PRINCETON RESEARCH SYMPOSIUM 2008

communicating our research To a broader audience

Saturday, November 8, 2008
8:30am-6:00pm
Friend Center
Princeton University

Princeton Research Symposium

Saturday, November 8, 2008
Friend Center, Princeton University

Events of the Day

Remarks and Talk Sessions will be held in Friend 004. Research posters will be displayed throughout the symposium in the space outside of Friend 004.

8:30-9:00 **Breakfast**

9:00-9:30 **Opening Remarks**

Daniel Oppenheimer
Assistant Professor of Psychology and Public Affairs

9:30-11:30 **Talk Session I**

11:30-2:15 **Poster Session & Lunch**

Poster authors will be present to discuss their work according to the following schedule:

11:30am-12:45pm:	odd-numbered posters
1:00pm-2:15pm:	even-numbered posters

2:15-3:45 **Talk Session II**

3:45-4:00 **Break**

4:00-5:00 **Keynote Address**

"From Butterfly Wing Pigments to Cancer: Discovery of the New Cancer Drug Alimta"

Edward C. Taylor
A. Barton Hepburn Professor of Organic Chemistry, Emeritus

5:00-6:00 **Awards & Reception**

Schedule of Research Talks

Talk Session I (9:30am-11:30am)

Direct write nanopatterning using near-field focusing by optically trapped microspheres
Euan McLeod, Mechanical & Aerospace Engineering

Romancing the Revolution: American Popular Fictions of the Commune
J. Michelle Coghlan, English

Prediction of damage due to salt crystallization in porous materials
Rosa Espinosa, Civil & Environmental Engineering

Race, Immigrant Generation, and Academic Aspirations in Predicting College Academic Performance
Jayanti Owens, Sociology

Air Quality Sensing in Beijing, China
Anna Michel, Civil & Environmental Engineering and Electrical Engineering

Talk Session II (2:15pm-3:45pm)

Unraveling the pathways of protein nitration
Basak Surmeli, Chemistry

Does immigration cause wages and internal migration or do wages cause labor movements? Evidence from a time-series approach.
Silvia Helena Barcellos, Economics

Conflicts in moral reasoning
Sangeet Khemlani, Psychology

Hearts and Minds: The Battle for Muslim Opinion
Roger Hardy, Near Eastern Studies

Poster Session (11:30am-2:15pm)

Lunch will be served during the formal poster session. All posters will be on display throughout the symposium. Authors will be present to discuss their posters according to the following schedule:

11:30am-12.45pm: odd-numbered posters
1-2:15pm: even-numbered posters

1- *Dritte: Development through Technology*
Muneeb Ali, Computer Science

2- *A De Novo Method for Untargeted Identification of Post Translational Modifications using Tandem Mass Spectrometry*
Richard Baliban, Chemical Engineering

3- *Collective animal behaviour*
Sepideh Bazazi, Ecology & Evolutionary Biology

4- *The Nature of Metallooxygenases Revealed by Radical Clocks*
Harriet Cooper, Chemistry

5- *Proteomics*
Pete DiMaggio, Chemical Engineering

6- *Intense Ion Beam Transport Through a Background Plasma*
Mikhail Dorf, Astrophysics

7- *Network exploration via the adaptive lasso and SCAD penalties*
Yang Feng, Operations Research & Financial Engineering

8- *Water-like dynamic anomalies in a repulsive spherical model*
Harold Hatch, Chemical Engineering

9- *A domino effect in antifolate drug action in Escherichia coli*
Yun Kyung "Sophia" Kwon, Chemistry

10- *Spatial Structure of Trees in Savannas: Integrating Field Data, Modeling, and Remote Sensing*
Alex Lester, Civil & Environmental Engineering

11- *The Impact of Input and Output Tariffs on Firms' Productivity: Theory and Evidence*
Tuan Anh Luong, Economics

12- *Theory for the Spontaneous Bending of Piezoelectric Nanobelts*
Carmel Majidi, Mechanical & Aerospace Engineering

13- *Host-Pathogen Interactions: the Effects of Siderophores on Macrophage Cellular Metabolism*
Courtney McQueen, Chemistry

14- *The Field-Reversed Configuration Fusion Reactor Concept and High-Temperature Superconducting Flux Conservers*
Clayton E. Myers, Astrophysics

15- *Loval Volatility Dynamic Models*
Sergey Nadtochiy, Operations Research & Financial Engineering

16- *Behavioral effects of immunocontraception on wild horses (*Equus caballus*).*
Cassandra M.V. Nuñez, Ecology & Evolutionary Biology

17- *A Scanning tunneling microscopy study on Ni, VO and Pt octaethyl porphyrin at the solid-liquid interface*
Nuri Oncel, Chemistry

18- *Are green galaxies special?*
Min-Su Shin, Astrophysics

19- *On the trail of La Syrie Trilingue: Jacob of Edessa and his circle*
Jack Tannous, History

20- *The role of fairness motives and spatial considerations in explaining departures from Nash equilibrium: stationary and evolutionary lessons from 2x2 games*
Alessandro Tavoni, Ecology & Evolutionary Biology

21- *Effective field theories for strong interactions*
Jaroslav Trnka, Physics

22- *On principal fibrations associated with one algebra*
Maria Dyachkova Trnkova, Mathematics

23– *A Greener Synthesis of Chlorine Dioxide Using a Water-soluble Metalloporphyrin Catalyst*
Thomas P. Umile, Chemistry

24- *Metabolomics in Action: From In-vitro Cellular Analysis to In-vivo Human Application*
Lisa K. Vingara, Chemistry

25- *Narratives of Cultural Pessimism in Horace's 'Odes' and 'Epodes'.*
Tom Zanker, Classics

Talk Session I Abstracts

Talk Session I will be held from 9:30 AM-11:30 AM in Friend Center 004.

Direct write nanopatterning using near-field focusing by optically trapped microspheres
Euan McLeod (Mechanical & Aerospace Engineering)

One challenge in nanotechnology is to accurately pattern surfaces at the sub-micron scale. Such a capability has many applications, including the fabrication of integrated circuits produced through lithography and the generation of templates for biological cell growth. While several nanopatterning methods exist, laser-based techniques have the potential to be superior in cost reduction, speed enhancement, and ease of use. However, the central challenge in implementation is circumventing the diffraction limit: a physical constraint that limits feature sizes to approximately one-half the laser wavelength. In this talk, we present a method for directly writing arbitrary patterns with feature sizes below the diffraction limit while enabling parallel processing for high throughput. An infrared (1064 nm) laser, configured as a Bessel beam, optically traps water-dispersed polystyrene microspheres in close proximity to a polyimide film. A large-area pulsed ultraviolet (355 nm) laser is directed down the same beam path and ablates or melts the surface only below the microsphere due to focusing and near-field enhancement, creating spots as small as 100 nm. Using an x-y translation stage, it is possible to move the substrate while keeping the bead fixed in the optical trap, thereby directly writing continuous features using overlapping pulses. The Bessel beam optical trap maintains an equilibrium sphere-substrate spacing over curved or rough surfaces, facilitating the patterning of nonplanar substrates. Furthermore, identical patterns are drawn simultaneously using multiple trapped beads, making this study the first step in establishing a high-throughput probe-based method for patterning surfaces with subwavelength features.

