x 57-meter pixels of each image as different land uses based on the spectral wavelengths they reflect. ArcView allows the analysis to be isolated to the visible red spectrum (~0.60 – 0.70um), which is a measure of photosynthetic activity. To verify that our classification scheme is accurate, we will use Global Positioning System (GPS) technology to locate sample areas of each representative classification and conduct ground-truthing assessments as well as verify lake water quality with Maine DEP data from 1999. Land use change from 1976 to 1999, the Forest Continuity Index (FCI) for 1976 and 1999, and lake photosynthetic activity (algal activity) will be mapped and calculated.

### **ASSESSMENT OF THE WEBBER POND WATERSHED USING A GEOGRAPHIC**

## **INFORMATION SYSTEM (GIS)**

**Christopher A. Makarewich ('03), Lauren E. Bliss ('03), William S. McCloy ('03) and Madeleine M. Mineau ('03), Biology**

A comprehensive study of the Webber Pond watershed was conducted by the Colby Environmental Assessment Team (CEAT) during summer and fall 2002. Webber Pond is a eutrophic lake that suffers from periodic algal blooms and water quality problems due to high levels of phosphorus. A Geographic Information System (GIS) played a key role in the analysis of the watershed land use patterns and physical characteristics. Slope and soil series maps were created from the Maine Office of GIS contour data and USDA soil type data, respectively, using ArcView v.3.2. Historic and present land use maps were also created by identifying and digitizing different land use areas from digital orthophoto quadrangles from 1956 and 1997. Historic land use trends were determined through comparison of the two maps. Major changes in the land use included a decline in agriculture by 61.8 percent, an increase in residential land by 970.9 percent, and an increase in the largest land use type, forested land, by 19.0 percent. An erosion potential model combined erosion risk attributes of soil, slope, and current land use maps to create a map highlighting areas of high erosion potential. It was determined that 93.9 percent of the Webber Pond watershed ranked between low and moderate erosion potential. Recommendations to the watershed stakeholders for remediation and future land use developments were based on our analysis.

## **MISHIMA YUKIO'S SHORT STORIES**

**Evan McGee ('03), East-Asian Studies**

Yukio Mishima is a iconic character in modern Japanese literature. Living a turbulent life that ended in a dramatic seppuku suicide in the office of a kidnapped regional General, Yukio is a figure that lives on in the numerous books he wrote throughout his career. This presentation will focus on two of his short stories, 'Patriotism' and 'The Priest of Shiga Temple and His Love,' both from Mishima's 'Death in Midsummer.' These two stories tell a great deal about the personality of Yukio Mishima. 'Patriotism' is the story of a young man forced to deal with the decision between battling former comrades-turned-traitors, and his devotion to his Emperor. In an unsettling foreshadowing of Mishima's future, he commits seppuku, or ritualistic suicide, with his wife. 'The Priest of Shiga Temple and His Love' is the story of an old ascetic who is ripped away from his visions of Paradise by the beauty of an imperial concubine. He eventually travels to visit the concubine, who in his mind has replaced Buddha as the figure of adoration. While the priest realizes his vision of paradise through the concubine, she never surpasses her planery attitude towards the afterlife. Both of these short stories reveal intricacies of Mishima's character, which shall be explored with textual examples.

## **GATHERING TOGETHER IN HIS NAME: AN ANALYSIS OF THE CHRISTIAN METHODIST EPISCOPAL AND AFRICAN METHODIST EPISCOPAL ZION CHURCHES' PENDING MERGER**

**Amina McIntyre ('04), Anthropology**

In the late 18th century, a split occurred in the churches of the United States. This split, which was a racially divided, led to the formation of Black denominations, which include the African Methodist Episcopal Church (A.M.E.), the African Methodist Episcopal Zion Church (A.M.E.Z)

and the Colored Methodist Episcopal Church (C.M.E., now Christian instead of Colored). Each church formed under slightly different circumstances but have the similar goal of creating a place for African Americans to worship. This entity is known as the Black Church. The focus of this paper is the history and the proposed merger of the A.M.E.Z and C.M.E churches in 2008. By researching the histories and structures of the churches, along with information on the proposals and meetings between and within the denominations, the possible benefits and drawbacks of the merger will be analyzed.

### **THREE CEREAL GRAIN PROTEINS, TAABF, TAWD40, AND AFN1, HAVE PUTATIVE ROLES IN THE ABSCISIC ACID-MEDIATED GENE EXPRESSION PATHWAY**

**Douglas C. Melzer** ('03), Biology

The plant hormone abscisic acid (ABA) regulates gene expression in response to many stresses including drought, cold, high salinity, and regulates gene expression for proper seed maturation and germination. Specifically in seed development, ABA is required for the acquisition of desiccation and dormancy. The three proteins TaABF, TaWD40, and AFN1 have putative roles in the ABA-mediated gene expression pathway in cereal grains. TaABF and TaWD40, both wheat proteins, have been shown to interact with ABA-responsive protein kinase, PKABA1. AFN1, an oat protein, may be a required to signal and initiate the early steps of germination. Currently, studies of these potentially key proteins in ABA-gene expression have shown mRNA accumulation during seed development or germination in vivo. My work has been to overexpress and purify TaABF, TaWD40, and AFN1 polypeptides that can be used for further investigation of their roles in the ABA gene expression pathway. From a plasmid encoding amino acid sequence of the TaABF, I overexpressed this fusion protein in E.coli, and purified it using a nickel affinity column. So far, I have purified a polypeptide of TaABF while work is underway on TaWD40 and AFN1.

