



The
UNIVERSITY
of **VERMONT**

UVM Student Research Conference



April 17, 2008

Sponsored by the Office of the Provost and the Office of
the Vice President for Research and Graduate Studies



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Welcome Conference Participants and Attendees!

I am very pleased to welcome you to the 2008 UVM Student Research Conference. The Conference is designed to celebrate the quality and breadth of undergraduate and graduate student research and creative projects at the University of Vermont. We celebrate all of our “Eureka” moments, not only for what they make clear to us now, but also for revealing what we have yet to discover. At UVM, research, scholarship, and creative activities are integrated into everyday learning. As a premier small research university, UVM is committed to the generation of knowledge and the sharing and application of innovations and inventions through creative and dynamic partnerships, locally as well as internationally. This celebration is intended to provide a university-wide and community-wide opportunity to share the exciting work of our students.

The Conference will showcase student scholarship from every UVM college and school. Their work reflects an impressive range of activity, including research with a direct impact on the city of Burlington and the state of Vermont, as well as on regional, national, and international environments. As indicated in the pages of this Conference Program, UVM students concentrate on topics across the academic spectrum. The focus of their work includes, but is not limited to, understanding and improving the environment, school reform and educational access, nanotechnology, robotics, cell biology, nutrition, affordable housing, immigration, irrigation, economics, farming, contemporary theater, and the study of ecosystems.

The successful academic enterprise is the sum of many dimensions and our success evolves from the sustained commitment to supporting excellence in research, scholarly, and creative endeavors and the engagement of UVM faculty, staff, and students. I congratulate and thank all student presenters and mentors for sharing their work, and for their contribution to enriching interdisciplinary exchange on campus.

Frances E. Carr, Ph.D.
Vice President for Research and Dean of Graduate Studies



UVM Student Research Conference
Dudley H. Davis Center
April 17, 2008

Schedule at a Glance

8:30am-9:00am Introduction Sugar Maple Ballroom
Speaker: JOHN M. HUGHES, Senior Vice President & Provost and
Professor of Geology

Oral Presentations – Morning Sessions I, II, III

As a courtesy to our student presenters, we ask that you attend the entire 45-minute session

9:00am-9:45am	Session I	Williams, Chittenden, Handy, Jost
10:00am-10:45am	Session II	Williams, Chittenden, Handy, Jost
11:00am-11:45am	Session III	Williams, Chittenden, Handy, Jost

12:00pm-1:00pm Luncheon (*By Invitation*) Silver Maple Ballroom
Speaker: DANIEL M. FOGEL, President and Professor of English

Oral Presentations – Afternoon Sessions IV, V, VI

As a courtesy to our student presenters, we ask that you attend the entire 45-minute session

1:15pm-2:00pm	Session IV	Williams, Chittenden, Handy
2:15pm-3:00pm	Session V	Williams, Chittenden, Handy, Boulder
3:15pm-4:00pm	Session VI	Williams, Chittenden, Handy

Poster Presentation Sessions – A & B

10:00am-12:00pm	Session A	Sugar Maple Ballroom
1:30pm-3:30pm	Session B	Sugar Maple Ballroom

4:15pm-5:00pm Closing Remarks & Awards Silver Maple Ballroom
Speaker: FRANCES E. CARR, Vice President for Research and
Dean of Graduate Studies and Professor of Pharmacology



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session I: 9am – 9:45am

Williams Family Room, 403

9:00 **Carrie Pucko**
Mechanisms Contributing to Rapid Forest Shift in the Green Mountains

9:15 **Mary Ackley**
Evaluating Environmental Risks in Mining: A Perceptual Study at the Vatukoula Gold Mine in Fiji

9:30 **Ted Auch**
The Influence of Climate and Ecosystem Productivity on Litter Decomposition

Chittenden Room, 413

9:00 **Elise Guyette**
An African American Farming Community in Hinesburgh, Vermont 1790-1870

9:15 **Sara Chace**
How NGOs Influence Equity in Irrigation Management in Tamil Nadu, India

9:30 **Jennifer Scudder**
Colicin and EDTA have Additive Antimicrobial Effects Against E.coli in Milk

Handy Family Room, 415

9:00 **Xiaolin Ren**
Characteristics of Muscle Activities in Young and Elderly Group During Tai Chi Gait

9:15 **Jennifer Abustan**
Who is Caring for the Elderly? Will They Care for Us?

9:30 **Megan L. O'Brien**
Perception of Rural Caregiving

Jost Foundation Room, 422

9:00 **Emily Stebbins**
Feasibility of Small-Scale, On-Farm Biodiesel Production: A Vermont Case Study

9:15 **Rebecca Rockefeller**
Liquid Biofuels Policy: A Report to the Maine State Legislature

9:30 **Karthikeyan Balasubramaniam**
Controlling Cascading Failures in Power Networks



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session II: 10am – 10:45am

Williams Family Room, 403

10:00 **Eric Garza**
The Theory and Reality of Peak Oil

10:15 **Jennifer Fricke**
Geographic Genetic Differentiation of a Malaria Parasite

10:30 **Mark Kolonoski**
Generating Public Revenue from Private Forests

Chittenden Room, 413

10:00 **Mark Cannella**
The Impact of Financial Uncertainty on the Economic Performance of Northeast Dairy Farming Systems

10:15 **Nicholas Meltzer**
Size Distribution of Agricultural Fugitive Dust Emissions

10:30 **Jessica Hyman**
Development Pressure and Land Use Decisions: Farmland Change in a Diversified Agricultural Sector

Handy Family Room, 415

10:00 **Emma Gordon**
America's Aging Voters

10:15 **Leah Sohotra**
Understanding Gender as Performance: When it is Sensual or Numbing

10:30 **Alex Lehning**
From False "Science" to Fatal "Science": The Role of Medical Professionals in the Holocaust

Jost Foundation Room, 422

10:00 **Melissa Martin**
Adolescents' Reported Experiences of Living with a Sibling with Autism

10:15 **Brandon Rhone**
Mexican Immigration and its Affect on Black Labor Markets in the U.S.



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session III: 11am – 11:45am

Williams Family Room, 403

11:00 **Brian Darby**
Desert Soil Microfauna in a Changing Climate

11:15 **Neil Thompson**
Quantification of the Effects of Electroshocking on Lake Trout Fry

11:30 **Hua Chen**
Evaluation of Tidal Effects on Groundwater Contaminant Discharging to Coastal Waters

Chittenden Room, 413

11:00 **Bernhard Nausch**
Construction of Urinary Bladder Smooth Muscle Depends on Influx of Calcium Rather Than Release From Sarcoplasmic Reticulum

11:15 **Alison Krywanczyk**
Development of Nanotechnology Approaches for Treatment of Mesothelioma

11:30 **Anbazhagan Rajendran**
Studies on Ciliopathogenesis of Human BBS in a Ciliate Model, Paramecium

Handy Family Room, 415

11:00 **Virginie Dupont**
Numerical Experiment on the Gekko Gecko Foot

11:15 **Alba Gabriela Garay-Romero**
Adaptive Sampling in Wireless Sensors

11:30 **Laura Balzer**
Minimal Mathematical Model for Activated Protein C Regulation of Factor Va

Jost Foundation Room, 422

11:00 **Daniel Lim**
Cities Achieving Sustainability by Restoring Green Spaces

11:15 **Emilie Kornheiser**
Burlington, Vermont: A Case Study in Economic Development Networks

11:30 **Rachael Hannah**
Brain Endothelial Cells: An Aspect of What We Do and Why We Are So Cool

11:45 **Erin Maskell-Ferland**
Maternal Perceptions and Observations of Play in Children with and without Autism Spectrum Disorders (ASD)



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session IV: 1:15pm – 2pm

Williams Family Room, 403

1:15 **Erika Partee**
The Effect of Calcium on Zebra Mussel Growth

1:30 **Terence Barrett**
A Portable Particle Analyzer for Transportation Air Quality Research

1:45 **Gary Johnson, Jr.**
Computer Science for Environmental Research and Planning

Handy Family Room, 415

1:15 **Sukanya Majumder**
Characterization of Pawn A Protein in Paramecium

1:30 **Gwen Buel**
Regulation of Tyrosine Phosphorylation on Collapsin Response Mediator Proteins

Chittenden Room, 413

1:15 **Atreyi Ghatak**
Can the PMAC-2 Knock Out Mice Smell? A Behavioral Study

1:30 **William Damsky**
Examining the Role of Beta-Catenin in Melanoma Formation and Progression

1:45 **Judith Dixon**
Impact of Multidisciplinary CKD Care on Outcomes in Patients Initializing Dialysis



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session V: 2:15pm – 3pm

Williams Family Room, 403

2:15 **Kelly Hamshaw**
Reinventing the Mobile Home: Affordable, Green, and Local

2:30 **Paul Lilly**
Why I Watch the Grass Grow: Attaching Ecological Significance to Residential Lawns

Chittenden Room, 413

2:15 **Nilanjan Lodh**
Spatial and Temporal Variation in the Incidence of the Whirling Disease in the Intermountain West

2:30 **Caitlin Cooper**
An Improved Model of Bioreactors to Produce Therapeutic Proteins

2:45 **Samantha Foster**
Nitrogen Dioxide Promotion of Allergic Asthma

Handy Family Room, 415

2:15 **Elizabeth Butler & Hunter Wade**
The Grammar of Sexism: La Presidente or La Presidenta?

2:30 **Laura Massell**
An Analysis of Factors Associated with Postsecondary Education Access and Persistence Among Vermont GEAR UP and Talent Search Participants

2:45 **Matthew MacNeil**
The Preparedness of Vermont Foster Youth for “Aging Out” of State’s Custody

Boulder Society Room, 411

2:15 **Melanie Brown**
Child’s Play: An Adventure in Design Theory and Graph Embeddings

2:30 **Steve Henck**
Capillary Technology and Laser Light Scattering of Salt Solutions



Oral Presentation Schedule
(see presenter index on pages 15-20)

Session VI: 3:15pm – 4pm

Williams Family Room, 403

3:15 **Andrew Roering**
*New Bond Forming Reactions with
Triamidoamine-Supported Zirconium
Complexes*

3:30 **James Ross**
*Approximate Reasoning in Hydrogeological
Modeling*

Handy Family Room, 415

3:15 **Penelope Nolte**
*A Chorus of Voices: Re-Examining Focus
Group Data for Evidence of Change*

3:30 **Justin Lane**
*Creating Coercion: An Alpha's Effect on Cult
Members*

3:45 **Erica Campbell**
*Pupil Transportation: Travel Behavior,
Traffic Impacts and Potential for Improvement*

Chittenden Room, 413

3:15 **Elizabeth Cheng Tolmie**
*A Case Study of Organizational Change
Strategies and Outcomes: Initiation of a Field
Services Division within the Vermont Agency
of Human Services*

3:30 **Valerie Esposito**
*The Role of Service-Learning in Ecological
Economics Education and Outreach*



Poster Presentation Schedule

(see presenter index on pages 15-20)
Poster Presentation Listing by Poster Number

Located in the Sugar Maple Ballroom, 401
Session A 10am-12pm, Session B 1:30-3:30pm

1A Romaica Omaruddin

Development of Gene Expression as a Biomarker for Human Radiation Exposure

2B Kimberley Beal

Changing Climate and Treeline in New England

3A Corey Paradis & Gregory Soll

A Hands-On Guide to Greater Food Self-Reliance

4B Tiffany Larsen

Forest Cover and Topographical Influences on Snow Distribution in a Mixed Hardwood-Conifer Forest of the Northeastern U.S.

5A Erin Roche

Good Habits Go Together: Regular Exercise and Good Nutrition are Related

6B Morgan Cromwell

Evaluation of Alternative Fungicides for Organic Apple Production in Vermont, 2007

7A Zachary Burchman

Growth and Characterization of Nickel Nanowires through Electrodeposition

8B Galen Wilkerson

Heredia Declaration on Payment for Ecosystem Services

9A Allison Curran

Employing Primary Source Documents to Promote Critical Thinking Skills

10B Catherine Durickas

“The Last Five Years”: Comprehending the Self through the Stages

11A Juan Alvez

Payments for Ecosystem Services: A National Policy for Brazil

12B Chris Wardell

Effectiveness of a Grassroots Soccer Curriculum in St. Lucia

13A Meredith Holmberg

A Community-Based Participatory Research Approach with Manikganj Bangladesh

14B Robin Kemkes

Vermont Woodland Owners’ Willingness to Provide Ecosystem Services

15A Rachel Hopkins

Race in Northern New England: Experiences of the Social Environment

16B Nicole Mason

Engineering and Sustainable Development: The Need for a Transdisciplinary Approach

17A John Woodward

Opportunity in Crisis: The Dollar Standard Demise and Local Finances

18B Caitlin Cooper

An Improved Model of Mammary Bioreactors to Produce Therapeutic Proteins



Poster Presentation Schedule

(see presenter index on pages 15-20)
Poster Presentation Listing by Poster Number

Located in the Sugar Maple Ballroom, 401
Session A 10am-12pm, Session B 1:30-3:30pm

19A Erin Maskell-Ferland

Maternal Perceptions and Observations of Play in Children with and without Autism Spectrum Disorders (ASD)

20B Alexandra Montalvo

Functional and phylogenetic analysis of flightin phosphorylation reveal lineage-specific differences in phosphorylation site selection

21A Matthew Cole

Postural control during a sit-to-stand task in people with and without LBP

22B Michael Previs

Absolute Quantification of Protein Phosphorylation by Liquid Chromatography

23A Jennifer Nakhla

The Mysterious Life of Children Revealed: An Archaeology of Children

24B Chun Yang

The involvement of chloride channels in pheromone response of mouse VSNS

25A Gwen Pokalo

Impacts of AmeriCorps VISTA Volunteers on Host Organization Capacity

26B Yone Jung Yoon

Effect of pharmacological blockade of synaptic activity on motoneuron

27A Katherine Rendall

Financial Systems and Foreign Direct Investment in Developing Countries

28B Chunxiao Yu

Structural Analysis of a Collagen Binding Protein of a Periodontopathogen

29A Douglas Robinson

Salving Comparative Religion: Buddhist Saints, Christian Martyrs and the Cult of Relics as a Case-Study

30B Ben Bakondi

Factors secreted from human bone marrow progenitor cells protect neural pro

31A Zachary Ewell

Motives in Mountaineering: Understanding the Culture of High Adventure and its Implications for an Evolving Conservation Ethic

32B Megan Doczi

A Possible Role for Golgi Localization of the Kv1.3 Potassium Channel in Postganglionic Sympathetic Neuronal Function

33A Devin Sprague

Effects of TASS on the Assessment Practices of High School Science Teachers

34B Samsudeen Ponissery-Saidu

Role of the Plasma Membrane Calcium Pump In Olfaction

36B Emilee Connors

Homeostatic Regulation of Kv1.2 Potassium Channel Trafficking by Cyclic AMP



Poster Presentation Schedule

(see presenter index on pages 15-20)
Poster Presentation Listing by Poster Number

Located in the Sugar Maple Ballroom, 401
Session A 10am-12pm, Session B 1:30-3:30pm

37A Laura Vogric

*The Fight for “Enduring Freedom”:
Presidential Rhetoric and the War on Terror*

38B Christian Draghici

*Synthetic Organic Chemistry: Development of
a Novel Ring Fragmentation*

39A Jessica-Lyn Wagar

Measuring Maternal Sensitivity

40B Ingrid Curril

*Human Mesenchymal Stem Cell Fusion with
Lung Epithelial Cells*

41A George Caldwell

*The platelet derived growth factor receptor
tyrosine phosphorylates the catalytic subunit
of PKA*

42B Xianglian Ni

*Role of Ca²⁺ permeable AMPA receptors on
motoneuron development*

43A Meredith Benson

*Analysis of amino acid differences between
human and *E. coli* endonuclease 3*

44B Mujeeburaheeman Cheerathodi

*Identification of phosphorylated CrkL-SH3
binding proteins from embryonic murine
brain: Implications for reelin signaling during
brain development*

45A Scott Geddes

*The application of photoelectron resonance
capture ionization aerosol mass spectrometry
(PERCI-AMS) to internally mixed amino acid-
lipid fine particulate proxies of marine
organic aerosols*

46B Winifred Trotman

*Valves of the Deep Venous System: An
Overlooked Risk Factor*

47A Maartje Melchior

*Investigating possible causes of cyanobacteria
blooms in Mississquoi Bay*

48B Madhurima Saha

*The molecular interaction of phosphorylated
Synapsins with 14-3-3 ϵ*

49A John Contompasis

*The Contribution of Myosin Binding Proteins
to the Biomechanical Properties of Thick.
Filaments: A Comparison of Normal and
Mutant Thick Filaments from Flies and Mice
Using Atomic Force Microscopy*

50B Hannah Flynn

*Analysis of Affordable Housing Best Practices
across the Nation and Bringing them Home*

51A Ali Johnson

*Sustainable Access to Safe Drinking Water
among Mayans in Rural Guatemala*

52B Zhenyu Lu

*Selective sampling for highly unbalanced data
sets*



Poster Presentation Schedule

(see presenter index on pages 15-20)
Poster Presentation Listing by Poster Number

Located in the Sugar Maple Ballroom, 401
Session A 10am-12pm, Session B 1:30-3:30pm

53A Bridget Kreger

Assessment of the microRNA expression in human cells exposed to chronic low doses of ionizing radiation

54B Josh Payne

The Influence of Scaling and Assortativity on Takeover Times in Scale-Free Topologies

55A Mohammed Al-Kateb

Simulation of Extreme-Scale Wireless Sensor Networks

56B Changfei Chen

Improved Footprint Modeling for Wireless Sensor Networks

57A Cyrus Mallon

*The Evolutionary Role of *Solenopsis geminata* in a Hybrid Fire Ant Zone*

58B Stephen DiStasi

In Situ Measurement and Emulation of Severe Multipath Environments

59A Dana Notte

Correlation Between Body Shape and Diet Composition in College Females

60B Songtao Wo

Large Grain Size Solution Processed TIPS-pentacene Thin Films

61A Elise Vincelette

Absolute Quantification of 3 mRNA Isoforms of APP in Human Brain

62B Tri Minh Tran

Adaptive Join Query Processing on Distributed Data Streams

63A Gregory Carpenter

An Autonomous Sensor-Based Mobile Robot

64B Jillian Davidson

Development of a Catalytic Cycle of Arsaalkenes

65A Matthew Falco

Synthetic Organic Methodology: A new ring fragmentation with applications in natural product synthesis

66B Douglas Fox, Chelsea Lowe, Kelly Todd, & Evangelia Zgonis

Introduction to Research in the Department of Chemistry

67A Jeremy Matt

Applications of Image Analysis: Leaf Wetness

68A Jeremy Matt

Applications of Image Analysis: Porous Building Materials

69A Heather Truax & Ashley Truax

Regulations of Myosin-II during Cytokinesis in Fission Yeast

70 B Alice Kosak

Self-reported mood sensitivity to pollen, seasonality of mood, and depressive symptoms in a northeastern college sample



Poster Presentation Schedule

(see presenter index on pages 15-20)
Poster Presentation Listing by Poster Number

Located in the Sugar Maple Ballroom, 401
Session A 10am-12pm, Session B 1:30-3:30pm

71A Lauren Gilligan

A Molecular Genetic Study of the Chagas Disease Vector Triatoma Infestans

72B Jaime Leclerc

Myosin binding activity of Drosophila flightin fragments

73A Katrina Parry

The Use of DGT Probes to Determine Phosphorus Concentrations in Missisquoi Bay Lake Waters

74 B Carrie McLane

Vermont Farm to School: An Examination of School Culture

75A Kesha Ram

Creating Healthy Communities Through Environmental Justice Policy

76B Jon Ramsey

Thermodynamic Insights into the ssDNA-binding Mechanism of Mouse Pur-beta

77A Amanda Richardson

Willingness-to-pay for watershed services: Case Study of the Fond D'or water

78B Tucker Stevens

Kinetics and species formation for the heterogeneous reaction of PAHs and ozone on glass fiber filters and diesel particulate matter

79A Anton Delwig

Regulation of Notch Signaling by ADAM Metalloproteases

80B Meagan Goodwin

Systemic Administration of Mesenchymal Stem Cells Abrogates Allergic Airway

81A Min Zheng

Finding Balance: Visiting the Old for New Inspiration and Solution to Environmental Problems

82B Elizabeth Butler & Hunter Wade

The Grammar of Sexism: La Presidente or La Presidenta?

Note: Presentation titles and abstracts were submitted by student participants and may reflect disciplinary conventions.



Presenter Index by Student Last Name

Enter the Session during the 15-minute break and stay for entire oral presentation session

Oral Session I.....9:00am – 9:45am
 Oral Session II.....10:00am – 10:45am
 Oral Session III.....11:00am – 11:45am
 Oral Session IV.....1:15pm – 2:00pm
 Oral Session V.....2:15pm – 3:00pm
 Oral Session VI.....3:15pm – 4:00pm

Poster presenters will be with their poster during the following times:
 Session A (10:00-12:00) or Session B (1:30-3:30)

Last Name	First Name	Poster/Room Number	Session	Type	Time
Abustan	Jennifer	Handy 415	I	Oral	9:15-9:30
Ackley	Mary	Williams 403	I	Oral	9:15-9:30
Al-Kateb	Mohammed	55	A	Poster	10:00-12:00
Alvez	Juan	11	A	Poster	10:00-12:00
Auch	Ted	Williams 403	I	Oral	9:30-9:45
Bakondi	Ben	30	B	Poster	1:30-3:30
Balasubramaniam	Karthikeyan	Jost 422	I	Oral	9:30-9:45
Balzer	Laura	Handy 415	III	Oral	11:30-11:45
Barrett	Terence	Williams 403	IV	Oral	1:30-1:45
Beal	Kimberley	2	B	Poster	1:30-3:30
Benson	Meredith	43	A	Poster	10:00-12:00
Brown	Melanie	Boulder 411	V	Oral	2:15-2:30
Buel	Gwen	Handy 415	IV	Oral	1:30-1:45
Burchman	Zachary	7	A	Poster	10:00-12:00
Butler	Elizabeth	Handy 415 & 82	V & B	Oral & Poster	2:15-2:30 & 1:30-2:30
Caldwell	George	41	A	Poster	10:00-12:00
Campbell	Erica	Handy 415	VI	Oral	3:45-4:00
Cannella	Mark	Chittenden 413	II	Oral	10:00-10:15
Carpenter	Greggory	63	A	Poster	10:00-12:00
Chace	Sara	Chittenden 413	I	Oral	9:15-9:30
Cheerathodi	Mujeeburahiman	44	B	Poster	1:30-3:30
Chen	Changfei	56	B	Poster	1:30-3:30
Chen	Hua	Williams 403	III	Oral	11:30-11:45
Cheng Tolmie	Elizabeth	Handy 415	VI	Oral	3:15-3:30
Cole	Matthew	21	A	Poster	10:00-12:00
Connors	Emilee	36	B	Poster	1:30-3:30



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 Oral Session VI.....3:15pm – 4:00pm

Poster presenters will be with their poster during the following times:
 Session A (10:00-12:00) or Session B (1:30-3:30)

Last Name	First Name	Poster/Room Number	Session	Type	Time
Contompasis	John	49	A	Poster	10:00-12:00
Cooper	Caitlin	Chittenden 413 & 18	V & B	Oral & Poster	2:30-2:45 & 1:30-3:30
Cromwell	Morgan	6	B	Poster	1:30-3:30
Curran	Allison	9	A	Poster	10:00-12:00
Curril	Ingrid	40	B	Poster	1:30-3:30
Damsky	William	Chittenden 413	IV	Oral	1:30-1:45
Darby	Brian	Williams 403	III	Oral	11:00-11:15
Davidson	Jillian	64	B	Poster	1:30-3:30
Delwig	Anton	79	A	Poster	10:00-12:00
DiStasi	Stephen	58	B	Poster	1:30-3:30
Dixon	Judith	Chittenden 413	IV	Oral	1:45-2:00
Doczi	Megan	32	B	Poster	1:30-3:30
Draghici	Christian	38	A	Poster	10:00-12:00
Dupont	Virginie	Handy 415	III	Oral	4:15-4:30
Durickas	Catherine	10	B	Poster	1:30-3:30
Esposito	Valerie	Handy 415	VI	Oral	3:30-3:45
Ewell	Zachary	31	A	Poster	10:00-12:00
Falco	Matthew	65	A	Poster	10:00-12:00
Flynn	Hannah	50	B	Poster	1:30-3:30
Foster	Samantha	Chittenden 413	V	Oral	2:45-3:00
Fox	Douglas	66	B	Poster	1:30-3:30
Fricke	Jennifer	Williams 403	II	Oral	10:15-10:30
Garay-Romero	Alba Gabriela	Handy 415	III	Oral	11:15-11:30
Garza	Eric	Williams 403	II	Oral	10:00-10:15
Geddes	Scott	45	A	Poster	10:00-12:00
Ghatak	Atreyi	Chittenden 413	IV	Oral	1:15-1:30