Euan McLeod is a fifth year graduate student advised by Professor Craig B. Arnold in the Mechanical Aerospace Engineering department. He recently received a Charlotte Elizabeth Procter honorific fellowship for his final year of study. Euan did his undergraduate work at Caltech in the field of Mechanical Engineering.

Romancing the Revolution: American Popular Fictions of the Commune
J. Michelle Coghlan (English)

My dissertation pursues America's longstanding but largely under-studied preoccupation with the Paris Commune of 1871. While several historians (among them Nell Irvin Painter and most recently Philip M. Katz) have detailed the ways that the Commune permeated American culture in the 19th century, becoming synonymous with labor unrest and fears about urbanization, my project represents the only sustained study of the American literary afterlife of the Commune and challenges the notion that the Commune as touchstone and as epithet was largely laid to rest in America in the aftermath of the failure of the Great Strike of 1877.

My talk will center on my second chapter, which traces the ascendancy of the Commune in American memory and literary life during the 1890s. Far from dead, it surfaces in lengthy retrospective accounts in both popular and high-brow American magazines, and in a host of bestselling "boy's books" and historical romances that revisited the Commune in such minute detail that reviewers at times likened them to newspaper reports. In attending in particular to these lengthy fictions, I argue their emphasis on making republican men suggests that the 1890s were a particularly apt time to revisit the Commune not because of the very real labor unrest plaguing the country, but rather because the Commune narrative served to revise American conceptions both of masculinity and revolution at a moment when America was re-imagining its role abroad and reevaluating its attitude towards empire.

Michelle Coghlan is a fifth year student in the Department of English and a member of the Committee on American Studies (CAS). She is looking forward to completing a draft of her dissertation with the generous support of a Harold W. Dodds Fellowship.

Prediction of damage due to salt crystallization in porous materials
Rosa Espinosa (Civil & Environmental Engineering)

Crystallization pressure of salt crystals growing in confined pores is found to be the main cause for damage to stone and masonry. However, the processes and pathways of salt damage are still poorly understood. In fact, there appear to be many unverified assumptions as to how and

why salt weathering occurs.

The theme of my research deals with the experimental investigation of crystallization kinetics in porous materials and of the resulting deformation with the goal to estimate the crystallization pressure of the confined salt crystals and of the resulting mechanical stress in the material.

Two new experimental methods (the dynamic mechanical analyzer and the warping experiment) are shown and discussed.

The dynamic mechanical analyzer is used to study cooling- and drying induced crystallization, revealing a very different damage pattern depending on salt and porous substrate. The second developed experimental method is based on the warping experiment, adapted here to measure the deflection of thin glass-stone composites caused by the stress induced during the crystallization process at different conditions.

The analysis of these results requires coupling thermodynamics and kinetics of phase changes of salts with transport of fluid in porous media, with thermoporoelasticity as well as with the thermal stress in composites. This analysis allows clarifying some of the mysteries of the damaging mechanism of crystallization. For example, the existence of a high-supersaturated thin film between crystals and pore wall is indirectly proved. Indeed, the crystallization pressure is given by the concentration in this thin film rather than by the concentration of the bulk pore solution. The concentration in the thin film can be temporarily higher than that one in the pore solution. That means that even in stones with relative large pores (micrometer size), salt crystallization can lead to a significant deterioration of the material, which is confirmed in the field and is contrary to the prediction of the classical models.

Rosa joined Professor Scherer's group as a postdoctoral visitor fellow in September 2007. She received her Ph.D. in civil engineering materials in December 2004 from Hamburg University of Technology with high honors. Rosa received master's degrees in Industrial Engineering from the Technical University of Valencia, Spain in 1997. Fellowship by Erasmus 1996 (European organization),"DAAD-La Caixa" 1997-99 (German-Spanish organization), and the "German Research Foundation" 2007.

Race, Immigrant Generation, and Academic Aspirations in Predicting College Academic Performance

Jayanti Owens (Sociology)

With an influx of non-white immigrants into the U.S. in past decades, the demographic composition of students enrolling at American universities today is not only increasingly racially diverse, but also diverse in terms of the proportion of students who are immigrants or come from immigrant families. Given the stereotype that immigrant students come from families that place a premium on high academic performance, earning higher grades and test scores in high school, and therefore making it easier to gain admission to four-year universities, the fact that a rising share of four-year college students of color come from immigrant backgrounds has led some scholars to empirically test whether the stereotype of immigrants' higher academic performance is in fact accurate.

This paper uses a sample of nearly 2,500 college juniors sampled through the Campus Life in America Student Survey (CLASS) to examine how race, immigrant generation, and academic aspirations predict students' college academic performance. Findings indicate that Black and Hispanic students consistently earn lower GPAs than White and Asian students. Additionally, Black and Hispanic students are not only less likely to perform within what they identify as their desired GPA range, but also more likely to perform below what they consider to be their lowest respectable GPA.

Meanwhile, we find that first and second generation immigrants tend to earn significantly higher GPAs than their domestic American counterparts, lending support to the claim that immigrants tend to have higher academic performance. The performance-enhancing effects of immigrant status, however, taper off after the second generation.

Overall, this research shows that students' academic aspirations when they enter college play an important role in predicting the actual GPA they earn by the end of their second year of college.

Jayanti is a doctoral candidate in the Department of Sociology and Office of Population Research at Princeton University. Jayanti's interests include social inequality, stratification and social mobility, higher education, education policy, and immigration. Before coming to Princeton, Jayanti was a research assistant in the Education Policy Center of The Urban Institute. Jayanti is a

recipient of the Mellon Mays Undergraduate Fellowship and the National Science Foundation Graduate Research Fellowship.

Air Quality Sensing in Beijing, China
Anna Michel (Civil and Environmental Engineering/Electrical Engineering)

Scientists need new field-going sensors for studying pollution and greenhouse gases, and to understand the effects of urbanization on air quality. Poor air quality in urban environments affects not only the health of its residents but also contributes to regional and global climate change. As a result, there exists a significant need for highly sensitive gas sensors for the analysis of the urban atmosphere.