### **DETERMINATION AND OPTIMIZATION OF CALCIUM AND PHOSPHORUS CONTENT OF CAPTIVE BIRD DIETS**

**Szymon Mikulski** ('05), Chemistry

Birds require adequate dietary calcium for proper bone development. In addition, an optimum dietary calcium-to-phosphorous ratio of 2:1 has been suggested, although this ratio has been extremely difficult to achieve in insects used for captive bird diets. This study analyzed the affect of culture composition on the calcium and phosphorous content of cultured insects. The goal of this work is to identify an optimum culture medium for insects so as to improve their calcium content and calcium-to-phosphorous ratio when used as food for captive birds. Frozen samples of mealworms, waxworms and crickets were dried, homogenized by microwave digestion, and analyzed for their Ca and P content via Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). Significant improvements in calcium content are observed in insects cultured on several different media. For mealworms and crickets, the highest calcium-to-phosphorous ratio found was 1:2, and for waxworms, it was 1:4.

### **HYDROGEN BONDING IN DISCRETE BASE PAIRING COMPLEXES CONTAINING 6-THIOGUANINE**

### **Andrew Moraco ('03), Chemistry**

In 1966 the anti-metabolite chemotherapy drug 6-thioguanine (6sG) was approved by the FDA. After being incorporated into the cell, it is thought that the increased size and decreased electronegativity of the thio-group leads to cytotoxicity by altering the hydrogen bonds between nucleic acid duplexes, resulting in the disruption the conformation of the DNA thus inhibiting replication and transcription. Through NMR spectroscopy we have gained insight into the enigmatic mechanism of this age old chemotherapy agent by have examining the dynamics of the rotation of the amine groups involved in hydrogen bonding interactions of the discrete base pairing complexes. The 1:1 complexes of G:C 6sG:C G:U and 6sG:U were prepared via NMR titration of the protected nucleoside 5'-tert-butyl-dimethylesilyl-2'3',-di-O-isopropylidene guanine(it-G), cytosine (it-C), uridine (it-U) or 6-thioguanine (it-6sG). Though expected, it-6sG sulfur to cytosine amine proton hydrogen bond did not exhibit a decrease in stability relative to its control it-G:it-C. However, the it-6sG:it-C samples did form less stable tetramers at low temperatures than was observed for the it-G:it-C solutions. Finally, despite theories that 6sG will also cause mispairing in DNA replication due to an ability to code for thymine or cytosine, there was little evidence for hydrogen bonding between it-6sG and it-U.

### **THE FORAGING BEHAVIOR OF BUTTERFLIES ON BOUGAINVILLEA**

#### **Jenna Morrison ('06), Biology**

The foraging behavior of three species of butterflies (Fritillary, Pterourus glaucus, Violet-banned Skipper) was studied on Bougainvillea in Anguilla, BWI. Studies were conducted over a five day period: observing butterfly foraging behavior at different time periods through out the day and manipulating the amount of nectar in the Bougainvillea flowers. Butterfly behavior data was collected by counting the number of flower visits and timing the flower visits for each butterfly seen during three time periods, morning, midday, and afternoon. It was found that there was an inverse relationship between the number of flower visits and the time spent on individual flowers throughout the day. The data suggests that there is more nectar available in the morning than in the afternoon, therefore, the butterflies visit fewer flowers and remain longer on them in the morning. The second experiment involved adding a sucrose solution to marked flowers and comparing the number of flower visits and timing of flower visits to a control group of flowers. It was found that butterflies spend more time on the flowers with the added sucrose, however, no learned behavior regarding revisiting manipulated flowers was observed. The differences in the foraging strategies of different species were also noted.

### **TISSUE-SPECIFIC TISSUE ANALYSIS SUGGESTS INCREASED EST LIBRARY CONTAMINATION**

#### **Daniel P. Morrison ('03) and Kevin J. Septor ('04), Biology**

Although various kinds of EST library contamination are known, many approaches currently in use to 'clean' EST datasets are unable to detect and subsequently remove contamination from an organism's own genomic DNA. Recently, statistical examination of a library's sequences as a group has allowed the identification of recognizable characteristics associated with EST libraries suspect for contamination (Sorek and Safer 2003). However, the pooling of cDNA clones from multiple tissues to derive some EST libraries may exhibit reduced levels of tissue-specific sequence contamination. Therefore, our study sought to examine the affect of tissue-specific



sequence analysis on previously published levels of pooled EST library contamination. By separating EST libraries derived from pooling cDNA clones from multiple tissues into tissue-specific subsets, we hypothesize that a significantly higher number of contaminated sequences identified than previously reported by Sorek and Safer (2003).