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Poster presenters will be with their poster during the following times:
 Session A (10:00-12:00) or Session B (1:30-3:30)

Last Name	First Name	Poster/Room Number	Session	Type	Time
Gilligan	Lauren	71	A	Poster	10:00-12:00
Goodwin	Meagan	80	B	Poster	1:30-3:30
Gordon	Emma	Handy 415	II	Oral	10:00-10:15
Guyette	Elise	Chittenden 413	I	Oral	9:00-9:15
Hamshaw	Kelly	Williams 401	V	Oral	2:15-2:30
Hannah	Rachael	Jost 422	III	Oral	11:30-11:45
Henck	Steve	Boulder 411	V	Oral	2:30-2:45
Holmberg	Meredith	13	A	Poster	10:00-12:00
Hopkins	Rachel	15	A	Poster	10:00-12:00
Hyman	Jessica	Chittenden 413	II	Oral	10:30-10:45
Johnson	Ali	51	A	Poster	10:00-12:00
Johnson, Jr.	Gary	Williams 403	IV	Oral	1:45-2:00
Kemkes	Robin	14	B	Poster	1:30-3:30
Kolonoski	Mark	Williams 403	II	Oral	10:30-10:45
Kornheiser	Emilie	Jost 422	III	Oral	11:15-11:30
Kosak	Alice	70	B	Poster	1:30-3:30
Kreger	Bridget	53	A	Poster	10:00-12:00
Krywanczyk	Alison	Chittenden 413	III	Oral	11:15-11:30
Lane	Justin	Chittenden 413	VI	Oral	3:30-4:45
Larsen	Tiffany	4	B	Poster	1:30-3:30
Leclerc	Jaime	72	B	Poster	1:30-3:30
Lehning	Alex	Handy 415	II	Oral	10:30-10:45
Lilly	Paul	Williams 401	V	Oral	2:30-2:45
Lim	Daniel	Jost 422	III	Oral	11:15-11:30
Lodh	Nilanjan	Chittenden 413	V	Oral	2:15-2:30
Lowe	Chelsea	66	B	Poster	1:30-3:30
Lu	Zhenyu	52	B	Poster	1:30-3:30



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 Oral Session III.....11:00am – 11:45am
 Oral Session IV.....1:15pm – 2:00pm
 Oral Session V.....2:15pm – 3:00pm
 Oral Session VI.....3:15pm – 4:00pm

Poster presenters will be with their poster during the following times:
 Session A (10:00-12:00) or Session B (1:30-3:30)

Last Name	First Name	Poster/Room Number	Session	Type	Time
MacNeil	Matthew	Handy	V	Oral	2:45-3:00
Majumder	Sukanya	Handy 415	IV	Oral	1:15-1:30
Mallon	Cyrus	57	A	Poster	10:00-12:00
Martin	Melissa	Jost 422	II	Oral	10:00-10:15
Maskell-Ferland	Erin	Jost 422	III	Oral	11:45-12:00
Mason	Nicole	16	B	Poster	1:30-3:30
Massell	Laura	Handy 415	V	Oral	2:30-2:45
Matt	Jeremy	67/68	A	Poster	10:00-12:00
McLane	Carrie	74	B	Poster	1:30-3:30
Melchoirs	Maartje	47	A	Poster	10:00-12:00
Meltzer	Nicholas	Chittenden 413	II	Oral	10:15-10:30
Montalvo	Alexandra	20	B	Poster	1:30-3:30
Nakhla	Jennifer	23	A	Poster	10:00-12:00
Nausch	Bernhard	Chittenden 413	III	Oral	11:00-11:15
Ni	Xianglian	42	B	Poster	1:30-3:30
Nolte	Penelope	Chittenden 413	VI	Oral	3:15-3:30
Notte	Dana	59	A	Poster	10:00-12:00
O'Brien	Megan L.	Handy 415	I	Oral	9:30-9:45
Omaruddin	Romaica	1	A	Poster	10:00-12:00
Paradis	Corey	3	A	Poster	10:00-12:00
Parry	Katrina	73	A	Poster	10:00-12:00
Partee	Erika	Williams 403	IV	Oral	1:15-1:30
Payne	Josh	54	B	Poster	1:30-3:30
Pokalo	Gwen	25	A	Poster	10:00-12:00
Ponissery-Saidu	Samsudeen	34	B	Poster	1:30-3:30
Previs	Michael	22	B	Poster	1:30-3:30
Pucko	Carrie	Williams 403	I	Oral	9:00-9:15



Presenter Index by Student Last Name

Enter the Session during the 15-minute break and stay for entire oral presentation session

Oral Session I.....9:00am – 9:45am
 Oral Session II.....10:00am – 10:45am
 Oral Session III.....11:00am – 11:45am
 Oral Session IV.....1:15pm – 2:00pm
 Oral Session V.....2:15pm – 3:00pm
 Oral Session VI.....3:15pm – 4:00pm

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Last Name	First Name	Poster/Room Number	Session	Type	Time
Rajendran	Anbazhagan	Chittenden 413	III	Oral	11:30-11:45
Ram	Kesha	75	A	Poster	10:00-12:00
Ramsey	Jon	76	B	Poster	1:30-3:30
Ren	Xiaolin	Handy 415	I	Oral	9:00-9:15
Rendall	Katherine	27	A	Poster	10:00-12:00
Rhone	Brandon	Jost 400	II	Oral	10:15-10:30
Robinson	Douglas	29	A	Poster	10:00-12:00
Roche	Erin	5	A	Poster	10:00-12:00
Rockefeller	Rebecca	Jost 422	I	Oral	9:15-9:30
Roering	Andrew	Williams 403	VI	Oral	3:30-3:45
Ross	James	Williams 403	VI	Oral	3:30-3:45
Saha	Madhurima	48	B	Poster	1:30-3:30
Scudder	Jennifer	Chittenden 413	I	Oral	9:30-9:45
Sohotra	Leah	Handy 415	II	Oral	10:15-10:30
Soll	Gregory	3	A	Poster	10:00-12:00
Sprague	Devin	33	A	Poster	10:00-12:00
Stebbins	Emily	Jost 422	I	Oral	9:00-9:15
Stevens	Tucker	78	B	Poster	1:30-3:30
Thompson	Neil	Williams 403	III	Oral	11:15-11:30
Todd	Kelly	66	B	Poster	1:30-3:30
Tran	Tri Minh	62	B	Poster	1:30-3:30
Trotman	Winifred	46	B	Poster	1:30-3:30
Truax	Heather	69	A	Poster	10:00-12:00
Truax	Ashley	69	A	Poster	10:00-12:00
Vincelette	Elise	61	A	Poster	10:00-12:00



Presenter Index by Student Last Name

Enter the Session during the 15-minute break and stay for entire oral presentation session

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 Oral Session V.....2:15pm – 3:00pm
 Oral Session VI.....3:15pm – 4:00pm

Poster presenters will be with their poster during the following times:
 Session A (10:00-12:00) or Session B (1:30-3:30)

Last Name	First Name	Poster/Room Number	Session	Type	Time
Vogric	Laura	37	A	Poster	10:00-12:00
Wade	Hunter	Handy 415 & 82	V & B	Oral & Poster	2:15-2:30 & 1:30-2:30
Wagar	Jessica-Lyn	39	A	Poster	10:00-12:00
Wardell	Chris	12	B	Poster	1:30-3:30
Wilkerson	Galen	8	B	Poster	1:30-3:30
Wo	Songtao	60	B	Poster	1:30-3:30
Yang	Chun	24	B	Poster	1:30-3:30
Yoon	Yone Jung	26	B	Poster	1:30-3:30
Yu	Chunxiao	28	B	Poster	1:30-3:30
Zgonis	Evangelia	66	B	Poster	1:30-3:30
Zheng	Min	81	A	Poster	10:00-12:00



Undergraduate Abstracts by Student Last Name

Abustan, Jennifer

Major: Professional Nursing; Advisor: Mary Val Palumbo

Who is Caring for the Elderly? Will They Care for Us?

Information about the existing long term care (LTC) workforce will help inform setting appropriate retention/recruitment initiatives. Scant research exists which examines demographics, satisfaction, and intent to leave of the LTC registered nurse (RN). This study provides a comparison of the LTC RN to a statewide RN sample within one small rural state. A voluntary survey was mailed to the entire population of RNs in Vermont along with relicensure materials. Demographics, education, current position, job satisfaction, intention to leave, and other elements of the minimum data set for nursing workforce analysis recommended by the Colleagues on Caring(1) were included. Reliability of the instrument was not determined; content validity was established by expert panel review. Statistical (t-tests and chi square analyses) and descriptive statistics were used, Results: 13,321 surveys mailed, 5,803 returned (43% response rate with large number of undeliverable, 51% of active RNs responded). In comparison with the statewide sample (n = 3,760), LTC RN's (n=301) are significantly older (p =.04), more likely to be prepared at the diploma and AD levels (p<.0001), less satisfied (p<.0001), and more likely to leave their current position in the next year (p<.0001). The LTC sample had a higher percent of nurses with 36+ years of experience (20%) compared to the whole sample (15%). However, most nurses in LTC (64%) reported being in their current position for five years or less. The LTC sample reported managerial (21%), administrative (11%), and "other" (14%) positions compared to 9%, 4% and 9% respectively; Attention should be paid to the LTC registered nurse workforce to ensure adequate knowledge/skills to improve satisfaction. These nurses are essential for meeting the health care needs of our aging society.

Balzer, Laura

Major: Applied Mathematics; Advisor: Daniel Bentil

Minimal Mathematical Model for Activated Protein C Regulation of Factor Va

The anticoagulant serine protease, activated protein C (APC), inhibits blood coagulation by specifically inactivating factor Va. Indeed, the mechanism for the inactivation of factor Va by APC has been the subject of intensive research. In human factor Va, for example, APC is known to cleave three amide bonds at Arg³⁰⁶, Arg⁵⁰⁶ and Arg⁶⁷⁹. Although the significance of each step in the enzymatic pathway should not be overlooked, the mechanism can be greatly simplified by assuming cleavage at Arg⁵⁰⁶ precedes cleavage at Arg³⁰⁶ and complete activity loss is due to the subsequent dissociation of the A2 domain. Using the proposed mechanism and the reported rate constants, a minimal mathematical model consisting of only seven ordinary differential equations is derived. The minimal model encapsulates the steps in the enzymatic pathway that we think are crucial in describing the rates of change of concentrations of Va, APC and cleavage products as a function of time. The model is able to reproduce results, which correlate very well with a previously proposed extensive model that has been validated by empirical evidence from prothrombinase assays. The proposed minimal model could potentially be a more efficient model mechanism for quantitative studies on the inactivation of factor Va by APC.

Benson, Meredith

Major: Microbiology & Molecular Genetics; Advisor: Susan Wallace

Analysis of amino acid differences between human and E. coli endonuclease 3

DNA damage can cause various problems in human cells leading to either apoptosis (programmed cell death) or uncontrolled replication which can lead to cancer. However, a cell has multiple enzymes to repair the damaged DNA and maintain the health of the cell and genomic integrity. Oxidative DNA damages represent a large portion of the daily damages affecting cells. I worked with endonuclease III, a repair enzyme which removes and repairs oxidized cytosine and thymine bases in the DNA. Cells lacking this enzyme exhibit a high spontaneous mutation rate. While the enzyme is present in both humans and Escherichia coli, the two have different specificities and catalytic rates to perform the same



Benson, Meredith (cont.)

task on various substrates. My goal was to determine which amino acids were responsible for these differences. I first looked at the non-conserved amino acids and picked several different ones of interest. I then created site-directed variants and tested their activity on different DNA lesions. By comparing the activity of the variants to those of the wild type enzymes I was able to find amino acids which, when changed, caused a difference in the enzyme's function. This information can be used to understand how this enzyme works, and learn more about the possible structure of the human endonuclease III, since one does not currently exist. This could also lead to an understanding of particular amino acid changes which reduce or abrogate the activity of endonuclease III, which may increase the risk of cancer.

Buel, Gwen

Major: Biochemistry; Advisor: Bryan Ballif

Regulation of Tyrosine Phosphorylation on Collapsin Response Mediator Proteins

Development of the vertebrate Central Nervous System (CNS) requires the migration of newly generated neurons to very specific positions. Essential to these migrations are attractive and repulsive cues which are generated by distinct cell types in the CNS. Collapsin Response Mediator Proteins (CRMPs) form a family of intracellular proteins that are produced in many migratory neurons and are essential to the transduction of specific neuronal guidance cues. Phosphorylation on serine and threonine residues has been shown to critically regulate CRMPs. We have identified a novel tyrosine phosphorylation site on CRMP1 isolated from murine embryonic brain and hypothesize that this phosphorylation site also critically regulates CRMP1 function. We found that hydrogen peroxide, which inhibits tyrosine and not serine/threonine phosphatases, induces tyrosine phosphorylation of CRMP1 in primary embryonic forebrain cultures. To study which tyrosine residue(s) in CRMP1 or other CRMP family members might be regulated by hydrogen peroxide, epitope-tagged CRMP isoforms 1-4 were expressed in HEK 293 cells and exposed to hydrogen peroxide. Following cell lysis and immunoprecipitation (IP) of the CRMPs, western blotting with anti-phospho-tyrosine antibodies indicated an increase in tyrosine phosphorylation unique to CRMP1, with no increase in isoforms 2-4. To determine which CRMP1 tyrosine phosphorylation site(s) increased in response to hydrogen peroxide stimulation, quantitative mass spectrometry was employed. Using this technique, we were able to identify a dramatic increase in a single tyrosine phosphorylation site on CRMP1 (Y504) that was undetectable prior to stimulation. As Y504 is one of only a few possible phosphorylation sites not conserved with other CRMP isoforms, this points to Y504 as a regulatory site unique to CRMP1. Intriguingly, Y504 is located in a region of CRMP1 known to be regulated by serine and threonine phosphorylation. Future work will determine if Y504 can regulate CRMP1 function and if the phosphorylation of Y504 is regulated by specific neuronal guidance cues.

Burchman, Zachary

Major: Mechanical Engineering; Advisor: Frederic Sansoz

Growth and Characterization of Nickel Nanowires through Electrodeposition

Making nanoscale mechanical and electrical devices using nanowires requires an understanding and control of the mechanical properties of nanowires on a small, atomic scale. Computer atomistic simulations have suggested that grain boundaries and nanoscale twins can significantly increase strength in metallic nanowires. Experimentally, however, a method of controlling the grain size and the number of twin planes within a nanowire has not yet been fully devised. The purpose of this study is to discover how to alter the microstructure of nickel and gold nanowires via electrochemical deposition. The plan for research will be divided in two steps. First, an experimental set-up will be developed in order to fabricate nickel and gold nanowires with controlled growth and microstructure. Second, we will investigate the influence of the electrochemical environment, including the bath additives, imposed voltage and pulse frequency, on the grain size and grain boundary structure in metallic nanowires. This research can help engineers design new electromechanical systems at the molecular level.



Butler, Elizabeth & Wade, Hunter

Major: Spanish ; Advisor: Guillermo Rodríguez

The Grammar of Sexism: La Presidente or La Presidenta?

A pivotal social change in the 20th century has been the way gender order transformed traditional patriarchal societies into more egalitarian settings. Women have climbed the power continuum and hold positions traditionally unavailable to them in the workplace. This new dynamic demanded that new vocabulary be created for female titles. Bergen (1980) states that this linguistic change depends upon a sociological change and illustrates how “the semantic component of the grammar of a language reflects the nature of the society within which the language functions.” Unlike English, gender is pervasive in the grammatical system of Spanish offering a more revealing source to trace these modifications. Not only does Spanish assign gender to biologically determined beings such as la niña (the girl) or el niño (the boy), inanimate entities are arbitrarily marked for gender as seen in the words la mesa (the table, fem.) and el libro (the book, masc.). As male forms of professional titles have long been in existence, how does one address female colleagues? Given that Spanish allows different ways to achieve this transformation: change of article (el jefe; la jefa) or change of article and suffix (el jefe; la jefa), a native speaker must decide amongst various forms that carry social implications. Using a Spanish Corpus* and regional periodicals, we will trace the change in frequency of these occupational nouns to test for a correlation between the rise of female participation in the workforce and their usage. We will also administer a linguistic survey (sample enclosed) to local native speakers of Spanish to obtain a perspective on how they instinctively make this gender assignment. We expect to find an increase of usage of feminine occupational titles over time (1800’s to present day) as well as preferred ways in which the feminine form is expressed grammatically.

Caldwell, George

Major: Medical Laboratory Sciences; Advisor: Paula Deming

The platelet derived growth factor receptor tyrosine phosphorylates the catalytic subunit of PKA

The platelet derived growth factor receptor tyrosine kinase (PDGFR) plays an important role in physiological processes such as inflammation, wound healing, and angiogenesis. Alterations in the signaling pathways stimulated upon PDGF binding to the receptor occur frequently in pathological states such as cancer. One of the cellular events that takes place in response to stimulation with PDGF is activation of the cyclic amp dependent protein kinase (PKA). For example, PKA activity is required for PDGF-induced cell migration, however, the mechanism/s that link the PDGFR and PKA signaling pathways is currently unknown. The overall goal of this project is to investigate whether the PDGFR directly regulates PKA activity and/or function. Initial studies revealed that the purified activated PDGFR could tyrosine phosphorylate the catalytic subunit of PKA (PKAc) in vitro, as determined via western blot. Additionally, in response to treatment of mouse fibroblast cells with PDGF, the catalytic subunit of PKA was found to be tyrosine phosphorylated in vivo. Ongoing work involves identifying the PDGFR-mediated tyrosine phosphorylation sites on PKAc using site-directed mutagenesis to convert putative tyrosine residues to non-phosphorylatable phenylalanine residues. Wild type and mutant PKAc protein will be expressed and purified from bacteria and then subjected to in vitro kinase assays with the PDGFR. A loss of phosphotyrosine signal with the mutated PKAc would indicate a target phosphorylation site for the PDGFR. Based on the crystal structure of PKAc, two of the tyrosine residues (248 and 331) appear likely candidates for phosphorylation. Both Tyr248 and Tyr331 are positioned such that phosphorylation would result in protrusion into the catalytic cleft, which could potentially inhibit the enzymatic activity of PKAc or alter substrate binding. Our initial efforts will focus primarily on determining if these two tyrosines are possible phosphorylation sites for the PDGFR.

Carpenter, Gregory

Major: Electrical Engineering; Advisor: Stephen Titcomb

An Autonomous Sensor-Based Mobile Robot

In order to explore a series of electrical engineering topics, including: system/sub-system development, linear/non-linear circuit design, sensor design, selection and implementation, wireless communication protocols, microcontroller software design and electronic/mechanical interfacing, a mobile robotics project has been devised; this was chosen due to the fact that it encompasses a broad range of electrical engineering topics, and because it requires understanding and work with mechanical engineering and computer science topics. This aim of the project to create a prototype robot which has



Carpenter, Gregory (cont.)

the capacity for radio communication, obstacle avoidance, autonomous navigation and decision making, as well as remote computer “control” and remote sensor polling, for the acquisition of robot-sensor data on a computer base station, and the transmission of joystick commands to the mobile robot.

Chace, Sara

Major: Environmental Studies; Advisor: Saleem Ali & Pablo Shiladitya Bose

How NGOs Influence Equity in Irrigation Management in Tamil Nadu, India

The traditional tank systems in Southern India have proven to be an efficient and sustainable irrigation method for thousands of years. Since British colonial rule, the central government is responsible for managing the tank systems and subsequently many have fallen into disrepair. The government of Tamil Nadu is successfully decentralizing the operation and management of the tank systems for the first time in centuries. This is a constructive step towards efficient and sustainable irrigation management, however the current literature points out that there are social inequalities occurring in the current management process and formulation of Water User’s Associations (WUA). In the field of rural development, non-governmental organizations (NGOs) have played a more dominant role. Since the 1980s and 1990s, donors fund projects through NGOs and they are now considered a wealthy source of knowledge in the development field. As issues of equity arise within tank management how do outside actors, NGOs influence equity in tank management? Therefore, this study evaluates how NGOs engage social equity in tank management. Three NGOs in Tamil Nadu, India were surveyed along with other actors to gather information on the programs concerning tank rehabilitation and WUAs. Key equity issues identified and discussed include caste, gender, landless laborers, politics, and position on the tank system. The result was a study of the projects and process NGOs develop in the community mobilization context.

Cole, Matthew

Major: Sociology; Advisor: Sharon Henry

Postural control during a sit-to-stand task in people with and without LBP

Low back pain (LBP) is a common and painful condition affecting approximately 80% of the United States population at some point during their adult life. With the majority of the population experiencing debilitating pain, it is essential not only to understand the underlying causes of LBP but also to search for effective treatments with the goal of returning these individuals to their pre-injury level of functioning. A definitive mechanism for the development of LBP has not been established, but neuromuscular factors, which differ between individuals with and without LBP, may contribute. However, it is unknown whether these differences are the cause of or result from LBP. This study aims to 1) compare postural responses during a sit-to-stand (STS) movement between individuals with and without LBP, and 2) compare the effects of a general strengthening and conditioning physical therapy treatment protocol on patients with LBP by comparing postural responses during a STS task before and after treatment. Ten subjects with chronic recurrent LBP and 10 subjects without LBP will be tested during a standardized STS task. The individuals with LBP will be tested before and after 10 weeks of physical therapy treatment aimed at improving trunk strength and flexibility. Postural responses during the STS task will be quantified using center of mass, center of pressure and kinematic data that are reflective of the underlying neuromuscular coordination. Ultimately it is hoped that this project will quantify alterations in postural coordination characteristic of LBP and determine whether physical therapy treatment aimed at strengthening the trunk will assist patients in changing their movement patterns. It is hoped that this study will lead to improved treatment protocols that will relieve pain and develop safer, more efficient movement strategies for individuals with low back pain.

Contompasis, John

Major: Biology; Advisor: Jim Vigoreaux

The Contribution of Myosin Binding Proteins to the Biomechanical Properties of Thick Filaments: A Comparison of Normal and Mutant Thick Filaments from Flies and Mice Using Atomic Force Microscopy

Despite the fundamental role of thick filaments in muscle contraction, little is known about the mechanical behavior of these filaments and how myosin associated proteins dictate differences between muscle and fiber types. Insect flight muscle and vertebrate cardiac muscle share common physiological properties such as their cyclical contraction for



Contompasis, John (cont.)

producing either a wing beat or a heart beat, as well as their reliance on a pronounced stretch activation response to produce oscillatory power. Here we used atomic force microscopy (AFM) to study the morphological and biomechanical properties of native thick filaments from IFM of normal and mutant *Drosophila* lacking flightin (*fln0*) and from normal and mutant mice heart lacking cardiac myosin binding protein C (*cMyBPC t/t*). The flexural rigidity of native filaments was determined from calculations of persistence length (PL) obtained from measurements of end-to-end length and contour length. Thick filaments from newly eclosed *fln0* IFM have longer contour length (3.73 ± 0.82 μm , $n=22$) than wild-type filaments from same age flies (3.04 ± 0.32 μm , $n=69$), and a PL of 1027 ± 1024 μm ($n=21$), about half that of IFM filaments from wild-type flies (2038 ± 2156 μm , $n=61$). Similarly, PL of cardiac thick filaments from *cMyBPC t/t* mice have a reduced PL (276 ± 226 μm , $n=20$) in comparison to wild-type (530 ± 446 μm , $n=20$). Unlike flightin, the absence of *cMyBP-C* has no effect on thick filament contour length (1.48 ± 0.11 μm *cMyBPC t/t* vs. 1.49 ± 0.12 μm wild-type). Our results show that cardiac and flight muscle thick filaments are highly inflexible biopolymers and that accessory proteins flightin and *cMyBP-C* contribute to thick filament stiffness. These results raise the possibility that thick filaments are a major contributor to the high resting stiffness of IFM and cardiac muscle, a characteristic feature of these muscles that underlies their ability to be activated by stretch.