Quantum Cascade lasers (QCL) are tiny designer lasers that operate in the mid-infrared spectral region that can be used for sensing trace gases. A new QCL-based sensor, QCLOPS, was designed to measure ozone, ammonia, water vapor, and carbon dioxide. Agriculture is the dominant global source of ammonia emissions. Ground level ozone is the primary constituent of smog and high levels of ozone cause significant health problems. Carbon dioxide is a greenhouse gas and is emitted from the combustion of fossil fuels (i.e. automobiles, factories). Its atmospheric levels are rising and they contribute to global warming.

The 2008 Olympic Games in Beijing, China focused attention on air quality in urban environments and served as an important platform for developing and testing new technologies and procedures for analysis and management of air quality problems. QCLOPS was set up in Beijing approximately 1.5 kilometers from the Olympics Stadium, the Birds Nest. The system made measurements before, during, and after a restrictive period was implemented during which factories were shut down and automobile driving was restricted. Here we present the design and field testing of this system in Beijing.

Anna Michel is the Postdoctoral Teaching Fellow at the Center for Mid-Infrared Technologies for Health and the Environment. Her work focuses on the development of novel Quantum Cascade Laser - based sensors for environmental monitoring. Michel received her doctorate in Mechanical and Oceanographic Engineering from the MIT-Woods Hole Oceanographic Joint program, her master's in Ocean Engineering from MIT, and bachelor of science degrees in Chemical Engineering and Biology from MIT.

Poster Session Abstracts

The poster session will be held from 11:30 AM-2:15 PM outside of the Friend Center 004.

1) Dritte: Development through Technology
Muneeb Ali (Computer Science)

Disparity in access to information and computing technologies is a primary hurdle in the economic prosperity of the developing world. The reason for this "digital divide" is that traditional research in ICT technologies is based on assumptions suited to the affluent world. High-end computing devices, broadband communication infrastructure, uninterrupted power supply, computer savvy users, are simply not there in developing regions.

Dritte (http://dritte.org) is an initiative for leveraging Information and Communication Technologies (ICT) for developing third world countries. We focus on developing both hardware and software infrastructure, specifically designed for the physical, social and economic realities of developing countries. In this presentation, Muneeb will highlight some projects that are enabling access to information, healthcare, and education for some of the poorest people on this planet.

Muneeb Ali is a graduate student in the Department of Computer Science. Last summer he was a visiting researcher at Stanford University. He has held research posts in the Netherlands, Sweden, and Pakistan. Recently, he served as the program co-chair of the ACM SIGCOMM Workshop on Networked Systems for Developing Regions (NSDR'08).

2) A De Novo Method for Untargeted Identification of Post Translational
Modifications using Tandem Mass Spectrometry
Richard Baliban (Chemical Engineering)

A novel de novo framework for the identification of post translational modifications is presented. This framework consists of (1) tandem mass spectral clustering to identify spectra with similar fragmentation patterns for a given parent mass and (2) subsequent analysis of each

spectrum in each cluster via an integer linear optimization (ILP) model to output the optimal set of modifications on a template amino acid sequence. The features of both the clustering method and the mathematical model are detailed and example data sets are used to test the capability of the method. The de novo approach is able to analyze spectra from several fragmentation methods and is independent of the mass spectrometer used. Each spectrum is analyzed by a preprocessing algorithm to reduce spectral noise and label potential complimentary, offset, isotope, and multiply charged peaks. Postprocessing of the output from the mathematical model will use monoisotopic mass values to resolve mass rounding errors in the complementary ion series and will select the most probable set of modifications for the spectrum input to the mathematical model. The proposed de novo method is compared to existing post translational modification methods such as InsPecT, VEMS, Modi, MASCOT, SEQUEST and X!Tandem. The proposed method consistently outperforms the current methods both in modification prediction accuracy and in determination of amino acid subsequences of a given length.

Richard Baliban is currently a second year graduate student in the Chemical Engineering department. Richard is working with Dr. Christodoulos Floudas in the field of proteomics, where he uses Integer Linear Optimization as a tool for peptide prediction and post translational modification identification. Richard is originally from Marlton, New Jersey and received his bachelor's degree in Chemical Engineering from the University of Pennsylvania.

3) Collective animal behaviour
Sepideh Bazazi (Ecology and Evolutionary Biology)

Plagues of mass migrating insects such as locusts are estimated to affect the livelihood of one in ten people on the planet. Identifying generalities in the mechanisms underlying these mass movements will enhance our understanding of animal migration and collective behaviour while potentially contributing to pest management efforts.

I provide evidence that coordinated mass migration in juvenile *Schistocerca gregaria* desert locusts is influenced strongly by cannibalistic interactions. Reducing the capacity of locusts to detect the contact of others from behind (i) decreases their probability to start moving, (ii) dramatically reduces the proportion of moving individuals in groups, and (iii) significantly increases cannibalism. Similarly,

blocking visual stimuli from behind inhibits individuals' propensity to march.

Locusts in marching bands tend to bite others, but risk being bitten themselves. When within groups, abdominal biting, and the sight of others approaching from behind, triggers movement. Individuals that move also bite those ahead of them, which further stimulates motion, creating an autocatalytic feedback that results in directed mass migration. This forced march driven by cannibalistic interactions suggests that we need to reassess our view of both the selection pressure and mechanism that can result in the coordinated motion of such large insect groups.

Sepideh Bazazi is a visiting graduate student from the Zoology Department at the University of Oxford. She is currently working with Professor Iain Couzin in the Department of Ecology and Evolutionary Biology. She is in the third year of her Ph.D..

4) The Nature of Metallooxygenases Revealed by Radical Clocks
Harriet Cooper (Chemistry)

Our research covers a wide range of metal-containing proteins which have one thing in common: They use molecular oxygen to create value-added products.

There are many applications for these enzymes. Some are very general and can handle many different starting materials, for instance the ones found in the human liver, which get rid of foreign substances. Others are very specific, they can put an OH group in one specified position out of 20 possibilities, to make an antibiotic. Still others could have environmental impact: to clean up oil-spills, or to turn natural gas into the easier to transport methanol.

These enzymes are difficult to study because their reactions happen so fast. We cannot observe intermediate steps directly. Therefore we use molecules based on cyclopropane ring structures to probe the reaction. These structures give information about the nature of the process by distinguishing between radical and cation pathways. These compounds are also known as radical clocks.

Harriet Cooper is a final year graduate student in the Groves lab in the

Chemistry department. She did her undergraduate and master's degrees at Imperial College London in the lab of David Widdowson. At the moment she is particularly interested in studying drug-metabolising cytochrome P450 enzymes.