## **POSSIBLE CONTRACTION AND ITS EFFECT ON 2002 MAJOR LEAGUE BASEBALL ATTENDANCE**

**Peter Newberry ('03), Economics**

POSSIBLE CONTRACTION AND ITS EFFECT ON 2002 MAJOR LEAGUE BASEBALL ATTENDANCE This paper creates three demand equations for baseball attendance to determine the factors that affect spring training and regular season attendance. It also examines what effect the threat of contraction had on the Montreal Expos' and Minnesota Twins' attendance. Cross sectional models using data from the 2002 spring training and regular seasons are estimated and analyzed. A third panel data set model is also formed and examined. Results from the spring training and regular season models indicate that the two teams threatened to be eliminated witnessed lower attendance compared to the rest of the league. The panel data model's results reveal that although attendance was lower than the rest of the league in 2002, both teams witnessed an increase in spectators in comparison with the previous two years. While possible elimination and a successful season by Minnesota may have actually increased attendance relative to previous seasons, both teams still witnessed lower attendance than the rest of the league during 2002.

## **ST. FRANCIS' IDEOLOGY AND ITS FRANCISCAN AND CLARISSAN IMPLEMENTATION**

**Doan Trang T Nguyen ('03), Art**

Instead of looking at Christ with awe inspiring fear and wonder, St. Francis wanted us to see the other side of Christ, less emphasized at the time, that of the human being. He wanted the Franciscans to preach among the people and for them to live the exemplary life of Jesus. For his second Order, the Poor Clares, he wanted a secluded life that consisted of prayers and focus on attaining the love of Christ. Although St. Francis did not set out to affect Western devotional art, his teachings, his ideology, and his actions caused his followers, the Franciscan Friars and the Poor Clares to invent new iconographies and as well as to expand old ones according to their spiritual needs. This paper investigates the role of the Franciscans in bringing forth the importance of Christ's sufferings to emphasize Christ's humanity, while the Clares used the images of the Christ child and the Virgin Mary to keep them company during their cloistered lives. In the end, they did as St. Francis hoped: they reminded the world that Christ was both man and God.

## **VIETNAMESE INTERPRETATION AND INTEGRATION OF RELIGIONS**

**Doan Trang T Nguyen ('03), Art**

Over the course of thousand of years, a wide range of religions entered Vietnam by way of merchants and missionaries. But how does the Vietnamese incorporate these religions into their culture and how are they reflected in their religious art and architecture? One can observe the integration of several beliefs, as, for example, Hindu gods in Buddhist pagodas. This religious

'melting pot' culminates into one of Vietnam's indigenous religions, Cao Dai. Those who follow Cao Dai preach that all religions originated from one supreme being. Therefore, Cao Dai incorporates elements of Confucianism, Taoism, Hinduism, Buddhism, Christianity, Islam, as well as ancestor worship. My JanPlan research took me to houses of worship of Vietnam's major religions: Catholic churches, Buddhist pagodas, Hindu temples, Islamic mosques, and Cao Dai cathedrals, as I investigated each religion's interpretation of their beliefs through art and architecture.

## **THE PARADOX OF NAPOLEON BONAPARTE: A FALLEN GENIUS**

**Kimberly Niederberger ('03), French/Italian**

THE PARADOX OF NAPOLEON BONAPARTE: A FALLEN GENIUS Napoleon Bonaparte remains one of the most important heroes of French national history. As a military genius and the Emperor of the French, he represents the power and grandeur of France during that time period. Nevertheless, Napoleon's search for personal glory and conquest pose a contradiction between his style of rule and the principles he was trying to promote in his campaigns. A struggle between two passions, nationalistic and egoistic, defines this paradox.

## **B CELL RESPONSE BY IL-4 OVERPRODUCTION IN FLAKY SKIN MUTANT MOUSE SPLEEN**

**Mari Nishino ('03), Biology**

The flaky skin (fsn) mutation provides a unique model to study the interaction between the immune system, skin disease, genetic mechanisms of IgE regulation, and autoimmunity. My research is focused on the formation of germinal centers in the spleens of fsn mutant mouse, to determine whether the disrupted lymphoid architecture and overexpression of the cytokine IL-4 affects normal B cell responses in these mice. To study them, a reliable, new procedure for staining interleukin-4 (IL-4) producing cells in fsn spleens must have been established. I first optimized a protocol for immunostaining, utilizing acetone-fixed sections of frozen spleens to stain for basic T cells, B cells, follicular dendritic cells (FDC), or germinal centers (GC). However, there had been no previous protocol to stain for IL-4 and IL-4 producing cells because of difficulty in preserving their structural integrity. A protocol based on PLP (Paraformaldehyde-L-lysine-Periodate sodium) fixation was therefore optimized for IL-4 staining.