Cooper, Caitlin

Major: Animal Sciences; Advisor: Zhongzong Pan

An Improved Model of Mammary Bioreactors to Produce Therapeutic Proteins

I am currently creating two gene constructs that will be transferred into mouse embryos, which will result in the birth of transgenic mice. The purpose is to produce transgenic mice that have mammary gland bioreactors that produce a therapeutic protein of interest, which in this case is KGF (human keratin growth factor), independent of lactation. Single mammalian cells that are cultured in large tanks currently produce most therapeutic proteins. The use of animal mammary glands as bioreactors for therapeutic proteins is becoming more prolific due to the ease in harvesting the therapeutic protein, the higher protein yield, and advances in gene manipulation. Most transgenic animals that produce therapeutic proteins can only do so during lactation. This is because when creating the gene constructs for the transgenic animals milk protein promoters are used. Milk protein promoters are controlled by lactogenic hormones and are only active during lactation, and are affected by the stage lactation an animal is in, so protein production fluctuates throughout lactation. I am creating two gene constructs for transgenic mice. One construct contains a lactation dependant promoter (MMTV-LTR) that drives production of the Cre protein. The other construct contains a promoter that is independent of lactation (CMV) and drives production of the protein of interest, KGF. Levels of KGF and Cre will be measured to determine if the lactation independent promoter (CMV) drives higher levels of protein production than the lactation dependant promoter. If this experiment works then the gene constructs could serve as models for creating constructs for animals that are more traditionally used for milk production like goats or cows.

Curran, Allison

Major: Secondary Education; Advisor: Holly-Lynn Busier

Employing Primary Source Documents to Promote Critical Thinking Skills

One of the main objectives of a Social Studies education is the growth of students' critical thinking skills. These critical thinking skills are most often derived from analysis, evaluation and reflection of complex issues or information. Despite the importance of these skills, much of Social Studies education has shifted its focus from students' own discipline-based inquiry to that of instructor-derived questions. In order to foster higher-order thinking, instructors must incorporate discipline-based inquiry into their classroom. One method for fostering critical thinking is through the integration of primary source documents into daily lessons. By using primary source documents students learn how to develop and explore their own questions, form a personal connection with the past, and look at history from multiple perspectives. In order to ensure that instructors use primary source documents effectively, instructors must know how to find appropriate documents, how to scaffold lesson, and how to encourage student interest. By having a comprehensive understanding of the new resources available for primary source documents, as well as strategies for student ownership of issues, educators can use primary source documents to cultivate critical thinking skills.



Davidson, Jillian

Major: Chemistry; Advisor: Rory Waterman

Development of a Catalytic Cycle of Arsaalkenes

Carbon-element double bonds have become a research focus due to their ability to generate energy from conjugated p-systems. These types of compounds are becoming popular in efforts to develop emissive materials such as organic light emitting diodes (LEDs). My research is focused upon developing a catalytic synthesis of arsaalkenes. This research began by studying insertion reactions into zirconium-arsenic bonds, which has yielded the general observation that insertions readily occur with a number of unsaturated polar small molecules. A key second step has been the rearrangement of isocyanide insertion products that generate an arsaalkene-containing ligand. Initial results suggest rearrangements that product a carbon-arsenic double bond are facile, and current efforts are directed at making this process catalytic.

Durickas, Catherine

Major: Theatre & Anthropology; Advisor: Jeffrey Modereger

"The Last Five Years": Comprehending the Self through the Stages

As musical theatre has grown increasingly commercialized, the size and costs of production have increased by huge margins in the past 50 years. In attempts to revisit simpler times, I have elected to mount a theatrical production of the small, contemporary musical *The Last Five Years* alongside research as to the current state of musical theater. *The Last Five Years* has a lot to offer today's audience, as it not only demonstrates the fragility within all relationships but also focuses on the ways people try to love each other. In my research, many resources have mentioned that the lack of a new, younger audience for the theater could be the death knell for the American musical. *The Last Five Years* is a wake up call for my generation and through sharing it with an audience, I hope to remind people what musical theater can be. Broadway musicals today have nearly stopped asking introspective questions from their audiences. The megamusical has, since the 1980s, come to dominate what we think of as musical theater. By definition, a "megamusical" is an epic show with a broad, sweeping message that often has huge sets and complicated orchestrations to match. These shows do not, as Jessica Sternfeld writes, "tell contemporary stories of say, New Yorkers with relationship issues." This is what *The Last Five Years* is about. It is not *Les Miserables* or *Cats* or one of the megamusicals dominating theaters today. The top 10 selling shows on Broadway right now are all massive, megamusical undertakings. *Wicked*. *The Phantom of the Opera*. *Mamma Mia!* It is no wonder that *The Last Five Years* never made it to Broadway, as this musical is too small and too personal to stand a fighting chance of drawing the same audiences enjoyed by top sellers like *The Lion King*. Through honesty, thoughtfulness, and simplicity, *The Last Five Years* demonstrates a revisiting to what musical theatre used to be about.

Ewell, Zachary

Major: Environmental Studies; Advisor: Adrian Ivakhiv

Motives in Mountaineering: Understanding the Culture of High Adventure and its Implications for an Evolving Conservation Ethic

Mountain landscapes have always played a pivotal role in the development of human relationships with the natural world. The convoluted evolution of these relationships has run the gamut from mountains existing as a curse and impediment to human civilization to the more recent views of mountains as a realm of scientific discovery and potential spiritual transcendence. These views have largely determined our uses of these environments and mediated aspects of our general environmental ethic. This paper examines the modern culture of high adventure and seeks to develop explanations for why we climb and what the literature, culture and experience of mountaineering can teach us about our developing conservation ethic. The research for this project was conducted directly through climbing experience with participant surveys, as well as an analysis of recurring themes in the expansive literature of adventure and mountaineering. Aspects of mountaineering considered include risk taking and sensation seeking, the impact of the adventure on the formulation and legitimization of popular conservation sentiment, as well as the position of the mountaineers' alpine ethic relative to the development of modern conservationist sentiments. This paper focuses on the observed aspects of adventure and



Ewell, Zachary (cont.)

mountaineering that potentially contribute to rewards outweighing the tremendous cost these activities come to bear on participants. While there can never be consensus on why we climb this examination of certain aspects of the climbers life offers insight into a frequently mischaracterized human relationship with the natural world.

Falco, Matthew

Major: Chemistry; Advisor: Matthias Brewer

Synthetic Organic Methodology: A new ring fragmentation with applications in natural product synthesis

The goal of this research is to develop novel synthetic methods that will allow us to easily prepare complex nitrogen-containing molecules. We have discovered that cyclic γ -silyloxy- β -hydroxy- α -diazoesters undergo a novel ring fragmentation reaction to provide tethered aldehyde ynoates that would be otherwise difficult to prepare. These tethered aldehyde ynoates are important synthetic intermediates because they readily participate in further synthetic transformations. For example, treating these products with natural amino acids at high temperature results in the union of the two molecules into one new molecule via the formation of two new carbon-carbon bonds. This reaction also provides a large increase in structural complexity and incorporates a nitrogen atom into the product. We are now working to develop these methods into a synthetic strategy for the preparation of the biologically active steroidal alkaloid solanidine. Solanidine is isolated as the glycoalkaloid conjugates solanine and chaconine from potatoes and other plants from the nightshade family. These glycoalkaloid conjugates are thought to function as endogenous insecticides and fungicides. Solanidine is also purported to have a variety of adverse as well as beneficial effects in animal and humans. To develop a clear understanding of the potential benefits of this naturally occurring alkaloid, we aim to develop an efficient synthetic route to it and to closely related structural derivatives. In this poster we describe our novel ring fragmentation methodology and we present our synthetic approach to, and preliminary results from, the synthesis of solanidine and its derivatives.

Flynn, Hannah

Major: Professional Nursing; Advisor: Hendrika Maltby

Analysis of Affordable Housing Best Practices across the Nation and Bringing them Home

Lamoille County is approximately 50 miles from Burlington in rural Vermont. There is a high demand for affordable housing and the Lamoille County Planning Commission (LCPC) and Housing Coalition are working diligently on a realistic plan. As the outside researcher I have been meeting with the housing coalition and working with the director of LCPC and put together a plan of work for me. I have written a statement paper explaining the ideas of LCPC and the Housing Coalition and expressing how the community can be involved including the Technical Center and local private sector individuals. I have found properties the Town of Morrisville has voted to donate to Lamoille Housing Partnership (LHP). I have met with the Town Lister and Zoning Administrator to discuss what have development potentials and of those what type of public infrastructure is available on these properties. With the use of Community Based Participatory Research I have been able to conduct this research working with the community one-two days a week to decide what their expectations and needs are along with what the next step will be. The plan is to come to a decision on 1-3 properties that would meet pre-established criteria and bring this information before the Select Board and the LHP board for consideration. The hope is to involve a few different private sector individuals in regards to the funding of this project.

Fox, Douglas & Lowe, Chelsea & Todd, Kelly & Zgonis, Evangelia

Major: Chemistry; Advisor: Rory Waterman

Introduction to Research in the Department of Chemistry

Every year, motivated first year students participate begin research projects in the Department of Chemistry by taking Introduction to Research (CHEM 39/40). This year, students have done work in analytical, inorganic, organic, and physical chemistry addressing problems that relate to synthesis, materials, environment, and medicine.

**Fricke, Jennifer**

Major: Biological Sciences & Asian Studies; Advisor: Joseph Schall

Geographic Genetic Differentiation of a Malaria Parasite

I am testing the hypothesis that the low degree of movement of both the lizard and sandfly will allow substantial differentiation of a malaria parasite among different geographic sites, even those only a kilometer or less apart. The genetic structuring of parasite populations carries important implications as to how treatment and prevention of disease is handled. *Plasmodium mexicanum* (a sister species of human malarias) is a malaria parasite that infects a lizard vertebrate host (*Sceloporus occidentalis*) and sandflies (*Lutzomyia vexator*), the insect vector. For my senior honors thesis, I am determining the degree of geographic differentiation in allele frequencies of this parasite in a region of southern Mendocino County, California, using microsatellite genetic markers. Genetic variation within each lizard host is present in the form of haploid clones, with many genotypes cycling in the lizard population. Parasite DNA is amplified via PCR reaction and sent to a genotyping facility for processing. Statistical analyses of population genetic estimates such as F_{st} and Mantel tests will then be done using these genotype data. If differentiation between sites exists, this could allow the parasite and host to evolve local adaptations, a controversial issue in parasite evolutionary studies.

Gilligan, Lauren

Major: Biology; Advisor: Lori Stevens

A molecular genetic study of the Chagas Disease vector *Triatoma infestans*

The *Triatoma infestans* is an insect that transmits Chagas disease to humans and other mammals throughout the Southern Cone Countries of South America. In Bolivia, a main concern is the high rate of re-infestation after spraying of insecticides is used to prevent Chagas transmission. In order to understand where and how the insects are colonizing and re-infesting domestic areas, population genetic studies can be used. An analysis of the population structure of *Triatoma infestans* from 3 communities in Chuquisaca, Bolivia will be performed using microsatellite markers. Using statistical software that is specific for population genetic studies, I can determine the degree of genetic differentiation between and within the three communities. The results will imply how *T. infestans* in this endemic area are moving and establishing populations among domiciliary areas.

Gordon, Emma

Major: Political Science; Advisor: Alec Ewald

America's Aging Voters

America's growing aging population and the related increase in the incidence of dementia pose significant challenges to the electoral process. Health care professionals, family caregivers, election officials and policy makers lack adequate information and guidance in how to decide if an individual with dementia is capable of voting. This project assessed the voting rights of aging Vermonters through a series of interviews conducted with nursing-home personnel and state and local elections officials. As a backdrop for this research, I synthesize previous work done by scholars working in psychiatric, gerontological, medical, and legal fields. My research reveals significant discrepancies between Vermont statutes and the current standards and procedures in determining voting capacity and how voting is facilitated. Furthermore, there is significant variation within Chittenden County nursing homes' facilitation of voting in long-term care facilities. Proper education and outreach must be provided for those working with our aging population in order to properly protect the rights of this population while preserving the integrity of the voting process.

Henck, Steve

Major: Physics; Advisor: Jie Yang

Capillary Technology and Laser Light Scattering of Salt Solutions

Professor Yang of the UVM physics department has developed a new system of Capillary gel filtration (size exclusion chromatography) for biological applications. The system uses online laser light scattering for the detection of eluted proteins from the filtration column. The advantage of this detection system is the use of an intensified CCD camera mounted on a microscope, offering the potential to detect proteins at very small concentrations. Recently we have found that the instrumentation can also be used to characterize the solution quality to detect the presence of ions in solution, and



Henck, Steve (cont.)

there is a high potential of extreme sensitivity. Thus, the instrument has the potential also to be employed in water quality characterizations. There are still details to be worked out, but at the current stage we have pinned down the direction of improvement on instrument sensitivity. After collecting a large amount of data, we have found that the smaller the inner diameter of the tip, the greater the enhancement of scattering intensity. These studies suggest that the flow of solution through the cone-shaped capillary tip was governed by micro-fluidics and the colossal linear rate gradient at the tip increases density.

Holmberg, Meredith

Major: Nursing; Advisor: Hendrika Maltby

A Community-Based Participatory Research Approach with Manikganj Bangladesh

In the global environment of today's world, nurses must be educationally prepared to meet the needs of people from culturally and linguistically diverse backgrounds in order to provide safe, culturally competent, appropriate, and high quality care. The specific aims of this research were to conduct a community assessment and create a sustainable long-term relationship with the Manikganj district of Bangladesh to advance the community goals of improving health outcomes. Using community based participatory research (CBPR), I interviewed families in three rural villages. CBPR can establish a long-term relationship and uses the community's knowledge to ensure that implementation efforts work towards their goals and not those of the researcher. My research is the beginning of a sustainable relationship between the Bangladeshi people and UVM nursing students. This partnership will aid in the improvement of health outcomes identified by the community. With the help of interpreters, a total of 100 families were interviewed by 17 students. Quantitative data were collected including education levels, income, health status as well as height, weight, and blood pressure. Qualitative data examined women's health issues and suggestions for community improvement. Results from data analyses will help plan and implement public health programs in collaboration with Bangladeshi partners and future nursing students. It is my hope that the villages we work with will benefit from these programs as much as we have benefited from our experiences with them. Traveling to Bangladesh provided a heightened perspective of, and growth in, cultural competency that cannot be gained in a classroom. Ultimately, it will aid in the goals of holistic and high quality nursing care here at home.

Hopkins, Rachel

Major: Social Work; Advisor: Gary Widrick & Holly-Lynn Busier

Race in Northern New England: Experiences of the Social Environment

The researcher compiled and distributed a survey examining experiences of social supports for people living in Maine, New Hampshire, and Vermont (Northern New England). The survey was geared to identify whether there are common experiences for people of color that differ from those of white people. The researcher had noted, anecdotally, the presence of a difference of the social experience based on race, though very little research exists comparing the experience of the social environment in Northern New England based on race. The researcher examined related studies prior to beginning her research, and sought any statistics possessed by the Human Rights Commissions in Maine, New Hampshire, and Vermont. Her survey inquired as to experiences of geographical community, schools, religious engagement, the justice system, commerce, health care, and specific social services (e.g.: TANF or a social worker in a medical setting). She attempted contact with over forty organizations that serve people of color in Northern New England, and had received support from three organizations in the editing and distribution of her survey at the time of this submission. She had collected approximately forty surveys, ninety five percent of which were from Vermont, and was continuing collection and outreach to attempt to collect a larger and more geographically diverse sample. Should she find her attempts at collecting more surveys to be successful, the researcher will conduct focus groups delving into preliminary findings with survey respondents willing to take part in the focus groups. At the time of this submission, the researcher had no statistically significant findings, as she had yet to collect from a control group of white people living in Northern New England.



Kosak, Alice

Major: Psychology; Advisor: Kelly Rohan

Self-reported mood sensitivity to pollen, seasonality of mood, and depressive symptoms in a northeastern college sample

This study explores the association between mood sensitivity to pollen and seasonality (seasonal fluctuation) of mood in a sample of 444 participants at a university in the Northeastern U.S. Consistent with prior research (Guzman et al., 2007), it is hypothesized that mood sensitivity to pollen will be associated with greater seasonality of mood as well as with pollen-present (versus pollen-absent) type seasonal affective disorder. In addition, this study adds to the literature in examining whether depressive symptom severity differs across season of assessment in participants with mood sensitivity to pollen.

Kreger, Bridget

Major: Medical Laboratory Sciences; Advisor: Ahmad Chaudhry

Assessment of the microRNA expression in human cells exposed to chronic low doses of ionizing radiation

The damage inflicted on the cells by exposure to ionizing radiation induces a complicated stress response. DNA repair, changes in growth cycle, signal transduction, and many other cellular processes are activated. All of these alterations have genetic basis, and a number of genes involved in those responses have been identified. The molecular basis of this gene regulation in irradiated cells is not fully understood. The gene regulation occurs at the post-transcriptional level and recent studies have suggested that micro RNA (miRNA) play a significant role in this process. miRNA are short single stranded non-coding RNA molecules and are thought to be regulators of gene expression. We hypothesized that exposure to ionizing radiation influences gene expression by altering the levels of miRNA. To test this hypothesis we investigated the expression of miRNA by real-time PCR in human cells. The exponentially grown AG01522 human fibroblast cells were irradiated with a chronic low dose of 10 centigray (cGy) radiation. These cells were also treated with acute low dose of 10 cGy and acute high dose of 400 cGy radiation. After 3 and 8 hours of radiation exposure, the miRNA fraction was recovered and subjected to real-time RCR assessment of miRNA expression trends. Conditions for recovering high quality miRNA from these cells and reverse transcription to make complementary DNA (cDNA) were determined. The miRNA expression trends corresponding to endogenous controls were assessed with real-time PCR. The expression analysis of 21 miRNA identified the upregulation of miRNAs associated with Ras, Myc and apoptosis pathways as a result of low doses of ionizing radiation exposure. These results suggest that miRNA involved in controlling genes in carcinogenesis pathways may potentially help explain the mechanisms of gene regulation in the stress response to low doses of ionizing radiation exposure.

Krywanczyk, Alison

Major: Biology; Advisor: Daniel Weiss

Development of Nanotechnology Approaches for Treatment of Mesothelioma

We are researching the kinetics, distribution and cellular uptake in vivo of Acid Prepared Mesoporous Spheres, (APMS), porous nanoparticles developed at UVM (Cheng & Landry 2007). These inert porous silica beads can be loaded with drugs and deliver a sustained release that allows a more concentrated and prolonged effect. This technology is especially useful for cancers like mesothelioma, an essentially incurable cancer of the pleural lining of the lung in which chemotherapy has limited effects due to poor drug penetration. We hypothesize that intratracheal delivery of the APMS containing a chemotherapeutic agent will be an effective means of treating mesothelioma and other poorly responsive lung tumors. We are currently evaluating the effects of APMS in the lung and other organs after direct airway administration of the APMS to normal mice. These APMS have been fluorescently labeled, and various cell samples from the mice will be analyzed by flow cytometry to determine where the APMS end up. The next step is to deliver APMS loaded with doxorubicin (a chemotherapeutic drug) to mice with experimentally-induced mesothelioma to determine the effectiveness of tumor-killing. This study will help determine the usefulness of APMS in chemotherapy. If initial results show the APMS gathering in organs such as the spleen or liver, indicating that they diffuse into the bloodstream, then certain toxicity aspects may need to be explored. However, if the APMS are absorbed by cells other than those lining the lung, then they may have a therapeutic potential for other types of tumors as well.



Lane, Justin

Major: Religion; Advisor: Kevin Trainor

Creating Coercion : An Alpha's Effect on Cult Members

My research investigates how members of cults and new religious movements are affected by the leaders of the cult, using The People's Temple of Jonestown and the millennial cult Heaven's Gate as case studies. This research helps to further our understanding of religions in their most natal stages. The study of religion has started to look through scientific lenses such as cognitive science and psychology. My research helps us to better understand how cults and new religious movements operate on a psychological and cognitive level. The research entails an overview of the historical events of the cult and going to primary sources in order to understand how authority was controlled on the psychological level. It will rely heavily on recent research on cognition due to the fact that studying religion has so many variations, outliers, and transcendental factors; therefore, the realm of psychology and cognition provides the most scientific method for study. By compiling and reviewing the primary sources as well as the most recent findings in the study of cognition, I will be able to form a comprehensive formula describing how alpha figures assert control and how their followers are affected by and react to the alpha. The result of this research will be a better understanding of how cult members can be coerced and persuaded by their leaders. The larger implications of this type of study will also allow religious scholars to glean the social and cognitive formations of religion; a goal pursued since the time of Emile Durkheim.

Leclerc, Jaime

Major: Nutrition Science, Premed; Advisor: Jim Vigoreaux

Myosin binding activity of Drosophila flightin fragments

Striated muscle structure is conserved across phyla in its organization of thick filament and thin filament interdigitation and uses myosin motors to produce animal locomotion. The complex assembly of myosin into helical filaments is not completely resolved but the team of accessory proteins necessary for myosin assembly is increasingly studied and better understood. Flightin is one such accessory protein. In *Drosophila*, flightin has been shown to be absolutely necessary for indirect flight muscles (IFM) development and function. Characterizing the protein structure, function and activity of flightin can provide significant insight for such analog proteins and functions of MyBP-C, in addition to building links between gaps in protein adaptation and evolution. In order to identify the myosin binding region in flightin, we conducted phylogenetic studies that lead to the identification of a 52 amino acid sequence found to be conserved across insects and crustaceans. A closer look at this conserved section of the protein will contribute to the characterization of flightin and help draw conclusions about flightin's structure and function. We cloned the N-terminus and C-terminus segments of the flightin protein into a pMAL expression vector in which purification of these protein segments will be aided with Maltose Binding Protein affinity. A stoichiometric analysis of the C and N- terminus segments of flightin and their binding ability to myosin binding protein in flies will be performed.

Lim, Daniel

Major: Integrated Natural Resources; Advisor: Marta Ceroni

Cities Achieving Sustainability by Restoring Green Spaces

Restoring urban green spaces has been touted as a successful means of achieving sustainability for cities. In this paper, New York City and Chicago's sustainability plans will be discussed. Urban greening is a vital component of their respective PlaNYC 2030 and 2005 Environmental Action Agenda. Interviews of different city agencies and non-governmental organizations in both cities reveal valuable information about the processes by which these and other entities collaborate on urban greening projects. The analyses of the approaches, successes, and challenges of these organizations can provide useful guidelines for other cities that are working on greening efforts as a way to achieve sustainability.



Lowe, Chelsea & Fox, Douglas & Todd, Kelly & Zgonis, Evangelia

Major: Chemistry; Advisor: Rory Waterman

Introduction to Research in the Department of Chemistry

Every year, motivated first year students participate begin research projects in the Department of Chemistry by taking Introduction to Research (CHEM 39/40). This year, students have done work in analytical, inorganic, organic, and physical chemistry addressing problems that relate to synthesis, materials, environment, and medicine.