5) Proteomics
Pete DiMaggio (Chemical Engineering)

In recent years, there has been significant interest in the identification of histone post-translational modifications. It is well-known that histone proteins are key regulators of many important DNA processes in eukaryotes and recent studies have elucidated complex relationships between histone modifications and DNA damage response and repair. Early studies could only analyze these histone modifications on a site-by-site basis and as a result lose any connectivity information on the molecular level. Recent experimental advances have resulted in the development of a novel high-throughput on-line liquid chromatography mass spectrometry method for the analysis of histone codes using a pH gradient and HILIC separation to elute the modified forms.
In this work, we present a novel methodology for the identification of the targeted post-translational modifications (PTMs) present in highly-modified proteins using mixed-integer linear optimization (MILP) and electron transfer dissociation (ETD). For a given ETD tandem mass spectrum, the rigorous set of modified forms that satisfy the mass of the precursor ion are enumerated by solving a MILP feasibility problem. Given the entire set of modified forms, a superposition problem is then formulated using mixed-integer linear optimization to determine the relative fractions of the modified forms that are present in the multiplexed ETD tandem MS. The utility of the proposed method is demonstrated on a complex-mixture of highly-modified histone H3 for a single liquid chromatography mass spectrometry (LC-MS) experiment, where we show that the proposed framework is capable of consistently identifying primary and even lower level modified forms that would be missed by conventional approaches.

Peter DiMaggio is currently a fifth year graduate student in the Department of Chemical Engineering. He works under the advisement of Professor Christodoulos Floudas on the formulation and implementation of high-throughput algorithms for discovery through mass spectrometry-based proteomics and the development of optimal clustering methods for the analysis of large-scale systems biology and drug discovery data. Peter is the recipient of the Porter Ogden Jacobus Fellowship for the 2008-09 academic year.

6) Intense Ion Beam Transport Through a Background Plasma
Mikhail Dorf (Astrophysics)

Nuclear fusion is the process that powers the Sun and other stars. A star confined at high temperatures and densities by means of massive gravitational forces can fuse, which results in the conversion of mass to energy. One of the modern approaches to controlled exploration of fusion on Earth utilizes high-energy heavy ion beams that can compress and heat the fuel target by direct bombardment, or indirectly, by transforming its energy into x-ray focusing radiation. However, intense ion beam compression to a small spot size on a fuel target is a challenging problem. The problem arises from the strong space-charge repulsive forces present in the beam, and one of the modern solutions is to use a background plasma, which acts as a large reservoir of positive and negative charges, and therefore can neutralize the beam charge, facilitating the compression. Recently, to determine the physical and technological limits of simultaneous longitudinal and transverse compression of an ion beam propagating through a background plasma, the Neutralized Drift Compression Experiment (NDXC I) has been built and operated at the Lawrence Berkley National Laboratory (LBNL). In the presented work detailed numerical and analytical studies of intense heavy ion beam transport through a background plasma has been performed, and the results of these studies are analyzed for the parameters characteristic for the neutralizing drift compression experiment (NDCX-I) and its future upgrade (NDCX-II).

Mikhail Dorf is a fifth year graduate student in the Program in Plasma Physics. For the 2008-2009 academic year he is awarded by the Harold W. Dodds Honorific Fellowship. His adviser is Professor Ronald C. Davidson. Mikhail Dorf obtained his bachelor's and master's degrees in physics from Nizhny Novgorod State University, Nizhny Novgorod, Russia.

7) Network exploration via the adaptive lasso and SCAD penalties
Yang Feng (Operations Research Financial Engineering)

Graphical models are frequently used to explore networks, such as genetic networks, among a set of variables. This is usually carried out via exploring the sparsity of the precision matrix of the variables under consideration. Penalized likelihood methods are often used in such explorations. Yet, positive-deniteness constraints of precision matrices make the optimization problem challenging. We introduce non-concave

penalties and the adaptive LASSO penalty to attenuate the bias problem in the network estimation. Through the local linear approximation to the non-concave penalty functions, the problem of precision matrix estimation is recast as a sequence of penalized like- lihood problems with a weighted L1 penalty and solved using the efficient algorithm of Friedman et al. (2008). Our estimation schemes are applied to two real datasets. Simulation experiments and asymptotic theory are used to justify our proposed methods.

Yang Feng is a third year graduate student in the department of Operations Research Financial Engineering. His thesis advisor is Professor Jianqing Fan. His research interest includes high dimensional learning, network exploration, and bioinformatics.

8) Water-like dynamic anomalies in a repulsive spherical model
Harold Hatch (Chemical Engineering)

Life on earth is intrinsically dependent on water and its unusual properties; without water we could not exist. Most liquids become more dense when they freeze, while water does just the opposite. Oceans would be uninhabitable without this bizarre behavior that causes ice to float. Water's capacity to store large amounts of heat, to insulate and to reflect solar radiation is instrumental in regulating our planet's environment. Within our bodies, cells and proteins without water would be as dysfunctional as a snowmobile without snow. Yet no one has developed a model of water which accurately describes its anomalous properties! Many believe the Mickey Mouse-like shape of water is responsible for water's unusual behavior, and scientists are mired in complex atomic and subatomic interactions of water to develop a model which reproduces its anomalous behavior. That is why we were surprised to find a highly simplified spherical model which reproduces many of water's anomalous properties. This spherical model, rather than a Mickey Mouse-like shape, redefines what we think is unique about water and allows us to investigate the physical mechanisms which are at the origin of water's anomalous properties. We focus specifically on the increase in diffusivity upon compression at sufficiently low temperature using statistical mechanical perturbation theory and a discrete molecular dynamic simulation.

Harold Hatch is a first year graduate student pursuing a Ph.D. in Chemical Engineering with a Wu Fellowship, and his research project was carried out

during the summer in Professor Debenedetti's laboratory. Harold Hatch is happily married, has a B.S.E. from Tulane University and grew up in Auburn, Alabama.

9) A domino effect in antifolate drug action in Escherichia coli
Yun Kyung "Sophia" Kwon (Chemistry)

Mass spectrometry technologies for measurement of cellular metabolism are opening new avenues to explore drug activity. Trimethoprim is an antibiotic that inhibits bacterial dihydrofolate reductase (DHFR). Kinetic flux profiling with 15N-ammonia in Escherichia coli reveals that trimethoprim leads to blockade not only of DHFR, but also of another critical enzyme of folate metabolism, folylpoly-•;-glutamate synthetase (FP-•;-GS). Inhibition of FP-•;-GS is not directly due to trimethoprim. Instead, it arises from accumulation of DHFRs substrate dihydrofolate, which we show is a potent FP-•;-GS inhibitor. Thus, due to inherent connectivity of the metabolic network, falling DHFR activity leads to falling FP-•;-GS activity in a domino-like cascade. This cascade results in complex folate dynamics, and its incorporation in a computational model of folate metabolism recapitulates the dynamics observed experimentally. These results highlight the potential for quantitative analysis of cellular metabolism to reveal mechanisms of drug action.