## **THE ECONOMIC EFFECTS OF BRITISH COLONIALISM ON INDIA: AN ANALYSIS OF THE GOODS AND CAPITAL MARKETS, 1853-1947**

**Katrina Noyes ('03), Economics**

It is inarguable that British colonialism had a significant effect on the development of India. From 1600, when the East India Company was granted a monopoly charter over trade, to the middle of the twentieth century, British influence expanded to all aspects of the Indian economy. This study is an attempt to quantify this influence and measure the expansion of goods markets through the introduction of the railroad as well as the integration (or disintegration) of capital markets. Hurd's (1975) model of price convergence and Feldstein and Horioka's (1980) model of capital mobility are used to achieve these measurements. Due to the availability of data, price convergence will be measured from 1853 to 1923, and capital market integration will be measured from 1900 to 1947, the year that India gained independence. While the study will

conclude that Great Britain had a positive influence of India through their introduction of the railroad and expansion of goods markets across India, the results of the Feldstein Horioka model are inconclusive, showing a closing trend in capital markets that can be attributed to either British policies or current global conditions.

### **UNMASKING 'THE PERFECT STRANGER': PIERRE BOULEZ, FRANK ZAPPA, AND THE COMMON GROUND BETWEEN MODERNISM AND POSTMODERNISM**

**Edward J. Piasecki** ('03), **American Studies**

In the last forty years cultural critics from a variety of fields have researched the transition from modernism to postmodernism. In this research, they have consistently focused on the ways in which modernism and postmodernism can be distinguished from each other. What the majority of these studies overlook, is how modernism and postmodernism are alike. In an effort to expand the dialogue on this subject, this study will suggest that modernism and postmodernism are more similar than they are different. In making this claim I will turn to the field of music and focus on an album called 'The Perfect Stranger'. Because this album is a collaboration between the lauded modernist composer Pierre Boulez and notorious postmodernist Frank Zappa, it is a perfect place to locate a dialogue about the shared values of modernism and postmodernism. Interviews with both of these men reveal that while Boulez and Zappa disagree on the ways in which musical elements should be organized, they similarly value the organizational process. By comparing these men to other well recognized modernists and postmodernists, this study concludes that both modernists and postmodernists actively search to create authentic meaning in the contexts of their works. As Zappa and Boulez both work to push the boundaries of music, they pride themselves on what Boulez calls 'intelligent deviation'. Thus, this study concludes that Boulez, Zappa, modernists, and postmodernists all have a vested interest in how human agency must be exerted to create not only an authentic works, but also a meaningful existence.

### **DISCRIMINATION BETWEEN GRAVITY AND LINEAR ACCELERATION BY NEURONS WITH BOTH LINEAR AND ANGULAR INPUT FROM THE INNER EAR**

**Sarah E. Pierce** ('03), **Mathematics**

The vestibular system is responsible for sensing body movement and orientation with respect to gravity. This information is essential for the correct control of motor coordination, eye movements and posture. Two types of organs in the inner ear are used to detect acceleration of the head: the semicircular canals sense angular acceleration, and the otolith organs sense linear acceleration. These sensed accelerations are then converted into perceived motion and perceived head position by neuronal processing. One challenge that the brain must deal with when processing this information is the fact that, according to Einstein's equivalence principle, gravity is indistinguishable from acceleration due to translational motion. Some neurons in the brain receive input from both the semicircular canals and the otolith organs. Experimental evidence suggests that these neurons are responsible for determining what portion of the sensed linear acceleration is the result of actual linear acceleration, and what portion is due to gravity. The computational mechanism used by these neurons remains unknown. My work examines possible computational strategies neurons with both linear and angular input from the inner ear could use to discriminate between gravity and linear acceleration.

### **INVESTIGATION OF THE GENE GOVERNING GAMETOPHYTIC SELF**

## **INCOMPATIBILITY (THE S-GENE) IN A POPULATION OF *WITHERINGIA SOLANACEA* (SOLANACEAE)**

**Sarah E. Pierce ('03), Biology**

Self incompatibility (SI) refers to the inability of a plant to be fertilized by its own pollen. In the Solanaceae, SI is governed by the S-locus, which encodes the S-RNase. This RNase enters growing pollen tubes, and digests the mRNA of pollen tubes that are of like genotype to the maternal plant at the S-locus. This kills the pollen tube, preventing fertilization. As a result of the ability of a plant to fertilize all unlike genotypes, rare alleles are favored over common alleles resulting in a high level of variation in this locus. A plant can gain the ability to self when mutations occur in the S-gene. This is a very frequently observed transition. The transition to SI can be advantageous because the plant is able to pass on more copies of its own genes, and because the plant is guaranteed to come into contact with suitable pollen every time it flowers. However, gain of selfing ability can also be damaging due to the effects of inbreeding depression. The combination of these benefits and potential losses determines whether or not it is favorable for SI to be lost. I have sequenced S-RNase alleles in plants from the Monteverde (MV) population of *Witheringia solanacea* (a member of the Solanaceae). This is an ideal species for the study of self incompatibility, because it has both SI and SC populations. The MV population of *W. solanacea* is also thought to have both SI and SC individuals. A phylogenetic tree was made with the S-RNase sequences from the MV population and from related species. Coalescent theory was then used to infer information about the history of the MV population based on the shape of this allele genealogy.