Mallon, Cyrus

Major: Biology; Advisor: Sara Helms Cahan

The Evolutionary Role of *Solenopsis geminata* in a Hybrid Fire Ant Zone

Hybridization can have an enormous negative impact on the fitness of a hybridizing individual because it invests energy into reproductively disadvantaged offspring. However, the lifestyle of eusocial insects is pre-adapted to avoid these consequences because most colony members, the workers, do not reproduce directly. In a hybrid zone between two fire ant species, *Solenopsis geminata* and *Solenopsis xyloni*, in Eastern and Central Texas, one species (*S. xyloni*) has become dependent on hybridization by biasing the fate of hybrid offspring toward becoming workers while non-hybrid female offspring only develop into the reproductive queen caste. Two alternative hypotheses have been proposed to explain the origin of this hybrid zone: it may be the result of expansions of the contiguous ranges of each species associated with historical climatic shifts, or it may be a very recent phenomenon resulting from colonization of eastern North America by *S. geminata* from the Caribbean. In this study, we investigated the ancestral origin of this hybrid zone by sequencing a (685 base pair) region of the Cytochrome oxidase I (COI) mitochondrial gene of *S. geminata* from individuals within the hybrid zone and comparing them to samples from across its range in North, Central and South America, and the Caribbean. The closest conspecific relatives to *S. geminata* in the hybrid zone occurred in Northern Mexico, while samples from eastern North America were more closely related to Caribbean populations. These relationships do not support the hypothesis of recent origins of the hybrid zone due to colonization, but instead suggest that the hybrid zone formed at the edge of the natural range limits of the two species. Given the relatively old age of this system, our results suggest that obligate caste differences between hybrids and non-hybrids appears to be evolutionarily stable despite the complex interactions between species required for it to persist.

Martin, Melissa

Major: Psychology; Advisor: Lynne Bond

Adolescents' Reported Experiences of Living with a Sibling with Autism

This study looks at the experiences of adolescents who have siblings with autism in Vermont through in depth interviews with those adolescents and questionnaires filled out by their parents. At this point, six families have participated, however we are hoping to have between 10-15 families by the end of the project. The study addresses the adolescents' relationships with their sibling with autism, their parents, and their friends, teachers, and neighbors, including how having a sibling with autism affects these relationships. The interview also addresses support systems used by the adolescents, and what support systems they would like to see provided in the future. Preliminary data analysis shows a large difference between the experiences of adolescents in the Burlington area, as compared to those of adolescents in other parts of Vermont. I expect that this difference will be a significant one, and will warrant further consideration. There has been a lack of attention given to this topic in the past, which is why I felt it important to address. Most research addresses conflicts faced by the parents of children with autism, or the family as a whole, but fails to address the individual experiences of the siblings of children with autism. This group is looking for a voice and a way to share and cope with their experiences. It is my hope that this project will be used as preliminary research, or as a reference, in the planning of future programs for the families of people with autism.



Maskell-Ferland, Erin

Major: Communication Science; Advisor: Elizabeth Adams

Maternal Perceptions and Observations of Play in Children with and without Autism Spectrum Disorders (ASD)

ASD is a pervasive developmental disorder characterized by impairment in communication and social interaction. Play is a particular area of deficit for children with ASD as compared to typically developing children. It is important to early learning and language and should be assessed prior to intervention. Caregivers are important informants regarding their children's play, therefore, play assessment should include observation and maternal perceptions of play. Research on the accuracy of mothers' perceptions of their child's play may facilitate the assessment and intervention process. Further, examination of play will enhance our understanding of play types and preferences of children with ASD.

Matt, Jeremy

Advisor: Donna Rizzo

Applications of Image Analysis: Leaf Wetness

Leaf wetness is a major indicator of the risk of crop disease, but measuring leaf wetness in the field is difficult. Experts are able to estimate leaf wetness to within 3-5%, but expert monitoring of leaf wetness during a rain event is expensive and often impractical. Mechanical sensors do not measure leaf wetness accurately because they do not wet or dry off at the same rate as leaves, and it has proven very difficult to find a mathematical or empirical relationship between the surface wetness measured by sensors and the actual leaf wetness. Farmers, who are unsure of the crop disease risk, tend to err on the side of caution during rain or dew events. They respond by spraying more pesticides than actually needed. This leads to increased pesticide concentrations in runoff and groundwater. The purpose of this project is to explore the possibility of determining leaf wetness using image analysis. We have developed methods for determining the weight of water stored in grape canopies and for processing leaf images to extract wetness data.

Matt, Jeremy

Advisor: Donna Rizzo

Applications of Image Analysis: Porous Building Materials

Increased quantities of pollutants in the environment leads to increased contamination of porous building materials. In many cases, it is cheaper to simply tear down and rebuild contaminated buildings than to decontaminate them but this is not an option for buildings with high levels of cultural or historic significance. Understanding how quickly and to what extent various contaminants can penetrate common building materials is important because this knowledge allows for more efficient decontamination. A Computed Tomography (CT) scan provides information about the pore spaces within a plane of the material. A series of scans taken at varying depths is needed to gather three-dimensional information but it is hard to visualize how pores change and are connected from a series of 2-D scans. We have developed methods for automatically separating pore space from grain space in CT scans. We were able to generate black and white images and to construct a three dimensional model of the pore structures within the material. We also developed a search function to find contiguous pore areas, which allows us to visualize how far into a sample a contaminant can penetrate.

McLane, Carrie

Major: Dietetics & Nutrition and Food Science; Advisor: Linda Berlin

Vermont Farm to School: An Examination of School Culture

Environmental sustainability and preventable health problems are two of today's pressing issues facing Americans. A movement to buy more local foods has been gaining popularity in order to address both of these issues. The nationwide Farm to School initiative came forward to encourage school cafeterias to work with local farms, while at the same time providing environmental, nutritional and agricultural education. Though beneficial on various levels, getting local foods into schools is a long process in which schools encounter many barriers. Using a case study approach and the qualitative methods of focus groups and written surveys, four different Vermont schools were explore to better understand the values regarding local foods and other aspects of school culture. Each focus group consisted of participants from the same school, using a stratified purposeful method to select schools based on their different stages of the Farm to School grant process. The participants of the focus groups were chosen by way of a purposive criterion method, choosing participants



McLane, Carrie (cont.)

who showed involvement or support in Farm to School in some way. The information gathered centered on relevant attitudes, behaviors and social norms regarding local foods among the school community. The four case studies illustrate that a fairly high value is placed on local foods in these schools. In the focus groups, the attitudes of the participants tended to be upbeat throughout each school, however the two schools further along in the grant process had integrated local foods into the school culture more substantially and had more confidence in their ability to implement Farm to School. These schools had a more realistic understanding of how much time was needed to make things happen.

Melchior, Maartje

Major: Geology; Advisor: Greg Druschel

Investigating possible causes of cyanobacteria blooms in Mississquoi Bay

Over the years, areas of Lake Champlain have suffered from increasing blooms of potentially toxic blue green algae. Cyanobacteria are a type of bacteria that are capable of photosynthesis, and produce oxygen. They reproduce rapidly in lakes and ponds where there is adequate amount of sunlight, warm temperatures, and sufficient amounts of nutrients such as phosphorus and nitrogen. These nutrients are often found as components in fertilizers, and enter the lake from storm water runoff, treated and untreated wastewater and agricultural runoff. Cyanobacteria are a natural component of Lake Champlain's phytoplankton, however changes in the relative proportions of nutrients, such as phosphorus and nitrogen, released from the sediment has given rise to the growing cyanobacteria populations. A potential health concern has been introduced as several species of blue-green algae have shown to produce microcystin and anatoxin-a, which are potent liver toxins. The amount of nutrients released from the sediments in impacted bays might, however, not be the only factor determining the type of cyanobacteria present, rather the nutrient ratio present in the sediments could play a role in determining whether or not large amounts of neurotoxins are produced. Cyanotoxins in Lake Champlain were first documented in 1999, and for the past few years, beaches have closed more regularly due to growing concern for human health. Since Lake Champlain is used as a water supply, and for extensive recreational purposes it is important to understand what exactly causes the seasonal blooms and what can be done to slow them. This research examined the speciation of nitrogen from the sediments in Mississquoi Bay, and how changes in these conditions favored the growth of cyanobacteria populations. We obtained sediment cores monthly from June to August. This period represents the cycle of bloom initiation, peak bloom conditions, and bloom senescence. A portable spectrophotometer was used to measure concentrations of nitrogen species in the overlying water trapped in the core. Pore water was analyzed for concentrations of NO₂⁻, NO₃⁻, and NH₄⁺ using ion chromatography.

Meltzer, Nicholas

Major: Civil Engineering, Environmental Concentration; Advisor: Britt Holmen

Size Distribution of Agricultural Fugitive Dust Emissions

Fugitive dust is the classification given to particulate matter (PM) that is generated by nonpoint and area sources such as construction sites, windblown dust, unpaved road travel and agriculture. These "nonpoint" sources can be contributors to non-attainment status of localities looking to meet EPA air quality standards. Agriculture is often considered one of the largest producers of fugitive dust, and given the large quantity of herbicides applied to cultivated fields, potential adverse health implications exist from respirable dust resuspended in the atmosphere by cultivating and tilling practices. Little research has been done in this area, so the chemical composition, transport patterns and distances, and quantity of dust emitted is not well quantified. Light detection and ranging (LIDAR) technology will be used in combination with point PM samplers (PQ 200, MOUDI, DustTRAK) to determine the generation, transport patterns and size distribution of the fugitive dust produced by agricultural disking. Different meteorological events will guide the data collection to be conducted using multiple samplers at different heights and locations across an active, in-use cotton field. Field testing will occur in the month of March, with results on the size distribution of PM as a function of meteorological conditions by early April. All field experiments will take place at the University of New Mexico's agriculture study fields, in Las Cruces.



Nakhla, Jennifer

Major: Anthropology; Advisor: Cameron Wesson

The Mysterious Life of Children Revealed: An Archaeology of Children

Children are invisible in archaeological records except for occasional toys because artifacts are assumed to have been used by adults. Since evidence of children in archaeological records is sparse, little is known about children of the past. Some argue that it is possible to learn a lot about children through archaeology. Although more difficult to trace child behavior through the archaeology because the lack of adult understanding of behaviors and objects utilized by children, it is not impossible. I hope to show that much can be learned of children through archaeology by using data collected from two sites in Vermont.

Notte, Dana

Major: Dietetics & Nutrition and Food Science; Advisor: Robert Tyzbir

Correlation Between Body Shape and Diet Composition in College Females

This objective of this retrospective study was to determine how body shape, measured as the waist to hip ratio (W/H), changed in undergraduate University of Vermont college-aged females from 1992 to 2007. And, to determine if any changes correlate to changes in diet composition and body mass index (BMI), measured as body weight in kg/height in meter². 1052 college females enrolled in an elective course in nutrition between the years of 1992 and 2007 participated in this study. Weight and height were measured using the same scale throughout the years and waist and hip circumferences were measured with the same type of flexible measuring tape. Data expressed as mean \pm SD were analyzed by linear regression using SPSS. The results indicate that the individual waist and hip circumference significantly increased ($P < 0.05$) in college females over the fifteen year time period; however, because the increases in each one are proportionate, the slight increase measured in the W/H was not statistically significant. BMI was not significantly different over the time period and there is no correlation between BMI and the individual waist or hip measurements or between BMI and W/H. Although total daily caloric intake increased only slightly, the percent of calories as protein and fat significantly increased ($P < 0.05$) while the percent of carbohydrate significantly decreased ($P < 0.05$). Thus, there is no correlation between metabolizable energy intake and the increase in the individual waist and hip measurements or W/H measured. There is a positive correlation between fat and protein intake, and a negative correlation between carbohydrate intake, and individual waist and hip circumference measured from 1992 to 2007. Therefore, it appears that diet composition may have more of an effect on body shape than total daily energy intake. However, the development of a more sedentary behavior as the reason for the increase in the waist and hip circumferences cannot be overlooked.

Omaruddin, Romaica

Major: Radiation Therapy; Advisor: Ahmad Chaudhry

Development of Gene Expression as a Biomarker for Human Radiation Exposure

Exposure to ionizing radiation can be unforeseen, rapid and very devastating. Accidental detonation of a radiological device leading to such an exposure can be detrimental to the exposed population. The radiation-induced biological effects may manifest as acute effects that can be detected clinically or may be more subtle effects that can lead to long-term radiation induced abnormalities. Accurate identification of the individuals exposed to radiation could be very challenging. A rapid and effective screening test that could be used as a biomarker of radiation exposure detection on a large scale is mandatory. Some of the molecular events altered in the radiation exposed tissues range from DNA damage, heritable mutations, altered gene expression, genomic instability, cell death and induction of carcinogenesis. We hypothesized that the alterations in gene expression could serve as a biomarker of human radiation exposure. We recently identified several radiation responsive genes using microarray technology. To develop a useful gene expression biomonitor, however, gene expression changes occurring in response to irradiation in vivo must be measured directly. Patients undergoing radiation therapy provide a suitable test population for this purpose. We examined the expression of CC3, MADH7, and SECPRO in blood samples of these patients before and after radiotherapy with relative quantitative RT-PCR to measure the in vivo response. The gene expression after ionizing radiation treatment varied among different patients, suggesting the complexity of the response. These observations are in accordance with the radio sensitivities and



Omaruddin, Romaica (cont.)

radio resistance phenomenon reported as a radiation response. Interestingly MADH7 gene was found to be upregulated in three out of four patients and could serve as a molecular marker of radiation exposure. However, further studies are needed to extend these observations in a large population.

Paradis, Corey & Soll, Gregory

Major: Environmental Studies; Advisor: Roelof Boumans

A Hands-On Guide to Greater Food Self-Reliance

The Slade Environmental Cooperative is a community of UVM students dedicated to living socially and ecologically responsible lifestyles in a university setting. We aim to be a self-sustained grower of local foods and supporter of small, organic farms in Vermont. The Slade Hall Environmental Cooperative is resolved to being a place on campus which promotes creativity, diversity, spiritual, and personal development to reduce stress and promote a healthier way of life at UVM. Hands-on projects promoting greater self-sufficiency have been implemented throughout the semester.

Parry, Katrina

Major: Geology; Advisor: Greg Druschel

The Use of DGT Probes to Determine Phosphorus Concentrations in Missisquoi Bay Lake Waters

Missisquoi Bay is one of several areas of Lake Champlain which experiences elevated nutrient levels namely during the summer months, frequently resulting in toxic algal blooms. Phosphorus is of main concern as it is considered a limiting nutrient in lake environments. One key research question has been to determine what forms (especially organic vs. inorganic forms) phosphorus exists in, because the form may significantly impact both the bioavailability and mobility of phosphorus. Diffusive gradient in thin film (DGT) probes were employed to study the flux of phosphorus from the sediments into the water column in Lake Champlain, and to determine whether this exchange could affect toxic algal blooms. A DGT probe is a commercially available product used for phosphorus sampling. It consists of a small plastic frame, containing a clear diffusive gel lying on top of an iron oxide gel, which acts as a phosphorus absorber. The DGT probes were placed in a combination of Missisquoi Bay lake water samples over varying periods of time. The iron oxide gels were later removed and digested in sulfuric acid, releasing the phosphorus to solution. This solution was then analyzed using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), which measures the concentration of phosphorus in the sample. A number of different experiments were run using inorganic phosphate and organic phytic acid. In addition, a few larger DGT probes were employed in the field, to measure the flux of phosphorus leaving the sediments and entering the water column. Results show there is not a large difference in phosphorus concentration when using organic vs. inorganic forms. Field results showed no significant gradient in phosphorus concentration leaving the sediments. This may be linked to observations that this past summer experienced no significant algal blooms. An experiment was also done with DGT probes with and without diffusive gels, in order to test the reliability of the diffusive membrane. It was concluded that the diffusive membranes may be subject to tearing and do not control phosphorus diffusion to the iron gel and report higher phosphorus concentrations than expected.

Partee, Erika

Major: Fisheries Biology; Advisor: Ellen Marsden

The effect of calcium on zebra mussel growth

The zebra mussel (*Dreissena polymorpha*) is a small bivalve mollusk found in many fresh and estuarine waters. Over the past 150 years it has become a species of particular concern due rapid expansion of its range. In 1993 zebra mussels were confirmed in Lake Champlain, marking the beginning of their spread throughout the lake. The effects of the zebra mussel invasion are numerous and costly both in economic and ecological terms, including fouling of permanent marine structures and increased mortality of native mussels due to fouling and consequent starvation. A major possible environmental limit to zebra mussel growth and survival is the calcium level in the surrounding water. Calcium is thought to be the main cation in shell formation, used to form the calcium carbonate crystals that comprise the bulk of the shell matrix. In waters where calcium is not readily available, shells of freshwater mollusks are often observed to be thin. The purpose of this experiment was to explore the effect of calcium on zebra mussel shell formation in Lake Champlain. This



Partee, Erika (cont.)

was done using a cage experiment in which zebra mussels were left to grow from June to October at three lake sites representing calcium levels from the southern, mid, and northern portions of the lake. Calcium levels vary within the lake, tending to be higher in the south and lower in the north. One half of cages were additionally treated with water-soluble calcium carbonate powder. Data analysis so far indicates that there may be a positive relationship between shell thickness and calcium level. Further analysis of the data will explore the relationship between calcium levels and shell thickness between size classes and locations within the lake. Analysis of data will be completed before mid-March.

Pokalo, Gwen

Major: Community & International Development; Advisor: Chris Koliba

Impacts of AmeriCorps VISTA on Host Organization Capacity

This research is the realization of the thesis developed in the PA 295: Community-Based Participatory Research course taught by Hendrika Maltby in the Fall 2007 semester. The purpose of this project is to form a sustainable partnership between the Burlington Community and Economic Development Office (CEDO) and the University of Vermont to aid in the development and retention of evaluative data. The central topic of research examines the impacts AmeriCorps VISTAs have on host organization capacity-building efforts. In keeping with the pillars of Community-Based Participatory Research, the collaboration promises to provide CEDO and the AmeriCorps VISTA host organizations with meaningful data that may be used to promote better capacity-building efforts per participating organization. Further, CEDO will be provided a clear assessment of the VISTA position and capacity building efforts for each organization, thus allowing for more informed decision-making and resource allocation in the future. The research utilizes a McKinsey-style rubric, inventory, and interviews.

Ram, Kesha

Major: Natural Resource Planning; Advisor: Clare Ginger

Creating Healthy Communities Through Environmental Justice Policy

The environmental justice movement in the United States embodies the intersection between human health and the environment, identifying the greater harm suffered by low-income and minority citizens because of their disproportionate proximity to polluting facilities and lack of political and financial wherewithal to improve their situation. After gathering momentum from the first documented case of environmental injustice in 1982, the movement substantial national visibility when President Clinton put Executive Order (EO) 12898 into effect early in his presidential career (1994). This EO was a significant step for the federal government toward improved infrastructure and increased awareness in dealing with environmental injustice, particularly through Title VI of the Civil Rights Act. However, as all levels of government implemented policies, obstructions to environmental equity arose. Many state and local governments have picked up where the federal government left off, strengthening their environmental administrations and creating policies that uphold the mandates of EO 12898 (Bonorris 2004). Vermont ranks among the eight states that have not created any comprehensive plan for assessing and mitigating environmental inequity (Sze 2004). This project will assess the need for an environmental justice policy and the potential for framing and executing such a policy unique to Vermont through interviews with various local officials, non-profit agents, and elected state leaders. This study will seek to answer the following questions: How could Vermont citizens benefit from an environmental justice policy? What barriers exist to the creation of this policy in Vermont? Data collection will be based on a review of relevant literature and government documents and analysis of interviews with key political and social actors in Vermont. In addition, it will be based on participant observation of the pending environmental justice legislation now circulating in the Vermont Statehouse, which the author of this study helped to foster and actuate.

Rendall, Katherine

Major: Economics & History; Advisor: Jane Knodell

Financial Systems and Foreign Direct Investment in Developing Countries

This project explores foreign direct investment (FDI) into developing countries. In particular it examines how financial systems in developing countries might encourage or discourage FDI. It will use Nathan M. Jensen's equation for



Rendall, Katherine (cont.)

determinants of FDI and add to Jensen's model new financial indicators, proposed by Robert King and Ross Levine to be possible measures of financial stability. My regression analyses will control for aggregate and firm-specific factors that might affect FDI. By conducting cross sectional and time series variations, I will be able to determine what, if any, relationships are born between financial systems and FDI into developing countries. This study will contribute to a broader debate over what attracts FDI into developing countries, adding the element of financial systems. My project will conclude with a narrative analyzing my findings and the implications for growth and stability.

Rhone, Brandon

Major: Economics; Advisor: Elaine McCrate

Mexican Immigration and its Affect on Black Labor Markets in the U.S.

This working paper explores the connection between legal and illegal Mexican migration to the United States and the persistence of wage and employment inequality experienced by native blacks. Findings thus far suggest that less skilled blacks are most adversely affected by Mexican immigration as the two groups compete for employment opportunities and are subject to the substitution effect. This paper incorporates an extensive literature review to aid the development of a theoretical model. My hypothesis is supported by an econometric study using a cross section of 5% PUMS data provided by the Census.

Robinson, Douglas

Major: Religion; Advisor: Kevin Trainor

Salving Comparative Religion: Buddhist Saints, Christian Martyrs and the Cult of Relics as a Case-Study

The method of comparativism in the academic study of religion has exerted a profound influence over the contours of both classical theory and contemporary scholarly discourse. Embodying the maxim "He who knows one, knows none," (Müller) the act of comparing religious phenomena, which is fundamentally an activity of typological classification involving varying degrees of meta-level generalization, provides for its proponents, the cross-cultural focus necessary for a true Religionswissenschaft (Science of Religion). The tenability of the comparative enterprise, however, has come under serious reproach with the emerging influence of postmodernism in the humanities which criticizes the prevailing epistemological hierarchies intrinsic to metanarratives. The result has been a complete theoretical repositioning which emphasizes the preeminence of context and self-reflexivity over that of generalization and objectivity. Given these two contrasting methodological frameworks, my own research aims to bridge these incongruities by further expounding upon the trajectories adumbrated by contemporary scholars who argue for comparativism as a second-order heuristic exercise which always presupposes difference over identity (Smith, 2004). Toward this end, I will examine two religious movements separated both temporally and geographically, namely, the relic cults of Theravada Buddhism and Medieval Christianity, as a case-study for this critical reconfiguration of comparativism. In doing so, my goal is to reformulate these old questions in a way that reintroduces the possibility of dialogue in such a culturally diverse and increasingly globalized religious landscape.

Sohotra, Leah

Major: Women and Gender Studies; Advisor: Beth Mintz

Understanding Gender as Performance: When it is Sensual or Numbing

Through examples pulled from research that is mostly contemporary and applicable mostly within western societies the purpose of this study is to understand and explore the line between performing gender and sexuality so that it either empowers or is understood as a mode of oppression. Mostly the focus is on sexism in the United States and how it serves to deny women of full personhood however racism and other forms of discrimination are also touched upon. Topics such as cosmetic surgery, and pornography are explored for positive and negative aspects, while the dangers of sexism are illustrated through research on such horrors as gang rape and FGM.



Soll, Gregory & Paradis, Corey

Major: Environmental Studies; Advisor: Roelof Boumans

A Hands-On Guide to Greater Food Self-Reliance

The Slade Environmental Cooperative is a community of UVM students dedicated to living socially and ecologically responsible lifestyles in a university setting. We aim to be a self-sustained grower of local foods and supporter of small, organic farms in Vermont. The Slade Hall Environmental Cooperative is resolved to being a place on campus which promotes creativity, diversity, spiritual, and personal development to reduce stress and promote a healthier way of life at UVM. Hands-on projects promoting greater self-sufficiency have been implemented throughout the semester.

Sprague, Devin

Major: Secondary Education Biology; Advisor: Holly-Lynn Bussier

Effects of TASS on the Assessment Practices of High School Science Teachers

This study examined the effects of the Vermont Higher Education Collaborative's Teaching All Secondary Students (TASS) initiative on the assessment practices of secondary school science teachers. The TASS initiative is a curriculum reform and school renewal program that seeks to enhance the professional practices of secondary school educators. TASS emphasizes the development of instructional practices that have been shown to improve the learning of all students. A central feature of the TASS initiative involves authentic and formative assessment procedures within classrooms. Through a mixed-methods case study, the impact of the TASS program on the assessment practices of four high school science teachers was evaluated. Specific methods to examine the effects of TASS on assessment practices included individual interviews, teacher perception surveys, and analysis of teaching materials. The study explored all areas of assessment including anticipated learning outcomes, assessment methods, student feedback, grading, and communication of assessment results. Respondents showed remarkable improvements in their grading practices, use and communication of assessment results, and planning and development of assessment goals. There was little change in respondents' understanding and development of curricular learning goals. Results on assessment methods and feedback were unclear, and may have resulted from differential interpretation of survey questions. Suggestions for further study include a similar survey tool with a larger sample size.