Yun Kyung (Sophia) Kwon is a fourth year graduate student in the chemistry department. She works with Professor Joshua Rabinowitz in the Lewis-Sigler Institute for Integrative Genomics. She is supported by the QCB Training Grant from the National Institutes of Health and is the recipient of the 2005-2006 Edward C. Taylor Eli Lilly Fellowship. Her work has been featured on the cover of Nature Chemical Biology.

10) Spatial Structure of Trees in Savannas: Integrating Field Data, Modeling, and Remote Sensing
***A**lex Lester (Civil & Environmental Engineering)*

The UN-commissioned Millenium Ecosystem Assessment identified land degradation in drylands as one of the largest threats to human welfare globally. My work addresses one piece of understanding this degradation in the hopes that it will lend insights to the prediction, conservation, and remediation of degraded lands. Because ecosystem

processes and the spatial structure of vegetation are inextricably linked, understanding of one informs the other. Previous studies have shown that changes in the structure of vegetation can be a predictor of large-scale degradation; thus, being able to define this structure becomes very important.

I use a mathematical model to link field data collected in a Kenyan savanna with data from satellite images to develop methods of characterizing the spatial structure of individual trees across large areas. Because satellite images capture tree canopies from above, it is impossible to tell the number of individual trees represented in the image. The model I employ creates a simulation of the placement of trees on the landscape, and the image that would be seen from above, by applying parameters from data collected at the field site. This information can then be used to extrapolate the structure of individual trees from real satellite images, allowing for a better characterization of the spatial distribution of trees anywhere that the satellite images are available.

Alex Lester is a third year graduate student in the Civil and Environmental Engineering department. He is supported through the Water, Savannas and Society in Sub-Saharan Africa project, and the Princeton Institute for International and Regional Studies. His field work was sponsored in part by Princeton's Technology for Developing Regions program.

11) The Impact of Input and Output Tariffs on Firms' Productivity: Theory and Evidence
Tuan Anh Luong (Economics)

This paper studies the impact of trade liberalization on productivity. I show that when intermediate inputs are not highly differentiated, lowering input tariffs leads to a rise in firms' productivity and wages, and lowering output tariffs has the opposite effect. When intermediate inputs are highly differentiated, the conclusions reverse. These predictions are supported by the data, given by the industrial survey from INEGI (Mexico's Insitituto Nacional de Estadistica Geografia e Informacion) in the period 1984-1990. The paper yields estimates for the elasticity of substitution among intermediate inputs, which are useful in determining the direction of the impact of trade liberalization. These estimates can be used to assess the gains from trade liberalization.

Tuan is a Vietnamese graduate student, currently in his fifth year in the Economic department. Before coming to Princeton, he received the French government fellowship to complete his bachelor's and Master degree in Ecole Polytechnique, France. He also received the Centennial Fellowships from the Princeton Graduate School.

12) Theory for the Spontaneous Bending of Piezoelectric Nanobelts
Carmel Majidi (Mechanical & Aerospace Engineering)

Nanometer thin sheets of crystal have been observed to spontaneously curl into arcs and rings. The sheet, which are often referred to as 'nanobelts' or 'nanoribbons,' are tens of nanometers thick, twenty to a hundred nanometers wide, several microns long, and bend with a radius of several hundred nanometers. Interestingly, sponantenous bending is only observed for crystals that are piezoelectric (elastic stretching is coupled to a change in the internal electric field), have electrically charged surfaces, and contain free electrons (which originate from point defects or impurities). We have performed a comprehensive thermodynamic analysis that suggests that all three properties are necessary and sufficient conditions for spontaneous bending. This is the first theory to successfully predict a relationship between nanoribbon thickness and bending radius that is consistent with experimental data. Such a strong fit between theory and experiment is achieved without adjustable parameters and is based entirely on previously measured values for the elasticity, piezoelectricity, and spontaneous polarization of the bulk crystal.

Dr. Carmel Majidi is a Postdoctoral Fellow in the Princeton Institute for the Science and Technology of Materials (PRISM). In the spring of 2007, he received his Ph.D. in Electrical Engineering and Computer Science from the University of California, Berkeley. Dr. Majidi's research has focused on the role of mechanics in understanding and developing micro/ nanoscale materials and devices.

13) Host-Pathogen Interactions: the Effects of Siderophores on Macrophage Cellular Metabolism
Courtney McQueen (Chemistry)

When disease-causing bacteria invade their host, they must obtain sufficient quantities of iron to survive. Siderophores (Greek: iron carriers) are iron-binding molecules produced by many bacteria during

periods of iron limitation. It has been shown that production of siderophores is necessary for virulence in several pathogenic species, including Bacillus anthracis (which causes anthrax) and Mycobacterium tuberculosis (which causes tuberculosis).

Because they are often produced by pathogenic bacteria, many common siderophores are recognized by the immune system. To date, many aspects of this recognition, and the immune systems response to siderophores, are not yet understood. To help elucidate this process, we are studying the effects of the siderophore mycobactin J, produced by mycobacterium paratuberculosis, on the metabolism of mouse macrophages. Thus far, these studies have indicated that at physiologically significant concentrations, mycobactin J causes large disruptions to macrophage cellular metabolism, including decreased protein production, changes in major metabolite pathways, and even cell death. Our current goal is to differentiate among several possible pathways for the observed cellular disruptions and to understand their roles in pathogenesis and host response. For example, it is possible that these dramatic effects indicate recognition of mycobactin J, followed by a strong inflammation response from macrophages. By elucidating this process, and the effect on host cells, we hope to better understand how the immune system responds to infection, and how bacteria in turn evade this response.

*Courtney McQueen is a fifth year graduate student in the Chemistry Department, in the laboratory of Professor John T. Groves. She is an NSF Graduate Research Fellow and winner of the Bristol-Myers Squibb Princeton Endowed Fellowship in Organic Synthesis (2008), the Miles Pickering Teaching Award (2008), and the George B. Rathmann *51 Graduate Fellowship in Chemistry (2005). She grew up in Southern California and graduated from Harvey Mudd College in 2004 with a B.S. in Chemistry.*

14) The Field-Reversed Configuration Fusion Reactor Concept and High-Temperature Superconducting Flux Conservers
Clayton E. Myers (Astrophysics)

Energy produced from controlled nuclear fusion offers immense hope for cleanly and sustainably meeting the growing energy needs of the modern world. A practical fusion reactor must confine a hot plasma long enough to extract a net energy gain as a result of fusion reactions. The field-reversed configuration (FRC) plasma confinement concept has the potential to produce far simpler and less expensive

fusion reactors than the mainline tokamak approach. FRC reactors could satisfy a variety of energy customers, particularly those seeking MW-scale reactors for a distributed power grid.