## **SOLID WASTE MANAGEMENT IN MAINE: CHALLENGES AND POSSIBLE SOLUTIONS FOR WATERVILLE**

**Donna M. Pitteri ('03), Economics**

Waterville Maine's waste management system has undergone a great deal of change in the past year due to a reduction in funding. Program services were discontinued and more waste was created. In order to provide better service and find a more efficient program, it is necessary to look beyond Waterville. Throughout the country, a variety of ways of funding systems and dealing with waste are used. To understand how costs are affected by different aspects of programs, it is necessary to isolate cost determinants. Using data from comparable Maine towns, it is possible to see what can and cannot be changed in a system. Taking the analysis one step further and comparing knowledge from first hand waste system managers allows a comprehensive look at how efficient systems are run. A prescription for Waterville is created by remaining sensitive to costs while attempting to provide greater service while considering environmental issues.

## **THE EFFECT OF COMPETITIVE BALANCE ON INDIVIDUAL GAME ATTENDANCE IN MAJOR LEAGUE BASEBALL**

**Thomas V. Richardson ('03), Economics**

In recent years much has been made of the effect that competitive balance has had on the welfare of Major League Baseball. Many studies have looked at competitive balance by examining the standard deviation of winning percentages over a season, but what about how competitive balance affects individual games? Previous studies have looked at how the demand for single

games is determined, but none have directly looked at competitive balance. By looking at the attendance of each MLB game for the last three seasons this study has helped to provide an answer. Using new and different variables this study uses a larger data set than any other study of its kind to explore the way competitive balance affects attendance. By controlling for other factors that affect attendance, the effect of competitive balance on attendance in baseball has been measured.

## **SEARCH FOR ROOTS: THE INFLUENCE OF 'THE PAST' ON FIFTH GENERATION FILM**

### **Ellie Roan ('03), East-Asian Studies**

During the Mao years and the Cultural Revolution, many old traditions and ways of thought had been abandoned for the sake of “progress” and “modernity.” Several contemporary filmmakers believe that along with this anti-traditionalist outlook came the breakdown of a Chinese identity. Though it would be impossible to define the shifting meaning of “Chineseness” at any given time, these filmmakers aspire to shed light on the “roots” of national identity, which they believe had been lost as China moved towards modernization. Fifth Generation filmmakers focus on aspects of culture that they see as specifically “Chinese,” attempting to form a connection to a perceived misplaced heritage. Creating a nostalgic mood for an unspecified past, they emphasize the traditions and ways of life that they believe to constitute the essence of what it means to be Chinese. This looking back to the past for meaning suggests a yearning for stability and structure that the Mao years and decade of the Cultural Revolution lacked. However, even as Fifth Generation directors explore the meaning of national identity in their films, which are often situated in the past, the films are also a reaction against traditional thought and culture. The directors believe that the negative effects of tradition strongly influence contemporary Chinese society, preventing the formation of a modern nation with the ability to compete with Western countries. On one hand, Fifth Generation directors draw attention to the rituals and traditions that they feel compose China, yet on the other, they depict many of these traditions as empty and without value—obstacles in the way of modernity.

## **NUNS AND DEVOTIONAL OBJECTS, IMAGES AND PRACTICES**

### **Nicole Russo ('03), Art**

Throughout the Middle Ages, nuns in convents relied on devotional objects and images to guide their religious practices towards a spiritual connection with God. These devotional tools, meant to act as aids for prayer and meditation, were also designed to inspire emotional responses from the nuns. Objects such as dolls, cradles, sculptures, paintings and prayer rolls engaged the nun's corporeal and spiritual senses through speech, sight and gesture.

## **FLANKING SEQUENCES MODULATE DIEPOXIDE CROSS-LINKING EFFICIENCIES AT THE 5'-GNC SITE**

### **Gregory Sawyer ('03), Chemistry**

Diepoxybutane, diepoxyoctane, and mechlorethamine are cytotoxic DNA cross-linking agents known to have both carcinogenic and anti-cancer potential. This cross-linking occurs between the N7 positions of deoxyguanosine residues on opposite strands of the DNA duplex. Each synthetic DNA oligomer used in this study contains four 5'-N1GN2CN3 sites (within a 32 base

sequence), and we are currently systematically varying the bases in the N1 and N2 positions to determine the resulting cross-linking efficiencies of each cytotoxic agent. Each duplex is 5'-end labeled, incubated with cross-linking agent, purified through denaturing polyacrylamide gel electrophoresis, and subjected to piperidine cleavage. The amount of cleavage at each deoxyguanosine residue represents the cross-linking efficiency at that site and is quantified through 2-D scanning on a phosphorimager. We have determined that cross-linking efficiency varies with the identity of N1 and N2.