Stiner, Elyse

Major: Political Science; Advisor: Alec Ewald

Brown, Seattle, and the Supreme Court in American Politics

The Supreme Court's responsibility is to interpret the Constitution and decide cases based on precedent and various modes of interpretation. However, political scientists often argue that ideology is the best predictor of what justices will decide. The purpose of this research is to closely examine and compare two cases, *Brown v. The Board of Education* and *Parents Involved in Community Schools v. Seattle School District*, in order to illuminate the Court's importance in American politics. I will accomplish this by merging legal and political ideas to better grasp how these two Courts dealt with the concept of racial integration. The legal element of my research deals primarily with the Court's utilization of prior cases, as well as their general and individual interpretive methods. I also assess activism; a term that comes with a strong political connotation and how it applies to each court. The political component of my analysis deals with the ideology of the individual Justices, an examination of the strength of the chief Justice's leadership and other personal

Thompson, Neil

Major: Environmental Biology; Advisor: Ellen Marsden

Quantification of the Effects of Electroshocking on Lake Trout Fry

Current management efforts to restore self-sustaining populations of lake trout to the Great Lakes and Lake Champlain have recently begun to focus on evaluating reproduction at deep, offshore reefs. A technique to detect newly hatched fry using an underwater camera equipped with an electroshocker has been developed, but the method has not yet been calibrated against known fry densities. Our study aims to quantify the electroshocking method to give researchers the data they need to use this method for evaluating lake trout reproduction on deep water reefs. Testing was conducted in 1 meter diameter tanks at the UVM Rubenstein Ecosystem Science Laboratory. The field generated by an electroshocker at



Thompson, Neil (cont.)

various voltage settings was mapped and fry responses were categorized at the different field strengths (i.e., distance from the electrodes). Number of fry visualized within the camera field of view per shocking period (15 sec) was recorded in two different complex substrates, plastic cylinders and natural cobble, at varying fry densities that mimicked field observations. The electric field was determined to be bimodal in shape. Fry response threshold was 0.5 V, with vigorous movement occurring at 0.8 V. The reactive distance of fry was approximately 20 cm from the electrodes at a setting of 190 V. This procedure was repeated using several developmental stages of lake trout fry. This study will allow comparison of existing fry density data from shallow reefs with ongoing research of fry production at deep reefs, and provide a standard for previously collected data useful to all researchers that use electroshocking techniques.

Todd, Kelly & Fox, Douglas & Lowe, Chelsea & Zgonis, Evangelia

Major: Chemistry; Advisor: Rory Waterman

Introduction to Research in the Department of Chemistry

Every year, motivated first year students participate begin research projects in the Department of Chemistry by taking Introduction to Research (CHEM 39/40). This year, students have done work in analytical, inorganic, organic, and physical chemistry addressing problems that relate to synthesis, materials, environment, and medicine.

Traux, Ashley & Truax, Heather

Major: Mechanical Engineering & Applied Mathematics; Advisor: Daniel Bentil

Regulation of Myosin-II during Cytokinesis in Fission Yeast

The fission yeast model system is being used to study the regulation of myosin-II, the actin based motor protein that forms the actomyosin contractile ring. Contractile ring constriction physically separates dividing cells at the end of the cell cycle, yet the mechanism behind this key event is poorly understood. We employed time-lapse fluorescence microscopy to examine the influence of myosin-II phosphorylation on contractile ring dynamics, and whether cells rely on a 'critical concentration' of myosin-II during cytokinesis. Analyses of myosin-II (phosphorylation site) mutants indicate that phosphorylation promotes the initiation of ring constriction, while dephosphorylation partially inhibits constriction. Based on these experimental observations, we employ mathematical modeling techniques, in conjunction with numerical simulations, to examine various scenarios for the regulation of myosin-II and ensuing chemomechanical events during cytokinesis.

Truax, Heather & Traux, Ashley

Major: Mechanical Engineering & Applied Mathematics; Advisor: Daniel Bentil

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Vincelette, Elise

Major: Biology; Advisor: Richard Pratley

Absolute Quantification of 3 mRNA Isoforms of APP in Human Brain

Alzheimer's Disease (AD) is a neurodegenerative disorder and the pathogenesis involves the abnormal accumulation of beta-amyloid plaques in the brain. These plaques include cleaved products of amyloid precursor protein (APP), and alternative splicing yields three major mRNA isoforms: the neuronal-cell-abundant isoform APP365 and non-neuronal-



Vincelette, Elise (cont.)

cell-abundant isoforms APP770 and APP751. Recent studies have shown altered expression ratios of APP isoforms in brain and periphery tissue of AD patients. This project will measure the exact copy number of each isoform in human brain and adipocytes by absolute quantification real-time PCR. Additionally I will determine if these isoforms have specific roles by comparing the expression data to clinical data.

Vogric, Laura

Major: Political Science & French; Advisor: Deborah Guber

The Fight for “Enduring Freedom”: Presidential Rhetoric and the War on Terror

This research explored the way in which Presidential speech influences modern political discussion. I examined a range of topics in discourse analysis, including Grice’s Cooperative Principle and its accompanying maxims, the semantic principles of presupposition and entailment, as well as the use and effect of metaphor. I used these linguistic features to evaluate their impact when employed by the President in times of national crisis. In order to see these rhetorical tools in action, I analyzed their use in speeches given by President George W. Bush during the period between September 11, 2001 and the American invasion of Iraq in 2003. Each speech was closely examined, and every use of these linguistic features was noted and unpacked to extrapolate the fullest meaning possible. I compared the subtextual implications of the President’s speeches with aggregate poll data concerning public support for the President’s position on the War on Terror—and in so doing determined the effects of Presidential crisis rhetoric on public opinion. This analysis also illustrated the potential for miscommunication and misinformation in Presidential speech. In a democratic system, it is important for citizens to be aware of instances in which the government is acting coercively; my study highlights characteristics of coercive Presidential rhetoric and serves to make citizens aware of their use and effect.

Wade, Hunter & Butler, Elizabeth

Major: Spanish ; Advisor: Guillermo Rodríguez

The Grammar of Sexism: la presidente or la presidenta?

A pivotal social change in the 20th century has been the way gender order transformed traditional patriarchal societies into more egalitarian settings. Women have climbed the power continuum and hold positions traditionally unavailable to them in the workplace. This new dynamic demanded that new vocabulary be created for female titles. Bergen (1980) states that this linguistic change depends upon a sociological change and illustrates how “the semantic component of the grammar of a language reflects the nature of the society within which the language functions.” Unlike English, gender is pervasive in the grammatical system of Spanish offering a more revealing source to trace these modifications. Not only does Spanish assign gender to biologically determined beings such as la niña (the girl) or el niño (the boy), inanimate entities are arbitrarily marked for gender as seen in the words la mesa (the table, fem.) and el libro (the book, masc.). As male forms of professional titles have long been in existence, how does one address female colleagues? Given that Spanish allows different ways to achieve this transformation: change of article (el jefe; la jefa) or change of article and suffix (el jefe; la jefa), a native speaker must decide amongst various forms that carry social implications. Using a Spanish Corpus* and regional periodicals, we will trace the change in frequency of these occupational nouns to test for a correlation between the rise of female participation in the workforce and their usage. We will also administer a linguistic survey (sample enclosed) to local native speakers of Spanish to obtain a perspective on how they instinctively make this gender assignment. We expect to find an increase of usage of feminine occupational titles over time (1800’s to present day) as well as preferred ways in which the feminine form is expressed grammatically.

Wagar, Jessica-Lyn

Major: Psychology; Advisor: Susan Crockenberg

Measuring Maternal Sensitivity

The significance of maternal sensitivity in developing secure attachments and adjustment is a controversial issue in developmental psychology. De Wolff and van IJzendoorn (1997) suggest that discrepancies in findings may be due to weaknesses in methods and differences in the conceptualizations of sensitivity used in different studies. The proposed study uses the same conceptual definition of maternal sensitivity in investigating the validity of two methods (observation



Wagar, Jessica-Lyn (cont.)

and self-report). Consequently, any differences in results can be attributed to the methods and not to the definition. The two measures will be correlated with one another to test for congruence. The validity of each measure will be tested by correlating sensitivity scores with developmental history ratings.

Zgonis, Evangelia & Todd, Kelly & Fox, Douglas & Lowe, Chelsea

Major: Chemistry; Advisor: Rory Waterman

Introduction to Research in the Department of Chemistry

Every year, motivated first year students participate begin research projects in the Department of Chemistry by taking Introduction to Research (CHEM 39/40). This year, students have done work in analytical, inorganic, organic, and physical chemistry addressing problems that relate to synthesis, materials, environment, and medicine.

Zheng, Min

Major: Environmental Studies; Advisor: Stephanie Kaza

Finding Balance: Visiting the Old for New Inspiration and Solution to Environmental Problems

When identifying the root cause of many environmental problems, human beings have played an important role in the overall well-being of the environment. Since human activities cannot be separated from the natural world whether its direct or indirect impacts. Environmentalists are suggesting a change to individual behavior and value system to improve the overall development in the socio-environmental field. With that perspective, this paper looked into the usage of Confucianism, a philosophy that was a major guiding principle in structuring the Chinese civilization. It is emerging to be the modern environmental ethic, especially when there has been increasing appreciation and retrieval of the philosophy after the May 4th movement in 1919. Will China be able to sustain itself by drawing knowledge from its ancient teachings such as Confucianism instead of the western ethic of modernization? The research was conducted in Kunming City in Yunnan. Information was gathered through interviews and participatory observation on the topics of Confucianism, cultural values, generation gap, modernization, environmental degradation, and the involvement of governmental, international and economic groups. The old philosophy is the foundation for many of the current development. Like history, it provides guidance and suggestion for future development.



Graduate Abstracts by Student last Name

Ackley, Mary

Major: Natural Resources; Advisor: Saleem Ali

Evaluating Environmental Risks in Mining: A Perceptual Study at the Vatukou Gold Mine in Fiji

Gold mining is often associated with positive economic benefits; however, it may also have negative impacts on the environment and human health. It is essential that communities understand the risks and benefits associated with mining, particularly in developing countries where there is often a lack of legislation governing the environmental performance of mining corporations. The perceptions of local people regarding the risks and benefits may differ significantly from those of company representatives, policy makers, and the scientific community. Furthermore, men and women have been shown to perceive risks differently. Examination of the complex social, economic, psychological, political, and cultural factors influencing risk perception in mining communities is thus important for successful risk management. Issues arising from the interplay between socio-economic benefits and risks are particularly acute in small island states which have isolated and highly limited economic development trajectories. The lessons learned in such cases are therefore instructive for crisis planning across the developing world. This study conducted firsthand empirical research into the perception of environmental and health risks in the communities surrounding the Vatukoula gold mine in Fiji. Data was obtained through a survey questionnaire designed to quantify and evaluate perceived risks (n= 340, representing approximately 24% of the target population). Concurrently, environmental samples were collected to assess the extent of environmental impacts at the study site. Major findings include: (1) Women feel they have less knowledge about the risks of mining compared to men. (2) Women feel they have less control to avoid the risks of mining compared to men. (3) Air pollution and water pollution are the risks that cause the greatest concern among Vatukoula residents. The information obtained during this study was made directly available to local stakeholders, to aid in risk management and decision-making.

Al-Kateb, Mohammed

Major: Computer Science; Advisor: Byung Lee

Simulation of Extreme-Scale Wireless Sensor Networks

A wireless sensor network (WSN) is a network of sensor nodes connected through wireless broadcasting channels, and has been used in various monitoring applications for tracking or estimation. The size of these networks has quickly grown from few tens of nodes to several thousand of nodes. The development of such extreme-size WSNs, therefore, demands a highly scalable sensor network simulation environment since it is usually not feasible to deploy sensor networks of realistic sizes in order to test, validate, and choose among design approaches, network protocols, and design parameters. In this poster we present GTSNetS, a highly scalable simulator for extreme-scale wireless sensor networks, which has been developed by researchers in Georgia Institute of Technology. GTSNetS is best characterized by its scalability, adaptability, and extensibility. It can be used to simulate a WSN scaling up to several hundred thousand nodes. The adaptability comes from the different methods included in the baseline implementations. The extensibility comes from the modular implementations using the C++ object-oriented programming language. In our research, we use and extend GTSNetS in our new project; "Energy-Efficient Data Storage and Retrieval in a Large-Scale Wireless Sensor Network". This poster presents an overview of GTSNetS, illustrates its functionality, and demonstrates its performance in simulating a WSN composed of 200,000 nodes.

Alvez, Juan

Major: Natural Resources; Advisor: Roelof Boumans

Payments for Ecosystem Services: A National Policy for Brazil

This article argues that Brazil has the opportunity to preserve and restore its valuable ecosystem services by devising a national policy. Historical trends in development and forest conservation, especially in the Amazon region, depict deforestation rates threatening forest's valuable services, in spite of many restrictive environmental laws. Greenhouse gas emissions, biodiversity loss, water flow disturbance, as well as cultural and traditional knowledge erosion, are major local,



Alvez, Juan (cont.)

national and global effects resulting from the complex and conflictive environmental governance. Market PES mechanism such as CDM is rapidly growing but it only marginally mitigates the deforestation problem and remains largely inaccessible for poor ecosystem service provider family farmers and traditional communities. Community based pilot experiences such as the Proambiente can be scaled-up to a national PES policy by adaptively constructing needed institutions and developing mechanisms required to overcome the constraints posed by the complexities of ecosystem management. Devise a sustainable financing system, the reduction of transaction costs, mapping property rights and ecosystem measurement and valuation are major challenges discussed.

Auch, Ted

Major: PSS; Advisor: Donald Ross

The Influence of Climate and Ecosystem Productivity on Litter Decomposition.

Leaf and coarse woody debris (LCWD) decay catalyzes the biochemical mechanisms of the soil-aboveground interface, and should be an important component of climate change models that address carbon and nitrogen. There is a clear need for the identification of determinant climate or litter chemistry parameters at the global scale. Local and global decay is commonly attributed to litter chemistry and climate, respectively. The objective of this synthesis was to illustrate LCWD decay across a global climate-chemistry continuum and contrast results with a previous assessment via both standard first-order (k) decay kinetics and gradient exponent values arranged in order of influence from initial to latter decay stages. Results suggest greater initial LCWD cation concentrations yielded the fastest initial rates of decomposition and most climatic indices appeared relevant at intermediate stages of decay. Elevation and refractory LCWD carbon (i.e. carbon, lignin, and tannins) were inversely correlated with decay, prolonging the process and possibly acting in concert as “end-point” determinants. Furthermore, the initial influence of nitrogen and phosphorus is universal across LCWD-type as well as ecoregion. Climate acts in a transitional role between easily solubilized and late or aromatic substrate decay. Global and continental carbon cycling assumptions and models must acknowledge: i) the influence of LCWD cation and N concentration during initial fragmentation, leaching, and transformation; ii) climate, specifically seasonal temperature averages > evapotranspiration > precipitation, during the interim; and iii) the ever-present influence of seasonality and litter aromatic components.

Bakondi, Ben

Major: CMB; Advisor: Jeffrey Spees

Factors secreted from human bone marrow progenitor cells protect neural pro

Factors secreted from human bone marrow-derived stem cell (hMSCs) provide functional recovery in animal models of neurological disease and ischemic brain injury. hMSC secreted factors influence the survival and proliferation of endogenous mature neurons and neural progenitor cells (NPCs). To determine the signaling pathways activated in NPCs, we used serum-free conditioned media (CdM) from hMSCs to rescue mouse NPCs from low-glucose and hypoxic (1% O₂) conditions that mimic tissue ischemia. We determined that the hMSC secreted factors stimulate the PI3-AKT, NFκ-B, and P38 (Erk) pathways, but not the JAK2/STAT3, P42 (Erk), or Notch signaling. hMSC CdM augmented the P38 and NFκ-B cell survival pathways that were constitutively active in hypoxic/ischemic mNPCs and induced signaling through the previously inactive PI3-AKT pathway. We are currently using proteomic approaches to identify the factors secreted by MSCs that enhance NPC survival. To determine whether different methods for isolating hMSCs produce cells with different cytokine and growth factor secretion levels, we performed sandwich ELISA screens on three hMSC subpopulations for candidate protective factors identified through microarray analysis of expressed genes. hMSC subpopulations isolated by plastic adherence, or immunomagnetically isolated via low-affinity nerve growth factor receptor (LNGFR; P75), or the prominin membrane glycoprotein (CD133) produced similar secreted factors. hMSC CdM produced under hypoxic conditions for 48 hours yielded significant differences in the secretion levels of select factors. We injected hMSCs into mice subjected to middle cerebral artery ligation to test whether the hMSC cytokine secretion level differences observed in hypoxia ex vivo are reproduced at the mRNA transcript level in vivo. Human specific RT-



Bakondi, Ben (cont.)

PCR of Lentivirally-transduced hMSCs in the stroke penumbra of immuno-competent C57/Bl6 2 days post intracranial injection determined that the transcriptional responses of engrafted hMSCs in mice subjected to MCAO increase in accordance with ELISA data for several factors when compared with uninjured mice.

Balasubramaniam, Karthikeyan

Major: Electrical Engineering; Advisor: Paul Hines

Controlling Cascading Failures in Power Networks

Power networks are very large complex networks, cascading failures often leads to a blackout which has adverse monetary and social consequences. Cascading failures start with an equipment outage which causes operational constraint violation and if these violations are not eliminated before they cause additional outages and hence more violations they can lead to a blackout. This research proposes a method to reduce the losses incurred due to cascading failures by eliminating violations before they cause additional outages. The first phase is to build a global model which eliminates the occurrence of cascading failures by taking control measures which restores optimal operating conditions. The second phase aims at eliminating the occurrence of cascading failures by placing an autonomous agent at each bus of the power network. Each agent builds a simplified model of the network based on locally available data and solves its local problem using model predictive control and cooperation.

Barrett, Terence

Major: Civil and Environmental Engineering; Advisor: Britt Holmen

A Portable Particle Analyzer for Transportation Air Quality Research

Particulate matter generated by internal combustion engines impacts human health by causing pulmonary distress including asthma, chronic bronchitis, and possibly cancer. In high concentrations it causes the haze seen in areas both close and far from dense populations, even obscuring the view in our nation's parks. Recent research has shown that particulate emissions vary widely by engine type, driving style, and environmental conditions, and so on-road measurements at fine temporal resolution are required to accurately assess and model these mobile source's effects on air quality. A proof-of-concept particle analyzer based on MEMS technology is the best candidate to be developed into a compact, portable, and robust instrument suitable for this data collection. A plan to lab/field-test and further improve the prototype instrument with calibrated particle counting and sizing will be presented. Challenges for empirical characterization of the MEMS and electro-mechanical components at the conditions of on-road vehicle emissions will be discussed.

Beal, Kimberley

Major: Plant Biology; Advisor: Brian Beckage

Changing Climate and Treeline in New England

In some parts of the world altitudinal and latitudinal treelines are rising due to factors like climate change and land use shifts. I replicated 60-140 year-old photographs of treeline areas in New England by re-occupying the original photographer's locations. The study areas were Mt. Mansfield, VT, the White Mountains, NH, and Katahdin, ME. Using geographic information system software and photo interpretation I assessed change in amount and location of tree cover. Preliminary results indicate that the summit of Mt Mansfield has more tree cover and less open terrain (alpine plants and rocks) than it did at the end of the nineteenth century.

Brown, Melanie

Major: Math; Advisor: Dan Archdeacon

Child's Play: An Adventure in Design Theory and Graph Embeddings

If you enjoy connect-the-dots, coloring books, and other fun kid crafts, you will be intrigued by this presentation based on original mathematical research. Consider a set of nine dots (vertices), where each pair of dots is connected by a line (edge). This forms the complete graph G on nine vertices. A Steiner Triple System on 9 vertices describes a way of partitioning the edges of G into 12 triangles. There are many different ways to partition the edges, and we will identify



Brown, Melanie (cont.)

which pairs of triple systems can be "glued" together along edges to form a surface and an embedding of G . This "gluing" is analogous to folding up paper cubes and taping matching edges together. The embedding is the graph stretched out over the surface so that each face is a triangle. We will examine the confluence of the areas of design theory, graph embeddings, geometry, topology, and group theory as we explore many of the hidden properties of these embeddings. For example, we will investigate relations between "glue-able" triple systems and try to visualize the resulting surface. We will also test how many colors would be needed to color the triangular faces of the surface so that faces with the same color are not next to each other.

Campbell, Erica

Major: CDAE; Advisor: Qingbin Wang

Pupil Transportation: Travel Behavior and Traffic Impacts and Potential for Improvement

There is a national trend in school transportation for parents to drive their children to and from school instead of using the school bus, walking, or biking. The major purposes of the study are to collect and analyze primary data on student travel behavior, to examine the impacts of pupil transportation on local traffic, and to derive recommendations for improving the efficiency and safety of school transportation. There is a dearth of national research on pupil travel behavior in determining why students use bus, walking, biking, or automobile for school transportation. Much of the national research has focused on Safe Routes to Schools, a program that promotes walking and biking. This study analyzes the reasons that contribute to mode choice, particularly looking at the question: why are parents increasingly choosing to drive their children to and from school? Data for this study were collected at six schools in two Vermont school districts: South Burlington, an urban district, and Addison Northeast, a rural district. The study includes the following methods of research: a collection of traffic data from selected streets around each school, tallies of student travel modes for one week, a mail-in and web-based parent survey on travel behavior, and analysis of collected data in SPSS. The parent survey was designed to gather demographic data, student characteristics, and the reasons for mode choice, allowing for a variety of multinomial and linear regression analyses to be performed. The results of the study are currently being analyzed and by early April a significant amount of the research will be completed. Academic articles will be written for transportation and planning journals and participating schools will receive a report with recommendations in June.

Cannella, Mark

Major: CDAE; Advisor: Qingbin Wang & Jon Winsten

The Impact of Financial Uncertainty on the Economic Performance of Northeast Dairy Farming Systems

Dairy farm businesses in the Northeastern United States are forced to operate under a shroud of uncertainty. The volatility of milk prices and the historic "cost-price-squeeze" from rising costs of production create a significant risk to the financial performance and sustainability of dairy based businesses. From 2000-2007 we witness the unpredictability of income as the Class III base price for the Northeast fluctuated widely between a low of \$8.57 and \$21.38 per cwt. By 2008 a biofuel boom has more than doubled corn prices in a matter of months, fuel prices continue to rise, and concern over inflation and an economic recession has the capacity to alter access and terms of financial lending. This research seeks to compare the financial robustness of multiple dairy farm systems subject to these elements of uncertainty. A whole-farm stochastic budgeting model that accounts for the volatility of milk income, farm productivity, feed prices, fuel prices and interest rates will be developed for 5 types of farms. Monte Carlo simulations applied to a traditional, management intensive grazing, seasonal grazing, organic and large modern confinement dairy profiles will quantify the collective influence of several variables simultaneously on farm profitability indicators. Simulations will produce cumulative distribution functions (CDF) that measure the likelihood that each farm profile will exhibit favorable profitability under stochastic conditions. Simulations will also be undertaken to identify critical thresholds of uncertainty in order to assess the potential for risk management tools to mediate market based uncertainty. Demonstrating the financial risk presented by any one farming system is a valuable undertaking at farm manager, lender institution and farm policy level. Decisions makers who have determined the consequences of different strategies will be better suited to plan for the financial success of dairy farm businesses in coming years.