To study fusion-relevant FRC dynamics, the Princeton FRC experiment employs an odd-parity rotating-magnetic-field current-drive and plasma-heating system to initiate and sustain high-beta plasmas. An integral part of any FRC is a flux-conserving shell that surrounds the plasma and applies magnetic pressure to the configuration. The PFRC experiment presently uses passive, discrete flux-conserver (FC) rings made of solid copper. The duration of confined high-beta plasma pulses is limited by the skin time of the FCs (now ~3 ms). An upgraded PFRC facility will produce plasma pulses in excess of 50 ms, which requires FCs with skin times longer than 500 ms.

To extend FC skin times, high-temperature superconducting (SC) tapes have been embedded in copper rings, resulting in high-performance FCs with skin times ranging from 400 ms to 12 s. Due to the high FC current required to balance the plasma pressure, critical current saturation of the SC tapes has also been closely studied.

Clayton E. Myers is a second year graduate student pursuing a Ph.D. from the Program in Plasma Physics at Princeton University. His research, which is based at the Department of Energy-supported Princeton Plasma Physics Laboratory, focuses on developing innovative plasma confinement concepts for sustainable energy production via nuclear fusion. Clayton was born and raised in rural northwestern Ohio and he received his B.S. in Applied Engineering Physics from Cornell University in May 2007.

15) Loval Volatility Dynamic Models

Sergey Nadtochiy (Operations Research and Financial Engineering)

We discuss the characterization of arbitrage free dynamic stochastic models for the equity markets with infinite set of basic instruments (European type options). Prices of the financial instruments are represented through local volatility, which is then given dynamics through Ito stochastic differential equation on a Banach space (following the HJM approach). The main thrust of our work is to characterize absence of arbitrage in these models and to parameterize them in a convenient for implementation way.

Sergey Nadtochiy is a graduate student in the Operations Research and Financial Engineering Department, who has got his undergraduate degree from Math Department of Moscow State University. In Princeton Sergey has been awarded Gordon S. Wu Fellowship (2005) and Charlotte Elizabeth Procter Fellowship (2008). His research interests are in the field of Financial Mathematics, more precisely Applications of Stochastic Analysis to Finance.

16) Behavioral effects of immunocontraception on wild horses (*Equus caballus*).

Cassandra M.V. Nuñez, James S. Adelman, and Daniel I. Rubenstein (Ecology and Evolutionary Biology)

The behavioral effects of the immunocontraceptive agent porcine zona pellucida (PZP) have not been adequately studied. Important managerial decisions for several species, including the wild horse (*Equus caballus*), have been based on this limited research. We studied 30 horses on Shackleford Banks, North Carolina to determine the effects of PZP contraception on female fidelity to the harem male. We examined two classes of females: contracepts, recipients of the PZP vaccine (n=22); and controls, females that have never received PZP (n=8). We conducted the study during the non-breeding season from December 2005 to February 2006, totaling 102.2 hours of observation. Contracepted mares changed groups more often than control mares (P = 0.04). Contracepts also visited more harem groups than did control mares (P = 0.02) and exhibited more reproductive interest (P = 0.05). For contracepted females, both the number of group changes (P = 0.01) and groups visited (P = 0.003) increased with the proportion of years the mares were not allowed to give birth. Our study shows that the application of PZP has significant consequences for the social behavior of Shackleford Banks horses. In gregarious species such as the horse, PZP application may disrupt social ties among individuals and inhibit normal social functioning at the population level.

Cassandra Nunez is a post-doc in the Ecology and Evolutionary Biology Department. She investigates the dynamics of social interactions in animal populations with Dr. Dan Rubenstein. Their work is funded by the National Science Foundation.

17) A Scanning tunneling microscopy study on Ni, VO and Pt octaethyl porphyrin at the solid-liquid interface
Nuri Oncel (Chemistry)

Metal-porphyrins are one of the most studied organometallic complexes because of their importance in many biological processes and possible applications in optoelectronic devices. However, the influence of the central metal atom on the adsorption geometry and the monolayer topography of these complexes are not completely understood. Therefore, we have studied the influence of the central atom. In the present work, the properties of Ni-, VO- and Pt-octaethyl porphyrin (OEP) thin films are studied on bare and 5-OIA covered HOPG surfaces at the solid-liquid interface and under ambient conditions. In order to avoid solvent induced effects, both molecules are dissolved in 1-phenyloctane. The purpose of the study is to observe how the OEP monolayer is influenced by a modified surface morphology. The experimental results suggest that the interaction of both Ni- and VO-OEP molecules with the substrate is stronger than the interaction of Pt-OEP molecules with the substrate. These results confirm the early prediction stating that the comparatively larger Pt atom essentially levitates the porphyrin ring and in this way reduces the interaction between the porphyrin ring and the substrate. [1]

[1] N. Oncel, S. L. Bernasek, Applied Physics Letters, 92, 133305, 2008

Dr. Nuri Oncel is a Post-Doctoral Research Associate in Professor S. L. Bernasek's group in the Department of Chemistry.

18) Are green galaxies special?
Min-Su Shin (Astrophysics)

We investigate the properties of green galaxies in the spectroscopic samples of the Sloan Digital Sky Survey. In particular, we examine their dependencies on mass and environment which are suspected to drive the evolution of galaxies. In addition to the well-known blue and red branches of galaxies in an optical color-magnitude diagram, a large fraction of galaxies have green color between the two branches. By reconstructing star-formation and metallicity history of the green galaxies with a stellar population synthesis and spectral modeling, we find that dispersion of green galaxies from the two branches is

explained by a different amount of young stellar population for low mass galaxies. But for galaxies that are massive than about 10^9.5 solar masses, the color dispersion is caused by metallicity differences instead of stellar age differences. Our finding implies that green galaxies are simply extensions of color-magnitude relations for early-type and late-type galaxies.

Min-Su is in the Department of Astrophysical Sciences and is supported this year by a Charlotte Elizabeth Procter Fellowship.

19) On the trail of La Syrie Trilingue: Jacob of Edessa and his circle

Jack Tannous (History)

The seventh century witnessed two of history's most momentous events: the death of the ancient world and the birth of Islam. My dissertation uses the history of a little-studied yet very important monastery named Qenneshre to offer a new perspectives on both of these issues. Located in Syria, on the banks of the Euphrates River, Qenneshre was perhaps the most important intellectual center in the Middle East during its heyday. Moreover, it was the most important place for the translation of Greek texts into Syriac (a dialect of Aramaic and the literary lingua franca of much of Middle Eastern Christianity for half a millennium); before the celebrated Greco-Arabic translation movement of ninth-century Baghdad, there were the translation activities undertaken at this monastery. With Qenneshre and its alumni, so to speak, as my focus, I question whether a Dark Age actually ever existed and furthermore explore the nature of early Christian-Muslim contact in Syria. How did Greek, Syriac and Arabic-speakers get along in the early Islamic period? Was there ever a moment when we could say that Syria was trilingual--when linguistic borders did not equal cultural frontiers? I use a series of little-studied Syriac texts from the early eighth century written by people associated with Qenneshre to attempt to answer these questions.