## **AN INVESTIGATION OF THE POSSIBLE BIOLOGICAL BASIS OF AUTISTIC BEHAVIOR**

### **Kristin Schaefer ('04), Psychology**

Autism is a pervasive developmental disorder that is characterized by social impairment and communication difficulties. Autism seems to be increasing in prevalence, as reports now show its incidence to be 20 out of every 10000 births. This investigation addresses the factors that may contribute to this increasing prevalence. As well as exploring the neuroanatomical abnormalities in autistic children, this paper examines evidence of environmental factors that may cause these abnormalities. Among the topics discussed are the controversial theories considering vaccinations and gastrointestinal disorders as triggers to the onset of autistic symptoms. The development of explanatory theories for the pattern of onset of autistic symptoms provides a basis for evaluating treatments and interventions that are not yet available.

## **THE ALLEGORICAL AND ARTISTIC USE OF MIRRORS IN LATE MEDIEVAL DEVOTIONAL ART**

### **Tracy Schloss ('03), Art**

Mirrors are a common religious and allegorical symbol in Late Medieval devotional art. I will discuss the particular meaning behind the depiction of mirrors, as well as their use in the medieval artist's workshop.

## **ESTUARINE MACROFOSSILS FROM THE TROUT VALLEY FORMATION IN THE NORTHEAST CORNER OF BAXTER STATE PARK**

### **Robert W. Selover ('04), Geology**

The Middle Devonian (Eifelian) Trout Valley Formation outcropped in the northeastern corner of Baxter State Park, Maine, is noted for its abundant plant fossils and palynomorphs. However, to date, there have been no detailed reports of any invertebrate macrofaunal assemblages in this fluvial-to-marine sequence. Isolated eurypterid parts have been reported previously, the first in the 1960s, but no associated or additional benthic taxa have been recovered. During the summer of 2002, an outcrop of coarse-to-medium grained siltstone was discovered in which a restricted, transported invertebrate assemblage was preserved. The depositional environment is characterized by mega-ripples containing macrofossils in varied orientation. Fossils were most abundant at the crests of the mega-ripples, and surveillance of the troughs showed minimal fossil preservation. Similar sedimentological features in other parts of the stratigraphic section are indicative of an estuarine and tidally influenced depositional regime. The macrofauna consists, in rank order abundance, of bivalves, spiral and planispiral gastropods, possible nuculid gastropods, (?) ostracodes, brachiopods, and one nearly complete eurypterid, cf. *Erieopterus*. The most

common bivalve is cf. *Phthonia sectifrons*, distinguished by its elliptical shape with a short anterior end, which ranges in length from 1 cm to 3 cm. Spiral gastropods are small, and are all roughly 2 mm in size. The eurypterid is approximately 3 cm by 1.25 cm with virtually all parts preserved in a single bedding plane. This is the first report of a nearly complete eurypterid of any age from Maine.

## **GEOPHYSICS AND THE GROWTH OF THE OIL INDUSTRY: A COMPREHENSIVE LOOK INTO TECHNOLOGICAL DEVELOPMENT AND ITS ROLE IN SOCIETY**

**Robert W. Selover ('04), Geology**

As the oil industry has grown, it has formed a reciprocal relationship with technology: spurring its expansion while depending on its development. Specifically, the development of geophysical techniques have helped to improve prospecting and extraction methods. Seismic stratigraphy dramatically affected oil prospecting by allowing geologists to view the subsurface without having to see the actual rocks in outcrop or core. As such, they were able to identify stratigraphic traps and other structures such as faults much more efficiently and cheaply, allowing them to drill for oil with increased precision without significant extra cost. Gravity anomaly methods allowed prospectors to identify particular structures of interest such as salt domes and anticlines by measuring the inherent differences in densities between these objects and the surrounding bedrock. Magnetic anomaly studies further broadened the area in which geologists could identify oil bearing structures by expanding the region in which geophysics was useful into areas where topographic features on underlying basement rocks control structures in the oil bearing sedimentary beds. These three methods, developed in the early 1900's were greatly enhanced by the development of well logging techniques. Well logging includes microfossil biostratigraphy, conductivity and gamma logging along with several other methods. The interpretation of well logs greatly magnified the precision to which sedimentary layers could be identified and the cyclical nature of sedimentary basins could be resolved on a much finer level. These developments have greatly improved the success rate of oil drilling, lowering the overall cost and allowing oil companies to spend more on technology without charging more at the pump.

## **THE BIOGRAPHY OF A MAN AND A MAGAZINE: MAX ASCOLI AND THE REPORTER**

**Jonathan Silberstein-Loeb ('03), History**

A history of the evolution and creation of The Reporter Magazine as well as a in depth analysis of the ideas Max Ascoli, its editor and publisher.