Cheerathodi, Mujeeburahi

Major: Biology; Advisor: Bryan Ballif

Identification of phosphorylated CrkL-SH3 binding proteins from embryonic murine brain: Implications for reelin signaling during brain development

Reelin is a large secreted glycoprotein that is essential for proper positioning of neurons during development of the central nervous system. The reelin signal is transduced through multimeric clustering of its receptors ApoER2 and VLDLR, leading to tyrosine phosphorylation of Dab1, a cytosolic adaptor protein constitutively bound to reelin receptors. In addition to effecting the activation of Src family tyrosine kinases (SFKs) and the serine/threonine kinase Akt, phosphorylated Dab1 recruits the adaptor protein CrkL following reelin stimulation. CrkL binds to Dab1 via its SH2 domain permitting further recruitment of effector proteins to phosphorylated Dab1 via the SH3 domain of CrkL. C3G is one such protein that is recruited to phosphorylated Dab1 and itself becomes phosphorylated and activated in response to reelin. Given the multimeric nature of the reelin receptor complexes we hypothesized that the SH3 domain of CrkL recruits additional effector molecules to reelin receptor complexes where they may become activated by SFKs or Akt. Using affinity chromatography we have identified more than a dozen proteins from embryonic murine brain that bind to the SH3 domain of CrkL and are phosphorylated either on tyrosine or in an Akt consensus motif. We are now working to identify these proteins and their phosphorylation sites using liquid chromatography tandem mass spectrometry (LC-MS/MS) toward an ultimate goal of determining their potential roles in the reelin signaling cascade.

Chen, Changfei

Major: Electrical Engineering; Advisor: Jeff Frolik

Improved Footprint Modeling for Wireless Sensor Networks

Wireless sensor networks (WSN) consist spatially distributed autonomous sensors, communicating wirelessly to cooperatively achieve some task. For example, a wireless sensor network can be used for habitat monitoring to determine temperature, pressure, humidity, etc. In order for a wireless sensor network to provide such data, we need to ensure the connectivity between nodes; i.e., nodes can communicate to exchange information. To analyze connectivity between sensors, the radio coverage of each sensor, also called communication footprint, needs to be known. However, to date, the models used to analyze a sensor's radio communication footprint have been overly simplistic (i.e., isotropic) and thus yield results not found in practice. Footprints highly depend on the environment, which are typically heterogeneous and non-isotropic in structure. In this work, a 'weak-monotonicity' (WM) model is leveraged to represent a footprint's non-isotropic behavior. In particular, the percentage of the area with received power higher than some threshold, which is called the 'usability', of the WM footprint is considered through analysis and simulation. Variability within an environment is addressed using the log-normal shadowing model. The log-normal shadowing model uses a random component, which is a zero mean Gaussian random variable, to model this variability. We then develop an enhanced footprint which overlays multiple WM patterns, which can be used to better represent the empirical data and scenarios. With the new footprint model, we can better analyze the deployments of wireless sensors and make these networks more reliable and robust in real world applications.

Chen, Hua

Major: Civil and Environmental Engineering; Advisor: George Pinder

Evaluation of Tidal Effects on Groundwater Contaminant Discharging to Coastal Waters

The evaluation of tidal effects on the concentration of groundwater contaminants discharging to surface water is important in coastal aquifer management. However, most previous studies focused on the influence on groundwater levels and salt-water intrusion, and neglected the importance of the tidal fluctuation. In this paper, a one-dimensional intermediate-scale subsurface research facility is used to explore this physical phenomenon. 10 feet long tube filled with soil grains with specified hydraulic conductivity is constructed. In this system, 15 Time Domain Reflectometry (TDR) sensors and 9 pressure transducers are applied along the length of the tube with equal space. Pressure transducers measure the pore pressure and TDRs measure the bulk electrical conductivity (EC) of the soils. These measurements are converted into water levels and salt concentration of soil water, respectively. With constant water pressure upstream, the downstream water level changes as a tidal fluctuation which is controlled by a wave generator. Given a hydraulic gradient, salt-free water initially resident in the tank was displaced by salt water moving from upstream to downstream and eventually the



Chen, Hua (cont.)

tank only contained salt water. The concept is to consider the salt water as the contaminated groundwater and the salt-free water from the downstream reservoir displacing the salt water as the surface water that is being tidally affected. The experimental results demonstrate that the tidal fluctuations in the downstream reservoir result in a decrease in average contaminant concentration at the point of groundwater discharge to the surface water body. The further upstream the well is, the smaller the amplitude of the concentration oscillation is. In addition, upstream migration of concentration oscillations was observed in spite of a net downstream flow; behavior which is compared to the results by numerical model simulation.

Cheng Tolmie, Elizabeth

Major: Educational Leadership and Policy Studies; Advisor: Susan Hasazi

A Case Study of Organizational Change Strategies and Outcomes: Initiation of a Field Services Division within the Vermont Agency of Human Services

The restructuring and reorganization of governmental organizations is a frequent occurrence in the human service sector. During the past decades, the literature has indicated that numerous states located throughout the nation have been reforming their human service delivery systems. In 2004, the Vermont Agency of Human Services (AHS) joined this trend and began a reorganization effort of its own. This dissertation examines one aspect of the larger restructuring effort: the creation of a Field Services Division (FSD) within AHS. The organization of the FSD included placement of key leadership positions, known as Field Services Directors in each of the twelve regions of Vermont. This new management structure was intended to provide AHS leadership at the local level, and assist with transformation of AHS' human services delivery system towards a model of service integration. This study explores the perspectives of the policy executives and field directors who were charged with visioning and implementing human service reforms in Vermont. The research employs a case study and survey approach to examine the organizational change strategies, processes, and perceived outcomes related to the FSD initiative. Findings indicate there have been successes and challenges associated with initiation of a FSD within AHS. While field directors were designated as agents of change, data supports that without further structural and system supports, service integration will not be easily achieved. Service coordination, consumer participation and development of community supports appear to offer the most promising practices in improving outcomes. This study also reveals that a local level of leadership offers promise in devising and implementing policy changes to improve human service delivery. The study informs future evaluations about the opportunities, challenges and paradoxes in human service reform efforts. The analysis also provides descriptive research with which to support continued improvement in the delivery of human services in Vermont.

Connors, Emilee

Major: Pharmacology; Advisor: Anthony Morielli

Homeostatic Regulation of Kv1.2 Potassium Channel Trafficking by Cyclic AMP

The Shaker family potassium channel, Kv1.2, is a key determinant of membrane excitability in neurons and cardiovascular tissue. Kv1.2 is subject to multiple forms of regulation and therefore integrates cellular signals involved in the homeostasis of excitability. The cyclic AMP/protein kinase A (PKA) pathway enhances Kv1.2 ionic current; however, the mechanisms for this are not fully known. Here we show that cAMP maintains Kv1.2 homeostasis through opposing effects on channel trafficking. We found that Kv1.2 is regulated by two distinct cAMP pathways, one PKA-dependent and the other PKA-independent. PKA inhibitors elevate Kv1.2 surface levels, suggesting that basal levels of cAMP control steady-state turnover of the channel. Elevation of cAMP above basal levels also increases the amount of Kv1.2 at the cell surface. This effect is not blocked by PKA inhibitors, but is blocked by inhibition of Kv1.2 endocytosis. We conclude that Kv1.2 levels at the cell surface are kept in dynamic balance by opposing effects of cAMP.



Cromwell, Morgan

Major: PSS; Advisor: Lorraine Berkett

Evaluation of alternative fungicides for organic apple production in Vermont, 2007

The objective of this trial was to compare the efficiency of potassium bicarbonate, neem oil, and *Bacillus subtilis* to a standard organic lime sulfur/sulfur fungicide program and a non-sprayed treatment for control of apple scab and other fungal diseases. Treatments were applied to 'Empire' trees arranged in a completely randomized design with five single-tree replications at the University of Vermont Horticultural Research Center in South Burlington, VT. Fungicides were applied with a handgun to drip, using maximum label rates. Applications began on 26 April and continued on approximately a weekly schedule through the end of June and then every two weeks through 23 July. Data obtained, representing the first year of a two year study, were analyzed by analysis of variance and significance between means was determined by Fisher's Protected LSD Test ($P \leq 0.05$). The alternative fungicides showed some activity against foliar apple scab compared to the non-sprayed treatment, and the potassium bicarbonate and neem oil treatments had significantly less fruit scab than the non-sprayed treatment. However, the lime sulfur/sulfur treatment provided the best overall control of scab. There were significantly more necrotic leaf spots in the neem oil and potassium bicarbonate treatments compared to all other treatments. On fruit, there was a significantly greater incidence of phytotoxic burn and russetting in the lime sulfur/sulfur treatment

Curtil, Ingrid

Major: CMB; Advisor: Jeffrey Spees

Human Mesenchymal Stem Cell Fusion with Lung Epithelial Cells

Mutations in the genes that encode ion channels, such as cystic fibrosis transmembrane conductance regulator (CFTR) and the epithelial sodium channel (ENaC) lead to cystic fibrosis (CF) and disorders of blood pressure, respectively. Mesenchymal Stem Cells (MSC) have great therapeutic potential for tissue regeneration and for treatment of human diseases. MSCs repair tissue through several mechanisms including growth factor/cytokine secretion, direct cell replacement, and cell fusion. Normal airway epithelia express both CFTR and ENaC, but only alpha ENaC subunit is expressed in MSCs. We tested the hypothesis that heterokaryons derived from fusion of normal human bronchial epithelial (NHBE) cells with MSCs would express functional ENaC and CFTR. Our results show that MSCs and NHBEs fuse in co-culture to form heterokaryons, which express both ENaC and CFTR mRNA and protein characteristic of normal bronchial epithelial cells. Single channel patch clamp recordings reveal amiloride-sensitive Li^+ currents (i.e., ENaC) in both the NHBEs and the hybrid cells. We conclude that ENaC and CFTR, epithelial ion channels, can be conferred from the NHBE to the hybrid cell. The heterokaryon model may provide a useful experimental system to determine whether gene correction for 'channelopathies' can occur through cell fusion.

Damsky, William

Major: Pathology; Advisor: Marcus Bosenberg

Examining the role of beta-catenin in melanoma formation and progression

Melanoma is the most deadly form of skin cancer; accounting for only 4% of all skin cancer diagnoses, yet causing over 80% of deaths. The incidence of melanoma is increasing worldwide, with current estimates suggesting that 1 in 63 Americans will be diagnosed with melanoma in their lifetime. Treatment for early stage melanoma is fairly successful; however, patients with late stage disease have only a 14% five-year survival. Melanoma arises from abnormal proliferation of melanocytes, which are the normal pigment producing cells in skin. Much work has been done previously to understand the biology of melanoma at a molecular level. For example, genetic changes have been identified in the CDKN2A tumor suppressor locus, the melanocortin-1 cellular receptor, and the MAPK, PI3K, and Wnt cellular signaling pathways. Despite these findings, a more precise and complete understanding of the molecular basis for melanoma formation and progression will be vital to developing novel treatment strategies in the future. Beta-catenin is an integral component of the Wnt signaling pathway. Beta-catenin/Wnt signaling are known to be altered in many human cancers, including melanoma where beta-catenin either contains an activating mutation or the Wnt is overactive through alternative mechanisms. This study will use a genetically modified mouse model to understand the role of beta-catenin activation on melanoma formation and progression. Our mouse model utilizes Cre-ER(T2)-lox recombination technology which allows



Damsky, William (cont.)

topical drug induction of genetic changes specifically in melanocytes only where the drug is applied. This study will use such an approach to introduce an activating mutation in beta-catenin only in melanocytes in adult mice. Differences in melanoma formation and progression will be assessed by combining beta-catenin activation with other genetic changes important in melanoma. The data from this study will be useful in further understanding the molecular basis of melanoma formation and progression.

Darby, Brian

Major: PSS; Advisor: Deborah Neher

Desert soil microfauna in a changing climate

Robust soil food webs are an ecosystem's biological means of cycling key elements such as carbon and nitrogen. Biologically fixed nitrogen, from free-living and symbiotic cyanobacteria and lichens, is a unique source of nitrogen to many arid lands. Microfaunal consumers, like nematodes, protozoa, tardigrades, rotifers, mites, and collembolans, retain organic-bound nitrogen in the soil system while periodically releasing inorganic nitrogen for plant use. Many arid regions, such as the southwest United States, are expected to experience elevated temperatures and prolonged droughts throughout the next century, causing direct abiotic stress to much of the soil biota. Diverse assemblages of soil fauna are important for at least two reasons, 1) to take advantage of the full suit of functional attributes of soil fauna, and 2) to supply a diverse range of individual tolerances to environmental stress and heterogeneity. There exist two hypothesized outcomes of climate change on the soil biota, 'loss of function' or 'over-function'. I propose that the climate changes predicted for the arid southwest US are most likely to result in 'over-function' of nitrogen mineralization relative to immobilization by the microfaunal consumers. This is important because most arid lands are characteristically leaky systems, susceptible to both liquid and gaseous nitrogen losses. Rapid cycling of nitrogen in such systems could expose inorganic nitrogen to losses and thus deplete total organic nitrogen storage.

Delwig, Anton

Major: ANNB; Advisor: Matthew Rand

Regulation of Notch signaling by ADAM metalloproteases

The Notch signaling pathway is fundamental for guiding cell fate decisions during development. A central mechanism in Notch activation is the cleavage of the Notch receptor by members of the ADAM family of metalloproteases. ADAMs are also known to cleave Delta, the ligand for Notch, with the net effect of downregulating Notch signals. Two ADAMs, Kuzbanian (Kuz, ADAM10) and TNF- α converting enzyme (TACE, ADAM17), are capable of processing both Delta and Notch, yet the relevance of these cleavages has remained controversial since it is not clear whether Kuz and/or TACE contribute to Notch signaling primarily by disabling Delta or by activating Notch. Using a defined *in vitro* cis-interacting experimental model of Delta-Notch signaling we show that Kuz predominantly regulates Notch signaling by participating in receptor activation on the signal receiving cell. Whereas ligand stimulation of Notch is highly sensitive to Kuz, expression of Kuz several-fold higher than endogenous levels can achieve ligand-independent Notch activation. The effect of Kuz on inactivating Delta has little overall effect on Notch signals. In contrast to Kuz, TACE can efficiently activate Notch in a ligand-independent manner at physiologically relevant expression levels. Altogether, these data demonstrate the potential for Kuz and TACE to participate in unique modes of Notch activation in during development.

DiStasi, Stephen

Major: Electrical Engineering; Advisors: Jeff Frolik

In Situ Measurement and Emulation of Severe Multipath Environments

Wireless sensors are becoming more commonly used in the world around us. Being wireless, they offer a very non-intrusive, low-maintenance means of monitoring the condition of structures (e.g. bridges), mechanical systems (e.g. aircraft), and natural systems (e.g. forests). These sensors collect information about their surrounding environment and then transmit this information, via radio frequencies, back to a control station where the data can be analyzed. One problem, however, is that radio frequencies reflect off or become absorbed by surrounding objects much in the way that sound does. If these sensors are placed in metal cavities, such as cars and aircraft, we are submitting them to an



DiStasi, Stephen (cont.)

environment in which reflections, or multipath waves, can create highly varying levels of constructive and destructive interference. Small changes in each sensor's position or carrier frequency can cause large drops, or fades, in their received signal strength, compromising connectivity with other sensors or the control station. We have shown that wireless sensors may use a technique we call Wireless Sensors Sensing Wireless (WSSW) to scan over all available frequency channels, and discover which frequencies or links are particularly susceptible to fades. WSSW data enables sensors to react to particularly bad fading, by switching to a good channel or by implementing other mitigation techniques, such as using a diversity antenna. However, the testing of such mitigation techniques is often problematic since application sites are far from controlled environments and are often difficult to access. To address this problem, we have developed a Compact Reconfigurable Channel Emulator (CRCE) to create a laboratory environment that is configurable to a variety of repeatable fading scenarios. With the CRCE, fading characteristics found at a specific wireless sensor network location may be replicated inside the chamber to discover the connectivity capabilities of the sensors and the effectiveness of diversity schemes.

Dixon, Judith

Major: Nursing; Advisor: Nancy Sowan

Impact of Multidisciplinary CKD Care on Outcomes in Patients Initializing Dialysis

This longitudinal, retrospective study looked at outcomes of 271 patients who initiated dialysis at either Dartmouth Hitchcock Medical Center Dialysis or Lancaster Dialysis Unit during the three year period from October 1, 2002 to September 30, 2005. The patients were categorized into one of three groups. The Intervention patients received care through the multidisciplinary CKD clinic (n=89), the Control group (n=82) received traditional nephrology care, and the Emergent group (n=100) were those who were nephrology naïve or who started dialysis within one month of their initial nephrology evaluation. There were no baseline differences in age (M=64.7), gender (Female 42.1%), type of insurance at dialysis initiation, or tobacco use. The intervention group had significantly more subjects with a coded comorbid diagnosis of hypertension and diabetes. Statistical comparisons were done between all three groups and were repeated with only the Intervention group and the Traditional Care group. When compared to the traditional group the multidisciplinary intervention group had significantly more fistulas placed (60.7% vs. 21%; $p < .001$), significantly more fistulas used at the first dialysis treatment (40.4% vs. 12.3; $p < .001$). More intervention patients were on erythropoietin replacement (68.2% vs. 36%; $p < .001$), with significantly higher mean hemoglobin at dialysis initiation (10.8g/dl vs. 10.0g/dl; $p = .003$). Subjects in the intervention group were 42% less likely than the traditional care group to be admitted to the hospital for dialysis initiation. The intervention group had significantly less days hospitalized ($p = .001$), fewer admissions ($p = .005$), and less charges for a 90 day period ($p = .003$) after initiation than the traditional group.

Doczi, Megan

Major: ANNB; Advisor: Anthony Morielli & Deborah Damon

A Possible Role for Golgi Localization of the Kv1.3 Potassium Channel in Postganglionic Sympathetic Neuronal Function

Kv1 channels are expressed in postganglionic sympathetic neurons (PSNs), although their role is unclear. In this study we focus on elucidating the role of Kv1.3 in PSNs. Western analyses indicated that Kv1.3 is highly expressed in PSNs, and electrophysiological and neurotransmitter assays indicated that this channel affects the function of these neurons. Immunohistochemical studies indicated that in the soma, Kv1.3 exists within a distinct intracellular compartment. Colocalization with the Golgi marker GM130 revealed that this compartment is the Golgi apparatus. This is confirmed in two ways. First, disruption of the Golgi with Brefeldin A caused a concurrent loss of Kv1.3 compartmentalization. Second, GFP-Kv1.3 transfected into PSNs colocalized with GM130. To aid in determining the significance of this localization, we used the HEK293 cell system. Whole cell patch clamp recordings revealed significantly less ionic current in cells with strong Golgi localization compared to those with weak Golgi compartmentalization. This result suggests that Kv1.3 localization to the Golgi apparatus is regulated and that such regulation is important for Kv1.3 function. To determine if Golgi localization of Kv1.3 is modulated in PSNs, we used an in vitro model of sympathetic neurovascular junctions in which PSNs are co-cultured with tail artery vascular smooth muscle (TAVSM) cells. Such co-culture



Doczi, Megan (cont.)

produced a significant decrease in Golgi colocalization with Kv1.3. Given the relationship between Golgi localization and Kv1.3 ionic current in HEK cells, this finding suggests that Kv1.3 function may also be altered in PSNs. We find that Kv1.3 is involved in regulating NE release from PSNs. Co-culture with TAVSMs caused a significant decrease in NE release from PSNs. Although a direct role for Kv1.3 in this phenomenon awaits further study, these findings are consistent with the hypothesis that regulated Golgi localization is a determinant of Kv1.3 channel activity and that such regulation influences sympathetic neuronal function.

Draghici, Christian

Major: Chemistry; Advisor: Matthias Brewer

Synthetic Organic Chemistry: Development of a Novel Ring Fragmentation

We report our discovery of a novel carbon-carbon bond cleaving reaction. When the carbon-carbon bond is contained in a ring, this reaction results in a ring cleavage to provide a highly functional linear molecule. Through further synthetic manipulations these organic molecules are expected to provide a quick and efficient method to assemble polycyclic heterocycles, which are molecular scaffolds found in many medicinally relevant natural products. The mechanistic details, scope and results of this methodology shall be discussed.

Dupont, Virginie

Major: Mechanical Engineering; Advisor: Frederic Sansoz

Numerical Experiment on the Gekko Gecko Foot

Geckos have specially designed hairs (setae) on their feet to adhere to any type of surface and that enable them to walk on ceilings. Experiments show that the angle needed to detach a seta from a surface is always around 30°. We want to show that it is numerically possible to reproduce the experimental results. We atomistically model a simplified seta on a smooth surface, and apply a displacement at the end of the hair. This seta is scaled down in order to have reasonable simulation times and made of a common polymeric material used to make synthetic gecko hairs. We achieve detachment at approximately 33°. The consistency of the result suggests that molecular simulations can be used to investigate the adhesive behavior of those sticky hairs.

Esposito, Valerie

Major: Natural Resources; Advisor: Thomas Hudspeth

The Role of Service-Learning in Ecological Economics Education and Outreach

Ecological economics focuses on problem-based learning to tackle real-world problems and enhance student understanding of complex issues. Service-learning offers another dimension to problem-based learning: engendering university-community partnerships to meet community needs while providing students with structured opportunities for applied learning. Through service-learning courses, students and communities pool resources and knowledge to work towards sustainable solutions to multifaceted problems. Service-learning, therefore, provides unique methods for students to gain critical-thinking skills and apply ecological economic problem-solving approaches to address environmental, economic and social conditions. This article discusses two case studies of service-learning courses for successful elements and areas needing improvement. The first course, an international service-learning travel course, examined HIV/AIDS and poverty in the Dominican Republic, while the second course engaged in local community workshops to conduct dynamic systems modeling about tourism issues in the Northern Forest in Vermont, New Hampshire and New York. Analysis reveals that students become more vested in their work when real-world clients are involved, gain deeper insight to complex problems and are more likely to make future choices based on their experiences in the service-learning class. Areas to be addressed include reflection, long-term follow-up and providing extended opportunities to work on the project beyond the tenure of the course to avoid student and/or community feelings of abandonment. The article concludes with discussion and recommendations for successful incorporation of service-learning into ecological economics curriculums.



Foster, Samantha

Major: CMB; Advisor: Matthew Poynter

Nitrogen Dioxide Promotion of Allergic Asthma

Nitrogen dioxide (NO₂) is an air pollutant formed during combustion processes that causes lung damage and inflammation. We have developed a novel experimental model system in which mice are exposed to 10ppm NO₂ for one hour followed by inhalation of the normally harmless protein, ovalbumin (ova). Following this exposure protocol, the mice become allergically sensitized to ova and upon subsequent exposure to ova alone, display symptoms of allergic asthma, including airways hyperresponsiveness, mucus production, eosinophilia, and antigen-specific IgE. We hypothesize that NO₂ acts as an adjuvant, stimulating the innate immune system and promoting the generation of an adaptive immune response to ova. To investigate the early effects of NO₂ inhalation, mice were exposed to 0-25ppm of NO₂ for 1 hour and then analyzed 24 hours later. The bronchoalveolar lavage contained a dose-dependent increase in white blood cells as well as protein and lactate dehydrogenase, indicating local inflammation and tissue damage. Additionally, NO₂ exposure increased the expression of genes modulating the generation of an adaptive immune response, including CCL20 and IL-6, and induced the release of chemical mediators associated with recruitment of inflammatory cells, including MCP-1 and MIP-1a. These data suggest that NO₂ inhalation induces damage in the lung, initiating the production of inflammatory mediators, potentially leading to the generation of an adaptive immune response.

Garay-Romero, Alba Gabriela

Major: Computer Science; Advisor: X. Sean Wang

Adaptive Sampling in Wireless Sensors

The wireless sensor research in the last decade has been motivated in a great extent by the technological advancement in microelectro mechanical systems-MEMS- and wireless communication. Ad-hoc deployments using tiny low-cost wireless sensors have grown in numbers, showing the effectiveness of their use to monitor spatio-temporal parameters in applications such as environmental monitoring, Structural Health, and weather forecasting. In these applications, good data quality is highly desirable. High data quality, however, usually means greater consumption of limited on-board energy, often provided by batteries, leading to the undesirable, limited autonomous operating lifetime of sensors. This research is focused on achieving the best balance between two aspects in wireless sensors: lower energy consumed but high data quality obtained by a sensor. As the first phase of the research, energy-consumption for a sensor has been recorded using different sensing (or sampling) rates. Temperature data in an outdoor setting using Tmotes from Moteiv deployed in the UVM Horticultural Research Center on Shelbourne Road have been recorded. The research now is in the analysis process to determine possible ways to adapt the sampling rates while maintaining the data at a desirable quality. As the second and future phase of the research, an adaptive sampling algorithm will be tested in sensors, again recording the energy-consumed and the temperature data. The goal is to verify that the algorithm will be able to maintain the data quality at the same level as a non-adaptive method while using less energy.