Jack Tannous is a graduate student in the history department at Princeton. Originally from Houston, Texas, he did his undergraduate degree at the University of Texas at Austin and completed an MPhil at Oxford before coming to Princeton. He currently holds a Whiting Fellowship in the Humanities and is a Graduate Student Fellow at the University's Center for Human Values.

20) The role of fairness motives and spatial considerations in explaining departures from Nash equilibrium: stationary and evolutionary lessons from 2x2 games
Alessandro Tavoni (Ecology and Evolutionary Biology)

Substantial evidence has accumulated in recent empirical works on the limited ability of the Nash equilibrium to rationalize observed behavior in many classes of games played by experimental subjects. This realization has led to several attempts aimed at finding tractable equilibrium concepts which perform better empirically, often by introducing a reference point to which players compare the available payoff allocations, as in impulse balance equilibrium and in the inequity aversion model. The first part of this paper is concerned with reviewing the recent reference point literature and advancing a new, empirically sound, hybrid concept. In the second part, evolutionary game theoretic models are employed to investigate the role played by fairness motives as well as spatial structure in explaining the evolution of cooperative behavior.

Alessandro Tavoni is a research collaborator with Simon Levin at Ecology and Evolutionary Biology and graduate student in Economics at the Advanced school of Economics in Venice, Italy. He has researched the impact of incorporating fairness motives in concepts for experimental games and is currently focusing on the use of diffusion processes to model evolution in time and space.

21) Effective field theories for strong interactions
Jaroslav Trnka (Physics)

Our grandfathers discovered that there exist four forces in nature. Electromagnetism is responsible for the repulsion and attraction of charged objects, gravity explains how stars and planets are moving in the sky, weak nuclear interaction comes into some processes in nuclei. Last one in our list is strong interaction that is present in protons, neutrons and other particles that are composed from quarks.

For any of these interactions we have the theory that tells us how the objects and the particles behave (this is called Standard model of elementary particles). Therefore, we can predict the scattering of two electrons using Quantum Electrodynamics, the fundamental theory for electromagnetism, precession of perihelion of Mercur in General

Theory of Relativity, the Einstein's theory of gravitation. We can study beta decay (neutron decays into proton and electron) in nuclei using Glashow-Weinberg-Salam model of weak interactions. For strong forces is the situation a bit different. In 1973 Gross, Wilczek and Politzer discovered Quantum Chromodynamics (QCD) that describes interactions between quarks. Quarks do not exist as free particles in nature and they are jailed in protons, neutrons and other hadrons. That is the problem. Despite we can well predict all processes with free quarks, we are unable to say much about neutrons and protons. The forces between quarks are in them so strong that we are unable to do perturbative calculations.

As a result, we use effective theory approach which means that we forgot almost everything about fundamental theory (in our case QCD) and we use just some symmetries (coming from the fundamental theory) to construct other theory that will describe what we want. Concretely, we try to build theory of hadrons (not quarks) that shares some properties of QCD. In 1985 it was done for lightest hadrons (pseudoscalar mesons), this theory is called Chiral Perturbation Theory and it is based on some interesting connection with QCD which is called spontaneously symmetry breaking. My contribution to this field consists of studying Resonance Chiral Theory which studies unstable hadrons (resonances) and their interactions.

Jaroslav Trnka is a first year graduate student in Physics. He received his bachelor's and master's degree from Charles University in Prague. His research interests include particle phenomenology, effective field theories and beyond Standard model physics.

22) On principal fibrations associated with one algebra
Maria Dyachkova Trnkova (Mathematics)

It is known that the projectivization of some algebra gives us a projective space with some structure. For example, from the projectivization of algebra of quaternions we get 3-dimentional elliptic space. So, it is interesting to consider a fibration of non-Euclidean space obtained by subalgebras.

We study a principal fibration of Lie group which is associated with one representation of 3-dimensional unital associative irreducible algebra and its basic properties. We define degenerate semi-Euclidean

sphere of this Lie group and investigate semi-conformal and projective models of its trivial principal fibration. Some results are different from the non-degenerate case.

Maria Trnkova is a Ph.D. student in Palacky University in Czech Republic. She received her bachelor's and master's degree from Glazov State Institute and Kazan State University in Russia. She is interested in differential geometry and moduli spaces.

23) A Greener Synthesis of Chlorine Dioxide Using a Water-soluble Manganese Porphyrin Catalyst
Thomas P. Umile (Chemistry)

Chlorine dioxide is an oxidizing gas which is employed as a bleaching agent in industries such as wastewater treatment and paper manufacturing. Because of its instability towards prolonged storage, it is often prepared on-site from precursor materials such as chlorite or chlorate salts. The vast majority of industrial preparations of chlorine dioxide require the use of harsh reagents and conditions, such as strongly acidic media and oxidizing agents. Reported here is the catalytic synthesis of solutions of chlorine dioxide gas from sodium chlorite, using a water-soluble manganese porphyrin catalyst under milder conditions. Metalloporphyrins are studied as biomimetic models of heme enzymes and catalyze a wide variety of biologically-relevant oxidation chemistry. We are currently studying the porphyrin-catalyzed generation of chlorine dioxide using stopped-flow ultraviolet-visible spectrophotometry in order to elucidate the mechanism of this new chemistry. Implications of this research to the field of Green Chemistry will also be discussed.

Thomas P. Umile is a third year graduate student in the Department of Chemistry. His research advisor is Professor John T. Groves. Tom received his B.S. in Biochemistry and M.A. in Chemistry from The University of Scranton.

24) Metabolomics in Action: From In-vitro Cellular Analysis to In-vivo Human Application
Lisa K. Vingara (Chemistry)

In clinical medicine, early detection of disease is crucial for appropriate

treatment and prognosis. However, neurological disorders are commonly based on clinical symptoms and are diagnosed too late, leading to delayed treatment and poor prognosis. Additionally, our understanding of the associated actual biochemical processes is quite limited thus far. This has lead to a search for earlier diagnostic markers of neurological diseases at the molecular level.

Using proton magnetic resonance spectroscopy (1H-MRS), we have applied metabolomic techniques for in-vitro analysis of cellular samples. We have translated these findings into rodent brain, where we can investigate the biomarker dynamics in a disease state using animal models of human disease. We further have developed methods which allow for direct application to the imaging and characterization of the condition of the human brain.