## **FROM MAINE FARMS TO MAINE COLLEGES: THE SYMBOLISM AND REALITY BEHIND THE LOCAL PURCHASING EFFORTS AT COLBY, BATES, AND BOWDOIN**

**Kathryn Spirer ('03), Anthropology**

The United States is a nation built upon agriculture, but in the past 100 years, the number of small farmers in our country has decreased dramatically. Recently though, a number of counter-hegemonic movements have arisen around the country in response to this trend as people are beginning to realize that they can make a difference in their community by purchasing locally grown food. More and more, students across the country are demanding that their schools

increase their purchasing of locally grown food for environmental, economic, health, and/or social reasons. This study explores locally grown foods projects in Maine and specifically at Colby, Bates, and Bowdoin. While all three schools are involved with local farmers, either directly or through a distributor, the degree of commitment varies from school to school. My research suggests that the combination of the structure of Bates' dining services and its dedicated staff has enabled it to earn the trust and respect of local farmers in a way that Colby and Bowdoin have not. While Colby and Bowdoin both support local farmers, it is on a much smaller scale than Bates does and their capacity to increase their local purchases is severely constrained by the institutional framework in place at these schools. While the projects at Colby, Bates, and Bowdoin are useful in understanding the evolution of agriculture in Maine, they also reveal a great deal about nationwide trends concerning agriculture, the environment, and the role of institutions in a community.

## **CHILDREN OF INCARCERATED PARENTS: THE THEORETICAL FOUNDATIONS OF INNOVATIVE PROGRAMMING**

### **Sarah D. Style ('03), Sociology**

As the number of incarcerated women and men in this country continues to increase at an astounding pace, healthy family structures that foster a child's development are consequently being threatened. The issue of parents in prison raises a range of complex issues, from racism and classism, to gender roles within the family, to a socially assigned stigma that has proved to attach itself to the children of an inmate. As the Criminal Justice and Child Welfare Systems begin to acknowledge the severe threat that exists for these young people it becomes important to critically explore programs that are currently developing to aid incarcerated parents and their children. With an identification of some of the major programs across the United States it becomes apparent that major tenets of sociological theory create the foundation upon which many of these programs are structured. An analysis of some of the most important organizations that are working to confront the threat to innocent children of incarcerated parents and the underlying tone of classic theoretical ideas creates a legitimate sense of hope in decreasing the amount of families entangled in our massive prison-industrial complex.

## **MALE VOCALIZATION AND TERRITORIALITY OF A BRAZILIAN TREEFROG, *Hyla faber***

### **Stephanie Tat ('03), Biology**

Calling activity in frogs is one of the most important behaviors for mating success, and interspecific variation in call properties, such as calling rate, may be influenced by both environmental and genetic factors. Treefrogs in the genus *Hyla* are widely distributed throughout North, Central, and South America, and vary widely in their reproductive behavior. In some species, males establish territories, build nests as egg-laying sites, defend these from competing males, and guard the eggs and developing tadpoles. *Hyla faber* exhibits these behaviors, is native to Brazil, and little research has been conducted on this species. In this study, I investigated the reproductive behavior of *H. faber* at the Boracéia Ecological Station in southeastern Brazil. These frogs have an extraordinarily high calling rate, averaging 56 calls/min. Calling bouts, however, often include irregular pauses. Male *H. faber* tend multiple nests within their territories, which probably are used several times during their breeding season. Most nests are clustered together in dense patches of vegetation. Like their close relatives, *Hyla boans* and *H.*



*rosenbergi*, male *H. faber* expend time and energy to successfully tend multiple nests, and use high levels of calling activity to enhance mating success and deter competing males. This investigation contributes to the understanding of the behavior and natural history of *H. faber*, and to the appreciation for the diversity of reproductive behavior among anuran amphibians.

## **FROM PROPAGANDA TO PUBLICITY: AN ANALYSIS OF THE ADVERTISING COUNCIL OVER THE PAST 60 YEARS.**

**Andrea Taylor** ('03), Sociology

The Advertising Council was created in 1942 in response to advertising industry troubles caused by public criticism and government legislation. In order for advertising to evade the threats of an adverse political environment brought on by the onset of World War II, members of the advertising community decided to donate their services and start up the Advertising Council, therefore creating public service advertising. The Advertising Council's purpose was to aid the government in keeping the American public informed about the war, bolster the wartime economy, and display the necessity and merit of advertising to the government and the public. Since the end of World War II, the Advertising Council has continued to exist as a 'private, non-profit organization and leading producer of public service advertisements' (Advertising Council, 2002). Known for producing slogans such as 'Only You Can Prevent Forest Fires' and 'Take a Bite out of Crime', the Council's objective is to produce non-commercial and non-partisan campaigns that serve in the public interest. This analysis of Advertising Council campaigns, advertising theory, and public opinion seeks to identify the role of public service advertising and the Advertising Council over time.