Garza, Eric

Major: Natural Resources; Advisor: Robert Costanza

The Theory and Reality of Peak Oil

Fossil fuels have powered a radical increase in economic productivity and standards of living throughout the world. These resources, however, are finite, and geologists have long recognized their extraction rates will pass through stages of growth, peak and decline. My research involves studying the fossil fuel depletion process, particularly that of crude oil, and exploring when a peak in global output might occur. I will present results of a simulation modeling exercise that suggests a near-term peak in global oil supply is a distinct possibility. I will also briefly explore how we, as energy consumers, can adapt to a post-peak world that will most likely be characterized by high and volatile energy prices.



Geddes, Scott

Major: Chemistry; Advisor: Giuseppe Petrucci

The application of photoelectron resonance capture ionization aerosol mass spectrometry (PERCI-AMS) to internally mixed amino acid-lipid fine particulate proxies of marine organic aerosols

Amines represent an important contributor to organic nitrogen in the atmosphere and may play a role in secondary aerosol formation. Atmospheric chemical processing of amines may lead to formation of new particles and may have implications on the cloud condensation nuclei ability of these particles, affecting global climate through indirect aerosol effects through the formation of more polar, water soluble compounds in aerosols. Herein we report on the oxidative processing by ozone of the particulate amines. Photoelectron resonance capture ionization aerosol mass spectrometry was used to measure strong NO_2^- and NO_3^- ion signals that increased with ozone exposure, suggesting a mechanism of progressive oxidation of the particulate amines to nitroalkanes. Additionally, a strong ion signal at 125 m/z is assigned to the ion $\text{NO}_3^- \cdot (\text{HNO}_3)$. Amide and imine products were measured for ozone pressures as low as 3×10^{-7} atm. These products most likely arise from reactions of amines with aldehydes (for imines) and stabilized Criegee intermediates (SCI) or secondary ozonides (for amides) from the lipid compound in the particle. Finally, direct evidence is provided for the formation of a surface barrier in mixed particles of octadecyl amine + oleic acid (OL) that resulted in the retention of OL at high ozone exposures (up to 10^{-3} atm for 17 s). This effect was not observed in other mixed amine + OL or single component OL particles, suggesting that it may be a species-specific surfactant effect from an in situ generated amide or imine. Implications to tropospheric chemistry, including particle bound amines as sources of oxidized gas phase nitrogen species (e.g. NO_2 , NO_3), formation of nitrogen enriched HULIS via ozonolysis of amines and source apportionment are discussed.

Ghatak, Atreyi

Major: Biology; Advisor: Judith Van Houten

Can the PMCA-2 knock out mice smell? A behavioral study

Plasma membrane Calcium ATPases (PMCA) are among the important calcium extrusion mechanisms in some mammalian excitatory cells. All four PMCA isoforms exist in the olfactory sensory neurons (OSN) of mice. Upon odor stimulation, the intracellular calcium concentration increases 50-100 fold in the dendritic knob of OSN followed by a calcium wave in the soma. Among all 4 isoforms, PMCA-2 is the most calcium-calmodulin sensitive; therefore it should play an important role in calcium clearance from the OSNs after odor presentations. Mice with mutated or no gene for PMCA-2 are reported to suffer from hearing loss, imbalance and weak vestibular system. Research from our lab has revealed that the rate of OSN calcium clearance after odor stimulation is slower in PMCA2 knock-out (KO) mice than that of wild types. Currently, using behavioral study, we are trying to answer the question whether these Knock-outs can smell or how efficient their olfactory system is. Classical conditioning has been performed which paired odorants as conditioned stimulus (CS) with mild electric shock as unconditioned stimulus (US) in both wild type and KO mice. The response of the animals was recorded using Video freeze to analyze motion activity. If the animals can associate the odorant with shock, they will stop moving or show freezing. Data from wild types show clear association between odor stimuli and shock whereas the knock outs do not show consistent results. Two bottle preference test was also performed where the mice were conditioned with a specific concentration of an odorant, geraniol and then injected with LiCl, a drug that makes their stomach upset. Animals then were tested with descending concentrations of the same odorant. Wild types showed a clear rejection of the concentrations close to the conditioning concentration while Knock-outs performed randomly indicating their inability to detect the odor effectively.

Goodwin, Meagan

Major: CMB; Advisor: Daniel Weiss

Systemic Administration of Mesenchymal Stem Cells Abrogates Allergic Airway

Recent studies demonstrate that MSCs have profound immunomodulatory actions in lung and can decrease acute inflammation in mouse models. The mechanisms by which this occurs are poorly understood but may involve down regulation of T lymphocyte actions. We hypothesized that MSCs might therefore decrease allergic airways inflammation, in part by down regulating CD4 T lymphocyte activation. To investigate this, we utilized a well established model of



Goodwin, Meagan (cont.)

allergic airways inflammation in mice resulting from immunization with ovalbumin/alum exposure followed by aerosol challenge with ovalbumin. We found a decrease in the total number of cells present in bronchoalveolar lavage (BAL) from mice receiving MSCs compared to saline controls and in particular a substantial decrease in eosinophils. BAL fluid from mice receiving MSCs had lower levels of Th2-specific cytokines including IL-4, IL-5, and IL-13 as well as decreased eotaxin. Mucin production was also reduced in lungs of mice receiving MSCs. Physiologic studies suggest a decrease in airways resistance and elastance in MSC-treated mice in response to methacholine. Indium-labeled MSCs showed trafficking to the spleen following Ova exposure, indicating possible interactions with lymphocytes. CD4+ cells isolated from MSC treated mice showed reduced proliferation in response to Ova and PMA. These data suggest that administration of MSCs decreases allergic inflammation in lung through inhibition of CD4+ lymphocyte activation and proliferation.

Guyette, Elise

Major: Educational Leadership and Policy Studies; Advisor: Judith Aiken
An African American Farming Community in Hinesburgh, Vermont, 1790-1870

Between 1795 and 1865, a number of African American families created farming neighborhoods on Lincoln Hill in Hinesburgh and Huntington, Vermont. In this presentation, I briefly examine 70 years of social change as I reconstruct various experiences of these pioneers who chose to live in the first state to outlaw adult slavery. I examine how they and their white neighbors negotiated new ways of blacks and whites living and working together in the midst of an increasingly racialized country. I contend that the people of this northwestern Vermont hill community acted differently in their own spaces than the prevailing racist philosophy might have dictated. I demonstrate how the people of color on the Hill and some of their white neighbors created their own principles for living in the new post-revolutionary world. As the ideology of the inferiority of blacks bumped up against the hard realities of the rural life on the Hill, the needs of family and neighborhood often, but not always, took precedence over the prevailing ideology of the country.

I employ a blending of ethnographic, archeological and historical methodologies to analyze primary sources such as town land records, vital statistics, Grand Lists, court records, cemeteries and the ground they made their own. The result is a cultural micro-history that adds to our scant knowledge of rural blacks in early America. This story breaks down many prevailing myths and stereotypes and offers new narratives and perspectives concerning Vermont settlers and early Vermont farming communities. I argue that this is a story that needs to be part of the curriculum in our schools so our young students can begin to break down their misconceptions concerning the early history of our country and replace stereotypes with more accurate images.

Hamshaw, Kelly

Major: CDAE; Advisor: Daniel Baker
Reinventing the Mobile Home: Affordable, Green, and Local

The mobile home has long been an affordable housing option for many low and moderate income households in communities across the United States. Mobile homes differ from conventional “stick-built” homes in several ways: (1) mobile homes are built off-site, (2) mobile homes are not placed on permanent foundations, and (3) mobile homes are predominately classified as chattel rather than real estate. According to the 2000 Census, there are 22,631 mobile homes in Vermont, representing 7.7% of the state’s total housing units. As housing prices rise, mobile homes will remain a significant portion of Vermont’s affordable housing stock. Property transfer data from 2004 shows that the average sale price for a mobile home sold with land was approximately \$75,000. This is considerably less than the average sale price for a conventional single family home which was greater than \$199,000. Despite the prevalence and affordability of mobile homes in Vermont, mobile home owners face serious challenges that place them at a significant disadvantage compared to conventional homeowners. While quality has improved since the 1970’s, social stigma continues to marginalize significant numbers of individuals. Studies have shown that the perception of mobile home residents as “trailer trash” persists in many communities. Financing practices discriminate against buyers of mobile homes—often resulting in high risk lending situations. This research aims to develop a holistic housing system that would reinvent the current form of the mobile home. The feasibility of using locally sourced materials to manufacture affordable mobile



Hamshaw, Kelly (cont.)

homes designed using green building practices will be investigated. Analysis of current eco-affordable housing models and in-depth interviews will build the foundation for the development of this system. A case study of the Wolcott Forest Research Station Rebuild will be used to illustrate the potential application of the holistic housing system in Vermont.

Hannah, Rachael

Major: ANNB; Advisor: Mark Nelson

Brain Endothelial Cells: an aspect of what we do and why we are so cool

Endothelial cells (EC) that line blood vessels in the brain modulate blood flow and serve as the blood brain barrier. However, little is known regarding the normal physiological functions of blood vessels that penetrate into the brain tissue, called intra-cerebral arterioles, yet these arterioles are critical for normal neuronal function. Furthermore, even less is known regarding intra-cerebral ECs, and the roles that intracellular calcium signals play in the activation EC signaling pathways within these cells. Elevation of calcium in these ECs is thought to perform a major role in transmitting vasoregulatory signals to adjacent smooth muscle cells in the arterial wall. I provide the first real-time images of calcium signals within the ECs of intact intra-cerebral arterioles and show that these dynamic signals occur both globally and in spatially restricted areas within these cells. In ECs in peripheral vessels it has been shown that these calcium signals activate small and intermediate conductance calcium-sensitive potassium (KCa2/3) channels. KCa2/3 channels are required for vasodilation of blood vessels. I investigate the presence and the function of KCa2/3 channels in intracerebral ECs and show that indeed their activation controls vessel diameter. These data begin to elucidate the contribution of EC signaling on the dynamic regulation of intra-cerebral arteriolar function and therefore cerebral blood flow. It is possible that disruption of this fundamental physiological mechanism may alter cerebral blood flow thereby altering neuronal function

Hyman, Jessica

Major: CDAE; Advisor: Fred Schmidt

Development pressure and land use decisions: Farmland change in a diversified agricultural sector

High land prices and development, a shift away from a dairy-based agricultural commodity economy and the explosion of the local food movement have contributed to the diversification of products and land use in Vermont. Many farmers have found economically viable niches in areas such as community supported agriculture, direct sales, organic products and specialty foods. A farm-level survey of targeted agricultural networks combined with farmer interviews and conversations with key agricultural and planning stakeholders has produced new information about how farmland is being used and farmers' plans to purchase or sell farmland. Almost a third of farmers surveyed plan to sell some or all of the land they use for farming within five years and roughly 40 percent said they plan to acquire more land. The farmers' decisions to purchase or sell land are significantly linked to their perceptions of development pressure and their local government boards' support for agriculture. This study uses econometric and spatial analyses to examine the relationships between development pressure and land use in Vermont. The land use and planning implications of the state's evolving agricultural sector are then used to develop recommendations for local and regional planners.

Johnson, Ali

Major: MBA; Advisor: Rick Jesse

Sustainable Access to Safe Drinking Water among Mayans in Rural Guatemala

In 1996, the close of a 36-year guerilla civil war left over 1 million Guatemalans displaced. This conflict is partially responsible for a lack of safe drinking water service coverage. The responsibilities for water supply policy development and resource management are vague. Municipalities are expected to deliver the services yet lack adequate resources to purchase water rights and maintain community systems. Economic and environmental regulatory oversight is nil. The lack of coordination among public and private organizations hinders the water and sanitation sector. The project focuses on UN Millennium Development Goal 7, Target 10: "Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation." Although country-level data suggest that Guatemala has reached its goal,



Johnson, Ali (cont.)

disparities exist. In 2002, only 53% of rural homes had access to water services. We will explore opportunities for operational changes to improve access to potable water among Mayans. Pure Water for the World is a non-profit organization whose goal is to prevent children from dying and suffering from drinking contaminated water. The organization provides sustainable clean water systems to families and communities in developing countries through the implementation of educational, parasitic treatment, and follow-up programs. Observational field research will be conducted among the Mayan people of San Miguel Acatán. We will explore whether the Pure Water for the World programs of other Latin American countries are translatable to this community. We hope to stimulate future research and the development of policy actions.

Johnson, Jr., Gary

Major: Computer Science; Advisor: Ferdinando Villa

Computer Science for Environmental Research and Planning

Ecoinformatics is a very new research field at the intersection of Computer Science, Ecology, and Environmental Science. Partly because of its novelty, it is sometimes mistakenly defined narrowly as the development of software applications to aid environmental research and management. However, while software and information systems are often the output of much of this work, the discipline of ecoinformatics as a field of science and engineering is largely concerned with the subject of naming and describing the elements and relationships that make up complex systems in ways that can be formalized logically and mathematically. In doing so, we make the analysis of human and environmental systems computationally possible and provide a clear foundation for opening up the field to further research using techniques from computer science and mathematics. In this presentation, I will demonstrate my current work on the NSF-funded ARIES project, which endeavors to apply techniques from artificial intelligence, image analysis, and Bayesian statistics to develop a next-generation Decision Support System for Ecosystem Service Assessment and Valuation. The project began on April of 2007 and will be completed by March of 2010.

Kemkes, Robin

Major: CDAE; Advisor: Joshua Farley

Vermont Woodland Owners' Willingness to Provide Ecosystem Services

Ecosystems provide services essential to human wellbeing and livelihood. Because the ecosystem structure that provides these services is often privately owned, ecosystem service provision is often compromised by the sale of ecosystem structure as raw materials in the marketplace. In addition, conservation objectives such as preserving forests for carbon sequestration, water filtration and aesthetic and recreational use are unmet by direct public provision. Therefore, it is essential that programs be developed to pay private landowners to supply ecosystem services. Many studies attempt to determine the willingness to pay of consumers of these services. However, valuation methods are flawed because they are weighted by ability to pay, provide only marginal values for services that require the existence of entire ecosystems and are particularly inappropriate where ecological thresholds are present. The estimation of a supply curve for ecosystem services provides a more accurate representation of where to begin conservation and restoration of ecosystems. This study analyzes survey results of 376 Vermont woodland owners. Relationships between income, education and willingness to provide ecosystem services will be determined. Respondents also report payment levels at which they would be willing to provide ecosystems services on their land. Based on these reports, supply curves for ecosystem services will be calculated for the state of Vermont. Regression analysis will reveal which variables influence willingness to provide ecosystem services with little or no payment. Preliminary results suggest that over half of the respondents are willing to provide ecosystem services without payment which indicates that influences beyond monetary incentives exist in supplier decision-making. Behavioral economics literature reports social motivations such as altruism and intergenerational equity play a large role in willingness to provide public goods. This study provides a baseline for comparative studies of other states with varying demographics. It will also inform Vermont policies aimed at expanding conservation programs.



Kolonoski, Mark

Major: CDAE; Advisor: Ken Bauer

Generating Public Revenue from Private Forests

Forests cover more than 4.6 million acres of Vermont's landscape. In 2007, forest-based manufacturing and forest-related recreation/tourism contributed over \$1.5 billion to the states economy. Revenues generated by forestry on public land, such as state parks, state forests, and Fish and Wildlife land, are collected into specific state funds to support the department that provided the land. However, revenue generated on private lands stays within the private sector. In conjunction with the proposed Vermont Common Assets Trust Bill, this research aims to uncover alternate ways to generate public revenue from the private sector. This revenue would then be collected into a public fund and redistributed to all Vermont citizens. Presently, *ad valorem* tax, also known as property tax, and current use tax are the only methods used in collecting funds from private forests. This research will clearly outline the current financial structure of Vermont's forests and how it both enables and challenges landowners to generate income from their land. Research will also examine the affects of a yield tax as a replacement to property tax as well as identify how money flows through all sectors affected by forestry. Landowners, state officials and foresters will be interviewed to determine the thoughts and opinions of those most effected by any proposed change in forest practices. Annual harvest reports and timber and stumpage price data will be examined to determine the potential revenue generated under the proposed yield tax. Results will be available to policy makers, landowners, conservationists, and the general public.

Kornheiser, Emilie

Major: CDAE; Advisor: Christopher Koliba

Burlington, Vermont: A Case Study in Economic Development Networks

Economic Development connotes a variety of ideologies, programs, and catch phrases: sustainability, stability, success, and growth. As various theories and agents of change collate towards action, the uniting goal of an organization or community is often distorted. Much is lost at the point of praxis; often goals or mission are cancelled by the institutional dynamics they are seeking to meliorate; reform is layered on top of reform. Organizational forms affect the deliverables of an organization and its tendencies within a larger network. However each ideology comes with its own set of tools. We can test if these tools appropriately promote the mission that they purport to. Burlington, Vermont is an interesting magnification of these issues. The city's economic development plan is firmly rooted in progressive politics, community development theory, and grassroots participation. This study will examine how these concepts interact in a community to satisfy the needs of that society. By mapping the flow of finances and evaluation benchmarks between community organizations I will explore the relationships between the organizational forms promoted in the city of Burlington and tendencies across a variety of indicators of success. Beyond the scope of it's strategic plan the City of Burlington promotes some concrete, observable methodologies, some practical and some ideological in motivation: the most obvious of these being the specific expansion of the not-for-profit and government sectors.

Larsen, Tiffany

Major: Geology; Advisor: Beverley Wemple

Forest Cover and Topographic Influences on Snow Distribution in a Mixed Hardwood-Conifer Forest of the Northeastern U.S.

Forested landscapes of the northeastern U.S. are facing increasing pressures from development and recreational uses. Changes in forest coverage (openings/clearings) may have measurable impacts on hydrology, particularly in high elevation terrain where gradients in atmospheric inputs are great. To assess the hydrological implications of forest manipulations due to development, Wemple et al. (2007) have been monitoring the hydrology associated with two alpine watersheds (Ranch Brook and West Branch). A mixed-northern hardwood forest covers both basins. The West Branch (11.7 km²) water yield exceeds Ranch Brook (9.6 km²) by 18-36% between 2001 and 2003. Ranch Brook has almost no development (1%) within the watershed, whereas West Branch is partially developed (17%) by a ski resort. This development consists largely of impervious surfaces and openings within the forest (ski trails). Wemple et al. (2007) hypothesize that a water yield discrepancy between the paired-watersheds could be attributed to differences in snow accumulation between the two watersheds. Here, we report findings from two field seasons from 2007-2008 that



Larsen, Tiffany (cont.)

examined the effects of topography and forest cover on the distribution of snow within the Ranch Brook and West Branch basins. Snow water equivalent (SWE) at peak accumulation exhibited a strong trend with elevation within the forest. Along ski trails (clearings), ground-penetrating radar (GPR) surveys showed significant differences in SWE between artificial and natural snow trails. Regression models from SWE surveys were used to extrapolate the distribution of SWE across both watersheds, incorporating SWE-elevation trends on the areas covered by ski trails. To assess the hydrologic responses to the varying forest and snow coverage within the West Branch watershed, runoff magnitudes were simulated using a simple, GIS-based model

Lehning, Alex

Major: History; Advisor: Paul Deslandes

From False “Science” to Fatal “Science”: The Role of Medical Professionals in the Holocaust

My ongoing research focuses on the complicity of physicians, nurses, and medical professionals in the organized killings that took place under Hitler’s regime. My two cases studies are the euthanasia project, which occurred within Nazi Germany, and the “medical experiments” that took place at Auschwitz, the death camp in Poland. More specifically, I am analyzing the role of language in this process. How did verbal and written communications regarding health reforms, philosophical concepts of biological superiority, and attitudes towards the sick during this time alter concepts of professional responsibility, medical training, and ethics? How were state and personal accountability displaced and ignored? My preliminary conclusions argue that speech forms and word choice were an integral instrument for suppressing medical norms, legitimizing state-sanctioned murder, and creating a critical distance between the healthcare establishment and their victims. The murder of political, social, and racial “undesirables” by the Nazi regime was carried out in a state of abstraction that distorted the reality of the events that occurred. The ideological framework that resulted from this disparity promoted the illusion of authority, scientific legitimacy, and moral credibility that fundamentally undermined ethical elements of the German medical profession.

Lilly, Paul

Major: Natural Resources; Advisor: Jennifer Jenkins

Why I Watch the Grass Grow: Attaching Ecological Significance to Residential Lawns

Usually, when an ecologist looks at an ecosystem, she can understand how it “works” – how energy and nutrients are stored and move through the system, and the roles different plant and animal species play. Unfortunately, this is not generally the case in a city. Urban ecosystems present special difficulties because human activities introduce types and quantities of materials that would not normally be present, and move them around in ways that simply would not happen in a comparatively undisturbed ecosystem. Urban ecologists attempt to take these difficulties into account as we try to understand how the ecosystem we call a city works. Lawns are a major component of the vegetation in urban areas, and can be remarkably productive. They also require continual management (think mowing), and the type and intensity of management they receive varies according to a variety of social and biophysical factors. Understanding the ecological effects of management is an important first step in being able to look around the city and understand the significance of patterns of differently-managed parcels within the urban mosaic. I’m using an experimental manipulation to test the effects of mowing, watering, and fertilizing – the three most common lawn management activities. The experiment is ongoing, and treatment effects are just beginning to show up. Preliminary results from basic monitoring mostly confirm our expectations – fertilization increases clippings production; watering increases soil respiration rates – but there are a few surprises.

Lodh, Nilanjan

Major: Biology; Advisor: Lori Stevens

Spatial and Temporal Variation in the Incidence of the Whirling Disease in the Intermountain West

Myxobolus cerebralis, the myxozoan parasite causes the whirling disease in salmonids, in the Western United States and causes considerable economic and ecological loss. The parasite’s definitive host, Tubifex tubifex (oligochaeta) is a cosmopolitan species capable of withstanding extreme and variable environmental conditions. Such adaptive qualities and



Lodh, Nilanjan (cont.)

abundance of *T. tubifex* likely influence rainbow trout WD disease risk (23 states affected) because high abundance provides ample host habitat for *M. cerebralis*. Host diversity within and among taxa plays a key role in virulence, susceptibility and/or transmission of the parasite. Classification of host taxa and determination of interactions of each taxa with the parasite are critical to understand the disease dynamics and how biodiversity affects transmission. A nested polymerase chain reaction (PCR) test is used to amplify a segment of the 18S rRNA gene from *M. cerebralis* to: (1) confirm the distribution of infection in mature and immature worms in a 40 km reach of the Madison River, Montana; and (2) test for differences in infection prevalence among genetic lineages. The rate of infection differs between the two-tubificid lineages (Lineage I & III) found in the Madison River, Montana (collection site). If there is spatial variation in worm abundance, it may result in the wide range of infection in natural streams. Also within a worm population, few become infected while others do not. Two of the six known lineages (Lineage I & III) are present in the Madison River. Susceptibility to the parasite among lineage III worms may be correlated to the level of genetic variability or polyploidy of worms. Amplification of conserved 16S rRNA shows that the lineage specific primers amplify sister taxa along with *Tubifex tubifex*. The whirling disease system provides an excellent experimental venue to test hypotheses about biodiversity and parasite transmission that integrates research into fisheries management and conservation programs.

Lu, Zhenyu

Major: Computer Science; Advisor: Josh Bongard

Selective sampling for highly unbalanced data sets

Selective sampling is a form of active learning which can reduce the cost of training by only placing the most informative data points into the training set. This selected training set is expected to contain most of the information necessary for a modeling task, thus make modeling faster and more accurate. We introduce a novel approach to selective sampling, which is derived from the Estimation-Exploration Algorithm (EEA). The EEA is an algorithm that uses model disagreement to decide the significance of a data point, and does modeling only on the selected data. The algorithm develops a population of Artificial Neural Networks (ANN) on the same selected training set, and uses their disagreement to seek new data for the training set. We use National Trauma Data Bank (NTDB) medical database to test the algorithm. Experiments show that the algorithm outperforms the equivalent algorithm using randomly-selected data.