We have been the first to apply statistical multivariate analysis methods to in-vivo 1H-MRS in a systematic fashion. Here, our pioneering and exciting results from in-vivo metabolomics study of multiple sclerosis will be discussed.

Lisa K Vingara is a fourth year graduate student in Chemistry. Her advisor is Istvan Pelczer, and collaborators are Mirjana Maletic-Savatic, M.D of Baylor College of Medice and Lauren Krupp, M.D of Stony Brook University Medical Center.

25-Narratives of Cultural Pessimism in Horace's 'Odes' and 'Epodes'.
Tom Zanker (Classics)

My dissertation looks at the lyric and iambic poetry of the Roman poet Horace (65 BC - 8 BC), and the way in which it uses narratives concerning the failure and collapse of the city of Rome. The twentieth century proved fertile ground for conceptions of cultural pessimism, yet ancient Rome also had its own narratives concerning its destruction, some inherited from the Greeks, some of its own invention. A number of these can be found in the first three books of Horaces 'Odes' and in his 'Epodes', which include (but are not limited to): 1) the idea of degeneration from a golden age; 2) the belief in the pollution of traditional Roman values by the advent of luxury and license; 3) the positing of an original sin consigning Rome to destruction; and 4) the view that a wrathful deity was persecuting the Roman people. I am

interested in understanding Horace's rhetorical use of these narratives to forward different agenda - the ways in which he used pessimism, the forms he allowed it to take, and how his usages developed over the course of his poetic career. In my poster presentation, I shall look at the interaction between two such narratives of pessimism within the same poem, Odes 3.6, and how this has caused various interpretative problems.

Tom Zanker comes from New Zealand and is currently in his fifth year of study in the Classics Department. *He is supported by a Whiting Fellowship.*

Talk Session II Abstracts

Talk Session II will be held from 2:15 PM-3:45 PM in Friend Center 004.

Unraveling the pathways of protein nitration
Basak Surmeli (Chemistry)

We breathe because we need oxygen to survive; oxygen is used in our cells via various reactions to produce energy. As a consequence of this activity, highly reactive molecules are produced known as free radicals. Free radicals interact with other molecules within cells such as proteins, membranes and genes. These interactions play an important role in a variety of diseases since they can modify biological molecules and inactivate them; this will result in cellular damage and eventual cell death. One of these harmful modifications that has been observed in a variety of human disorders, such as diabetes, Alzheimers, and Parkinsons, is addition of a nitro group (NO2) to proteins, known as protein nitration. Recently, a protein that plays a critical role in defense against these free radicals - MnSOD, manganese superoxide dismutase - was found to be nitrated under various disease conditions. My project is involved in understanding the pathways leading to nitration of this protein, and trying to shed some light on the mechanisms of nitration of proteins in general so that we can explore new and better therapies for these diseases.

Basak Surmeli is a sixth year graduate student in chemistry department, working with Professor Groves.

Does immigration cause wages and internal migration or do wages cause labor movements? Evidence from a time-series approach.
Silvia Helena Barcellos (Economics)

The number of immigrants in the US economy has been increasing at an impressively fast rate in recent decades. An extensive literature has investigated the effect of this large influx of immigrants on native workers' labor market opportunities. However, to date this literature has not reached a consensus about such consequences of immigration. In this paper, I present a new approach to the analysis of the relationship between immigration and wages. I develop a theoretical model of the joint dynamics of wages, foreign immigration, and internal migration. I

then implement this model empirically using high frequency data, relying on the timing of the events to identify the effects of immigration on wages and internal migration and of wages on labor movements. I find that immigration is not a significant predictor of wages and internal migration. In contrast, wages are a significant predictor of immigration. The estimated effects imply that a 10 percent increase in wages cause a 20 percent increase in the rate of immigrant inflow. However, these estimates hide significant heterogeneity: the effect is strong for low skill immigrants while it is small and insignificant for high skill immigrants. I find no evidence that immigrants lower native workers' wages.

Silvia Helena Barcellos received a bachelor's and a master's degree in economics from the Catholic University of Rio de Janeiro, Brazil. She is currently a fifth year Ph.D. student in the Department of Economics at Princeton University. Her research interests include Labor Economics, Development Economics and Applied Econometrics. She is also a proud member of the Fellowship of Woodrow Wilson Scholars.

Conflicts in moral reasoning
Sangeet Khemlani (Psychology)

We propose a new theory of moral reasoning based in part on a principle of moral inconsistency: those beliefs that are the product of moral intuitions and moral reasoning are neither complete nor consistent. That is, situations can occur in which individuals are unable to derive a moral evaluation or to determine whether a moral issue is at stake. The principle implies that individuals should be able to construct situations that are morally irresolvable for them. In an experiment, the participants first evaluated a moral action as permissible or not, then modified the context of the action so that their evaluation was reversed, and finally modified the context again so that they were unable to resolve whether the action was permissible or not. They bear out the principle of moral inconsistency, but cast doubt on the existence of an innate moral grammar akin to Chomsky's universal grammar: grammars do not yield conflicts.

Sangeet Khemlani is a third year Ph.D. student in the Department of Psychology. He is studying cognitive psychology and works in the Mental Models and Reasoning Laboratory. He is a recipient of the National Science Foundation Graduate Fellowship.

Hearts and Minds: The Battle for Muslim Opinion
Roger Hardy (Near Eastern studies)

Despite much talk about the West's need to win Muslim hearts and minds, there's little sign of success or of a coherent strategy. This talk focuses on the character of the Al-Qaeda 'narrative' -- and the difficulties posed for those trying to counter it.

Roger Hardy has been a BBC journalist for over 20 years, specializing in the Middle East and the Islamic world. He's spending 2008-2009 as a visiting fellow at Princeton -- and plans to use his time to write a book about the crisis in relations between Islam and the West.

Keynote Address

"From Butterfly Wing Pigments to Cancer: Discovery of the New Cancer Drug Alimta"

Edward C. Taylor
A. Barton Hepburn Professor of Organic Chemistry, Emeritus

In 1946 I started my graduate work in organic chemistry at Cornell. While searching for a thesis topic, I was fascinated by the bizarre finding that a recently discovered growth factor for bacteria, isolated from human liver, possessed a core chemical structure that was identical with the core structure of some of the major pigments found in the wings of butterflies. This lecture will describe investigations of the chemistry of butterfly wing pigments, the structure and biological significance of the liver growth factor (now known as folic acid), and finally the discovery of the new and extraordinarily active new cancer drug, Alimta. The success of this project critically depended, in its latter stages, on a remarkably successful and harmonious collaboration between Princeton and Eli Lilly & Co. The discovery of Alimta also represents one of only a few examples of the successful discovery of a new drug in academia, and serves as a vivid example of the potential of purely academic basic research motivated entirely by curiosity.

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