## **ANDACHTSBILDER: ASPIRING TO BECOME THE BRIDE OF CHRIST THROUGH IMAGES OF CHRIST AND ST JOHN AND THE PIETÀ**

**Elizabeth Urstadt** ('03), Art

“Andachtsbilder,” or contemplation images, were commonly used in 14th-century private devotional practices, and often included representations of Christ and St John, the Pietà, the Coronation of the Virgin, the Crucifixion or the Lamentation. Nuns in particular were known to use these images to enhance their prayers and meditations. Some nuns believed that the highest form of meditation involved imagining oneself as the *Sponsa Christi*, or the Bride of Christ, eternally united with Christ in heavenly state. Through the aid of images of Christ and St John or the Pietà, a nun might imagine herself as St John or Christ, respectively cradled in Christ’s or the Virgin Mary’s arms, jointly enthroned. Images of Christ and St John and of the Pietà are excerpted from the lengthier narrative of Christ’s life. By portraying one isolated moment, the images allowed the nuns to focus their energies more particularly, channeling their thoughts to a vision of union with Christ. Without regard for gender, a nun could picture herself as the Virgin Mary, but also as St John or Christ; what remained critical was her desire to be one with Christ.

## **A REVIEW OF PHENOMENOLOGY AND TREATMENT OF CHILDHOOD DEPRESSION**

**Jennifer A. Varley** ('03) and **Christopher K. Varley**, Psychology

Depression affects 0.4% to 2.5% of prepubertal children. Several environmental factors are associated with the onset of childhood depression such as increased life stressors and detached

family relationships. Although children with depression tend to have depressed parents, a specific genetic cause has not yet been confirmed. Childhood depression is also associated with a high incidence of comorbid disorders such as anxiety and conduct disorder. Symptoms of prepubertal depression are manifested differently in children than in adults. Research studies tend to use depression inventories, such as the Children's Depressive Inventory (CDI), to measure depression levels in children. Phenomenology and treatment of childhood depression are reviewed. Various forms of therapy are available to treat childhood depression including pharmacotherapy and several psychosocial treatments. The efficacy of drug treatments requires further research, and cognitive-behavioral therapy is thus far the best-supported treatment available for childhood depression.

### **KIRK'S DIK-DIK IN TANZANIA: A STUDY OF TERRITORY CHARACTERISTICS OF A DWARF ANTELOPE**

**Emily L. Weiser ('04), Biology**

Kirk's dik-dik inhabit East Africa and part of southwestern Africa. These dwarf antelope hold territories in mated pairs, and place dung middens along the perimeter of their territories as boundary markers. This study examines dik-dik midden and territory characteristics in Ndarakwai Estate, a privately-owned game reserve in northern Tanzania, and focuses on the effects of habitat on these characteristics. Midden size, distance to nearest cover, and height of surrounding underbrush were the factors analyzed for the 108 middens found; territory boundaries were estimated using midden placement, and for the five territories established, area, number of middens, and proportion of each habitat (grassland, open woodland, intermediate woodland, and dense woodland) were analyzed. Middens were found to be significantly larger in grassland than in open woodland; distance from midden to cover was significantly greater in open than in intermediate woodland; and middens were significantly more likely to be found in intermediate than in open woodland, and in open woodland than in grassland. Territory area was found to be correlated with percent open woodland and with percent intermediate woodland, as well as with the ratio of [percent grassland plus open woodland] to [percent intermediate and dense woodland].

### **SCREENING THE HUMAN GENOME FOR TRINUCLEOTIDE REPEAT EXPANSIONS**

**Jill S. Wentzell ('03), Biology**

To date 19 disorders have been associated with triplet repeat expansions in the genome. Ten of these show anticipation, an earlier age of onset and greater severity in subsequent generations. This is usually associated with a longer repeat. Many psychiatric disorders also show anticipation. Ideally a panel of all the potential expansion regions could be useful in screening patients. The goal of this project was to develop a panel for CAG repeats in the human genome. Primers were designed for amplification of regions with eight or greater CAG triplets. Polymerase chain reaction was performed on control DNA to test the primers and get an idea of region size in an unexpanded genome. This was then compared with PCR done on patients with various mental illnesses. Thus far patients were found to have two alleles for some regions, but no expansions have been found for tested regions.

## **TYING TOGETHER WORLD ECONOMIES: USING AN ESTIMATION OF THE J-CURVE PHENOMENON TO RECREATE THE ASIAN CURRENCY CRISIS OF 1997**

**Christopher A. Zeien ('03), Economics**

The focus of this paper is to use a bilateral trade model approach to determine whether or not the J-curve phenomenon can be produced from data between the United States and the United Kingdom and then apply the model to recreate the effects of the Asian Currency Crisis of 1997. To find a J-curve, a vector autoregression (VAR) model is created with quarterly data from 1960:1 through 2002:2 and an exchange rate shock is introduced to the model using the impulse response function. What is found is that when nominal data are used, the theoretical J-curve response for the trade balance can be identified. In the practical application of the J-curve model, data from 1984:1 through 2002:2 for macroeconomic variables for the U.S., Japan, Singapore and South Korea are used to recreate the currency crisis. It is found that the VAR model accurately predicts many of the actual trends exhibited by the variables during the two and a half years immediately following the initial shock that caused the crisis.