MacNeil, Matthew

Major: Educational Leadership and Policy Studies; Advisor: Susan Hasazi

The Preparedness of Vermont Foster Youth for “Aging Out” of State’s Custody

This project examines the experiences of foster youth as they prepare for life after emancipation from state custody. Every year in the U.S., around 25,000 youth in foster care reach the legal age of emancipation and subsequently leave state’s custody. Colloquially, this transition is known as “aging out”. Although the youth who “age out” are legally considered adults, few are ready to meet the challenges of adulthood independently. These youth are more likely than their same aged peers to end up incarcerated, face unemployment or underemployment, drop out before finishing high school, and experience substance abuse problems or a mental health disorder. Using illustrative case methodology, this study attempted to capture life story perspectives on the experiences of teenaged foster youth and their guardians as they prepare for life after emancipation. A project of the Vermont Research Partnership, the study was able to utilize logistical and ethical consultation from state agency leaders during the development of methodology. Transcripts were analyzed from interview data collected from 13 youth in custody, 14 caregivers, and 22 service providers. Results categorized themes related to youth preparedness including resiliency factors, barriers to concrete planning, the ubiquity of trauma experiences, the costs of service provider turnover, the impact of long term relationships, and the “pull” of the biological family. Findings revealed a complex intertwining of personal, familial and systemic issues that converge to hinder preparedness for independent living despite the determined efforts of foster parents, service providers, families and the youth themselves. Based on these findings, the authors pose areas for future research as well as policy implications related to service provision for teenaged youth in custody.

**Majumder, Sukanya**

Major: Biology; Advisor: Judith Van Houten

Characterization of Pawn A Protein in Paramecium

Paramecium, a unicellular organism, is used as a model organism in our lab, because it has many characteristics that resemble neurons, such as an excitable membrane with receptors and ion channels that activate in the presence of stimuli. In the culture medium Paramecium swims forward and occasionally turns. This swimming behavior is the manifestation of the ciliary beat and ciliary beat direction is governed by intracellular $[Ca^{++}]$. When the membrane is depolarized by an external stimulus, the voltage gated Ca^{2+} channels that are in the cilia open causing a Ca^{2+} action potential, increased Ca^{2+} inside the cilia, change in the beating of the cilia, and a turn. Some mutations cause Paramecium to fail to move backward and it has been found that these mutations affect the function of voltage gated Ca^{2+} currents. These cells are called Pawns for the chess piece because they do not turn. Till now 4 genes (Pw A-D) have been found to be mutated in Pawn cells, but no protein has been purified or localize on the cell surface. We used RNAi technique to down regulate the wild type Pawn A gene and observed the swimming behavior. We found that we could produce a Pawn phenotype with RNAi. In addition to using RNAi, we are expressing the Pawn A gene with a tag to follow the protein product in order to find its location and try to find how it associates with the voltage gated Ca^{2+} channels

Mason, Nicole

Major: CDAE; Advisor: Daniel Baker

Engineering and Sustainable Development: The Need for a Transdisciplinary Approach

In recent years there has been a rapidly growing interest within collegiate engineering programs to apply engineering skills to the International Development field. There is strong demand for these technical skills in the developing world. There is evidence of “failed” or un-sustained projects seen around the world. The general hypothesis explored by this thesis is that integrating development methodologies with engineering programs will lead to better chances of success. This research aims to first document what types of development projects these engineering programs are focusing on, and secondly to identify which types of development models, if any, are being used. The first stage of study will be done using web-based research and a literature review content analysis on a selection of engineering programs that are undertaking international projects. Key informant interviews will then be used to determine how these programs are identifying and utilizing development models, if they are. The results from this research are expected to clarify what types of development models are used by engineering programs, and how successful or unsuccessful the different models are at creating productive, prolonged project relationships. Results are expected to be useful for professors and students in engineering programs that are doing international work, and as a result also to the communities where the projects are taking place. It is hoped that in the future the need to combine the technical skills of engineers with the community developmental knowledge of those in the field will be realized and will lead to more productive and sustainable international projects.

Massell, Laura

Major: Educational Leadership and Policy Studies; Advisor: Kieran Killeen

An Analysis of Factors Associated with Postsecondary Education Access and Persistence Among Vermont GEAR UP and Talent Search Participants

The Vermont Student Assistance Corporation (VSAC) administers Vermont's two statewide college access grants, GEAR UP and Talent Search. Working with low-income youth in grades six through 12, these programs are designed to strengthen academic skills, raise educational aspirations, and support students in the college and financial aid application process. This study examines the postsecondary enrollment patterns of GEAR UP and Talent Search participants in High School Classes of 2001 and 2003 ($n=1200$) using a combination of National Student Clearinghouse, Vermont Higher Education Grant records, and telephone interview data. Using logistic regression, this work-in-progress study examines the extent to which postsecondary education enrollment, persistence and completion can be predicted from students' 6th-12th grade participation in either college access program (duration and intensity), students' educational aspirations and postsecondary planning, high school coursework and grades, Pell and Vermont grant award history and expected family contribution levels, and other student demographic factors.



Mastrangelo, Cristina

Major: CDAE; Advisor: Jane Kolodinsky

Planning for Change: Awareness and Attitudes in Vermont Communities

Several eras in history have influenced aspects of development in American cities and towns. A significant change in the land use planning and community development took place in the years following World War II with the popularization and affordability of the automobile. No longer was there a need to centralize development around urban areas and downtowns as people relied more and more on private transportation. Suburbs became the residence preference for middle to upper class families. Low-density residential development was segregated from industrial and commercial development, as well as from schools and offices requiring many people to use private transportation. Subdivisions and suburbs have remained popular among homeowners in America. Development sprawls around city centers dominating more and more of the American landscape. However, as the price of oil rises, as climate change necessitates a decrease in CO₂ emissions and as critical habitat must be protected to maintain healthy ecosystems communities will need to adapt their current built environment to accommodate more local commerce, more non-motorized travel, and to include green space for agricultural activity as well as to support ecological processes. This study will analyze historical data pertaining to development patterns and population migration in Vermont. Additionally, preferences for types of settings in which citizens would ideally like to reside will be identified. The project will then gauge citizens' awareness and understanding of community planning strategies that integrate more alternative transportation options, encourage local commerce, promote local food systems, and protect open space. Finally, the interest level of residents in rural, suburban and urban environments and their willingness to participate in community planning will be addressed. The data will be collected using focus groups and surveys. Information from this research will be valuable in identifying preferences for future community planning strategies and barriers to public participation.

Montalvo, Alexandra

Major: Biology; Advisor: Jim Vigoreaux

Functional and phylogenetic analysis of flightin phosphorylation reveal lineage-specific differences in phosphorylation site selection

Proper assembly and structural stability of thick filaments in *Drosophila melanogaster* indirect flight muscles (IFM) requires flightin, a 20 kDa myosin rod binding protein found widely in insects and crustaceans. Adult *D. melanogaster* express eleven flightin isoelectric variants, two non-phosphorylated variants (N1 and N2) and nine phosphorylated variants (P1 through P9). The specific function of phosphorylation is not known but transgenic *D. melanogaster* expressing phosphorylation site mutant flightin are flightless due to impaired IFM structure and mechanics. Changes in phosphorylation of IFM flightin occur prior to acquisition of flight competency in both *D. melanogaster* and *Apis mellifera* (honeybee), but in the latter a reduced number of isoelectric variants are expressed. Identification of phosphorylation sites by ion trap mass spectrometry revealed that phosphorylation sites are not conserved between flies and bees. To gain insight into the role of phosphorylation in flight muscle function, we measured the relative abundance of flightin isovariants in non-flying and flying *D. melanogaster* by quantitative two-dimensional gel electrophoresis. A significant decrease in flightin phosphorylation, manifested as reduced abundance of P1, P2, P3 and P4, was detected upon flight initiation. This reduction was accompanied by an increase in abundance of N1 and N2 between 90 sec and 180 sec after initiation of flight. No significant changes were detected in the abundance of P5-P9. Phosphopeptide profiling of flightin isovariants suggests that phosphorylation of S139, an amino acid that is conserved in 10 of 12 other *Drosophila* species examined, is modulated during flight. Evaluation of flightin phosphorylation sites in an ecological and phylogenetic framework provides information on the evolutionary processes that act at the level of the gene vs protein modification. Our results are consistent with the hypothesis that flightin fulfills a conserved muscle physiological function and a rapidly evolving behavior-associated function.



Nausch, Bernhard

Major: Pharmacology; Advisor: Mark Nelson

Contraction of Urinary Bladder Smooth Muscle Depends on Influx of Calcium Rather than Release from Sarcoplasmic Reticulum

The urinary bladder has two main functions, storage of urine and micturition. Pathologies of either function significantly decrease a person's quality of life and cause a considerable economic burden. Drugs used to treat bladder dysfunction such as incontinence and urinary retention are similar to drugs used 100 years ago and are relatively ineffective with numerous side effects. The development of new drugs is hindered by an incomplete understanding of mechanisms that regulate bladder filling and emptying. It is known that urinary bladder smooth muscle (UBSM) contracts in response to an increase in the concentration of intracellular calcium. However, the mechanisms that underlie the increase in intracellular calcium are a matter of debate. In this study, we used mouse urinary bladder to examine the role of the following two pathways for UBSM contraction: 1) the influx of extracellular calcium through voltage-dependent calcium channels (VDCC) and 2) the intracellular release of calcium from calcium stores located in the sarcoplasmic reticulum (SR). Our data indicate that acetylcholine, an excitatory neurotransmitter released from parasympathetic nerve varicosities in the urinary bladder, depolarizes the membrane potential of UBSM causing the opening of VDCCs. This brief opening of VDCCs, visualized as an action potential using intracellular recording techniques, allows calcium influx leading to smooth muscle cell contraction. The action potentials and the accompanying contraction can be blocked by nifedipine, a selective inhibitor of VDCCs. On the contrary, depletion of the SR calcium stores with cyclopiazonic acid, an inhibitor of the pump responsible for filling the stores, does not decrease contraction of UBSM. In conclusion, our data support an important role of VDCCs to initiate contraction of UBSM and suggest that VDCCs may be a useful target for drug development to treat pathologies of the urinary bladder.

Ni, Xianglian

Major: Biology; Advisor: Miguel Martin-Caraballo

Role of Ca²⁺ permeable AMPA receptors on motoneuron development

AMPA receptors are glutamatergic receptors that mediate fast synaptic transmission in central synapses. They play an important role in the formation of neuronal circuitry, synaptogenesis and synaptic plasticity. AMPA receptors allow a significant influx of Ca²⁺ ions under certain conditions. The Ca²⁺ permeability of the AMPA receptors can be regulated by the insertion of one or more edited GluR2 subunits. In addition to GluR2 subunits, AMPA receptors may also contain other subunits, such as GluR1, GluR3 or GluR4 subunits. We have shown that chick lumbar motoneurons express Ca²⁺ permeable AMPA receptors at early stages of development. At embryonic day (E) 6, Ca²⁺ permeable AMPA receptors allow a significant increase in intracellular Ca²⁺. However, by E11 the Ca²⁺ permeability of AMPA receptors is significantly reduced. GluR2 expression is absent between embryonic day (E) 5 and E7 but increases significantly by E8 in the chick ventral spinal cord. In a series of experiments, we have examined the subunit composition of AMPA receptors at early stages of development and the functional role of Ca²⁺ permeable AMPA receptors in the morphological development of chick lumbar motoneurons. We hypothesize that expression of GluR2-lacking AMPA receptors limit dendritic outgrowth in the chick spinal cord. Our results show that while GluR2 is absent at early stage of embryos, expression of GluR3 and GluR4 mRNA is significant in the motoneuron pool. This accounts for the functional expression of AMPA receptor between E5 and E7. Expression of Ca²⁺ permeable AMPA receptors between E6 and E8 may play a role in regulating dendritic outgrowth in developing chick motoneurons. Pharmacological inhibition of Ca²⁺ permeable AMPA receptors causes a significant increase in dendritic outgrowth. These findings raise the possibility that Ca²⁺ influx through Ca²⁺-permeable AMPA receptors plays an important role during early embryonic development in chick spinal moto neurons.

Nolte, Penelope

Major: Educational Leadership and Policy Studies; Advisor: Kieran Killeen

A Chorus of Voices: Re-Examining Focus Group Data for Evidence of Change

It has been pointed out that teachers' "voice" is not often heard in school reform. Berliner (2006) states this is perhaps based on the supposition that something must be done by "outsiders" in order for the "broken" school system to be



Nolte, Penelope (cont.)

“fixed.” I believe that the teacher voice present in full-text focus group transcripts is a unique and important feature of the methodology. This “snapshot” of reform at the teacher level is frozen in time while experiences and opinions change, participants come and go, as the group moves through a school reform effort. Participants’ opinions may be validated, or their suspicions reified, by others present. Likewise, tensions between participants surface when contesting view-points are present. The dynamics of group interaction bring participants to think and respond to what others have said. This focus group analysis, as the name implies, was treated with the group as the unit of study. Participating teachers’ comments in each group are not and indeed cannot be traced back to specific individuals. It is through patterns in group statements made over time that I tracked teachers’ thinking about their practice, while not following any one individual’s journey. This use of focus group data is in keeping with evaluation standards for identifying “both common and unique local patterns of interaction” (Joint Committee on Standards for Educational Evaluation et al., 1994, p. 150). This approach to the analysis is also supported by literature about focus group methodology, which confirms that groups drawn together to “share some common identity and goals, as well as some common ‘concrete situation’” (Stewart & Shamdasani, 1990, p. 10), can provide qualitative investigators with an understanding of a “group’s” state of mind at a given time.

O'Brien, Megan

Major: Nursing; Advisor: Nancy Morris

Perception of Rural Caregiving

Families providing informal care for loved ones face challenges with aging population expansion, rising costs of health care, and shrinking families. Analysts predict a doubling of the aging population in the next half century, while concurrent decreasing birth rates propose a future mismatch of family caregiving resources. Similar trends are expected for the state of Vermont. With the majority of aging adults living in rural areas, an estimated 64,000 informal caregivers provide between 64 and 69 million hours of care annually, at an estimated market value of \$683 million dollars. Partnering with families to provide care within these constraints will necessitate understanding the impact of caregiving from the family perspective. Role theory posits the experience of caregiving is influenced by personal and external resources. The purpose of this research was to investigate which variables produce strain or facilitate well-being within the informal caregiving role by investigating five previously identified domains: a) disrupted schedule, b) financial problems, c) lack of family support, d) health problems, and e) caregiver self-esteem. The previously validated Caregiver Reaction Assessment was distributed by local Vermont agencies to solicit subjective experiences to caregiving through a one-time survey. The results of this study promote understanding of variables influencing the caregiving role for rural Vermonters. When working with families, practitioners need to be sensitive to the dynamics of the caregiving relationship. The advance practice nurse can use these findings to advocate for families through barrier identification, education and resource allocation.

Payne, Josh

Major: Computer Science; Advisor: Margaret Eppstein

The Influence of Scaling and Assortativity on Takeover Times in Scale-Free Topologies

In evolving systems, the topological characteristics of population structure have a pronounced impact on the rate of spread of advantageous alleles, and therefore affect selective pressure. One common method for quantifying the influence of population structure on selective pressure is through the analysis of the expected number of generations required for a single favorable allele to saturate an entire population (a.k.a. takeover time analysis). While takeover times have been thoroughly investigated in regular population structures, the selective pressures induced by irregular interaction topologies, such as scale-free graphs, have received much less attention. In this study, we systematically investigate the influence of scaling and assortativity, two frequently overlooked topological properties, on takeover times in scale-free population structures. Our results demonstrate that the scaling parameter and the magnitude and sign of assortativity have profound and unexpected nonlinear influences on takeover times in scale-free interaction topologies. We explore the reasons behind these results and suggest ways in which they may be exploited in future studies.



Ponissery-Saidu, Samsudeen

Major: Biology; Advisor: Judith Van Houten

Role of the Plasma Membrane Calcium Pump In Olfaction

Cilia-bearing olfactory neurons impart the ability to smell in mammals. Odorants in the air bind to G-protein coupled receptors on the cilia of an olfactory neuron and cause an increase in intracellular calcium concentration, which ultimately results in the generation of an action potential that is transmitted to the brain through the axon. The elevated calcium in the cell has to be brought down to resting level of ~60nM for another round of odorant-sensing to take place. The Na⁺/Ca²⁺ exchanger has been identified as one of the mechanisms, which clears out calcium from olfactory neurons, but it cannot fully account for bringing the calcium down to ~60nM due to its low affinity for calcium. A mechanism with higher affinity for calcium that can bring the resting levels to <100nM has to be present and one such candidate is the Plasma membrane calcium pump (PMCA). We have established through immunostaining that all four isoforms of Plasma Membrane Calcium ATPases are indeed present in mouse olfactory neurons. To test whether they play a part in returning calcium to basal levels after stimulation, we used calcium imaging and curve fitting techniques. We compared wild type mice with mice lacking PMCA2 isoform by stimulating the olfactory neurons using either 60mM of KCl or an odorant-mimicking mixture of IBMX/Forskolin and studying the calcium clearance rates. PMCA2 knockout cells were significantly slower than the wild type cells in clearing calcium. Also, the PMCA inhibitor Carboxyeosin (CE) significantly slowed down calcium clearance in these cells. Our results suggest that PMCA isoforms are expressed in mouse olfactory neurons and that they are involved in calcium regulation in these cells during and after an odorant-induced depolarization, which allow the cells to keep on sensing subsequent odorants.

Previs, Michael

Major: CMB; Advisor: Dwight Matthews

Absolute Quantification of Protein Phosphorylation by Liquid Chromatography

Identification of phosphopeptides by mass spectrometry is difficult, and quantification of the degree of phosphorylation is even more challenging. Every peptide has a unique ionization efficiency that alters with phosphorylation, and therefore, phosphorylated and unphosphorylated peptides cannot be compared directly by mass spectrometry. Phosphorylation can also alter trypsin cleavage patterns, shifting peptide distribution through miscleavage. In addition, potential phosphorylated peptides generated by tryptic digest may be small, hydrophilic, and not retained well on LC columns. We have developed a simple stable isotope ESI-LCMS method using a mass balance approach to quantify the absolute degree of phosphorylation of proteins. Our method allows for differences in ionization efficiencies between peptides and differential cleavage due to the presence of phosphate. A protein sample is first split into 2 fractions, and one fraction treated with alkaline phosphatase to dephosphorylate the proteins. Both fractions are digested with trypsin, then the resulting peptides are esterified using unlabeled propyl reagent for one fraction and deuterium-labeled propyl reagent for the other fraction. The fractions are then combined, and measured together by ESI-LCMS/MS both to identify peptides and to perform phosphorylation quantification calculations using only the unphosphorylated unlabeled/deuterium-labeled peptide ratios. Several experiments were carried out to assess the labeling strategy, evaluate the dynamic range of quantification, and demonstrate absolute quantification measurement of phosphorylation stoichiometry for muscle protein troponin complex. A benefit of the derivatization strategy was to increase significantly chromatographic retention of hydrophilic peptides on the LC C18 column away from the void volume. For example, the tryptic peptide SSANYR from troponin I is not retained on a normal column, but the propylated SSANYR peptide is retained on the column for ~20 min. This peptide is also a phosphorylation target that would not be seen without derivatization. The ESI-LCMS ratio measurement of unlabeled/deuterium-labeled peptides was linear over the range of 0-100%. Minimal fractionation of the deuterium-labeled peptides was observed on the LC column (~15% separation of peaks per deuterium-labeled propyl group added). Troponin protein complex samples containing defined degrees of phosphorylation were prepared using protein kinase A treatment and measured. Two key peptides were phosphorylated in troponin I (SSANYR, 99% and ISASR, 49%). A linear decrease in phosphorylation was measured for both SSANYR and ISASR when the PKA-treated samples were diluted with unphosphorylated protein, demonstrating the linearity and precision of the method. Additional



Previs, Michael (cont.)

tryptic peptides were quantified when the troponin protein-complex was phosphorylated with PKC (peptide phosphorylation: 100% for SSANYR, 47% for ISASR, 37% for ISADAMMQALLGAR, 77% for FKRPTLR, and 82% for ALSTR). Detection limits are ~10% phosphorylation and an uncertainty of measurement of ~5%.

Pucko, Carrie

Major: Plant Biology; Advisor: Brian Beckage

Mechanisms Contributing to Rapid Forest Shift in the Green Mountains

Decades of warming in the Northeast have caused rapid changes in forest composition and ecotone elevation in the Green Mountains. As anthropogenic climate change continues to affect Vermont forests, it is important to understand the mechanisms that lead to forest shift and be able to identify regions where rapid transition is likely to occur. In order to project forward, we must first understand what has happened in the past. To detect and measure change over large areas in the past forty years we have developed techniques which classify and compare forest cover in historic aerial photographs and high-resolution satellite imagery. These techniques have also allowed us to identify environmental conditions associated with quickly transitioning forests. We have found that the changes observed were not solely the result of a warming climate, but of interactions between climate and other human-induced phenomena such as acid deposition. In order to directly test the effects of acid deposition as well as other environmental conditions which may control ecotone formation such as temperature, soil nutrient content and predation, a reciprocal seedling transplant study was conducted last summer on Mount Mansfield, which yielded some surprising results. We found that small mammal predation may be a very important and previously unaccounted for factor in controlling high-elevation establishment of northern hardwood seedlings. In plots located above the boreal-deciduous ecotone, we found that 70% of sugar maple seedling mortality was caused by small mammal predation compared to 30% below the boreal-deciduous ecotone. We hope that this ongoing research will lead to more accurate predictions of forest change over the coming century in response to climate change and illuminate gaps in our understanding of forest dynamics.

Rajendran, Anbazhagan

Major: Biology; Advisor: Judith Van Houten

Studies on Ciliopathogenesis of Human BBS in a ciliate model, Paramecium

Cilia are the microtubule based organelles distributed in almost all tissues in the human body. Cilia, as organelles of chemo- and mechano-sensation have diverse functions such as body fluid movement, cell migration and tissue development. Defects in such key organelles are manifested as a disease syndrome in human such as Bardet-Biedl syndrome (BBS), Polycystic Kidney Disease (PKD), Kartagener syndrome (KS). Human BBS is an autosomal recessive multifactorial genetic disorder characterized by obesity, retinal photoreceptor dystrophy, polydactyly, renal abnormalities, male hypogonadism and learning disabilities. Interestingly, 8 of the 12 BBS genes in human genome have been found in Paramecium Genome. Because cilia are conserved organelles, it is possible to study the functions of ciliary genes like BBS in Paramecium, convenient model organisms. The biological roles of these BBS proteins are determined by interrupting their gene expression at the mRNA level by RNA interference (RNAi) feeding method. When the BBS1, BBS3.1, BBS5.1, BBS4 and BBS8 gene products are reduced by RNAi, we find a constellation of phenotypes. The long backward swimming of BBS1, BBS3.1, BBS4 and BBS8 silenced cells in NaCl/ tetraethylammonium buffer suggests that a calcium activated potassium channel is defective. Similar long backward swimming in high potassium buffer shown by BBS3.1 and BBS5.1 down regulated cells suggests that voltage gated potassium channels are defective. Delayed ciliary re-growth followed by deciliation has been observed as a consequence of BBS1 down regulation. Disruption of BBS1, BBS3.1, BBS4, BBS8 gene products slightly alters the ciliary length. Mechano-stimulation assay shows the defective mechano-sensitive potassium channels in BBS1 silenced cells. However, down regulation of BBS1 and BBS 8 proteins had no effect on the chemo-attractant behavior of paramecia. Future work will be focused on the localization of BBS proteins and their association with intraflagellar transport (IFT) proteins.



Ramsey, Jon

Major: Biochemistry; Advisor: Robert Kelm, Jr.

Thermodynamic insights into the ssDNA-binding mechanism of mouse Pur-beta

Pur-beta is a gene regulatory factor belonging to a family of transcription/translation factors, known as the Pur family of proteins, characterized by their ability to bind purine-rich single-stranded nucleic acids (ssDNA/RNA) in a sequence-specific manner. Pur-beta, along with family member Pur-alpha, has been implicated in the transcriptional repression of the gene encoding smooth muscle alpha-actin (SMaA), a critical contractile apparatus protein involved in vascular smooth muscle and cardiac development, disease progression, and wound repair. Transcriptional repression of SMaA by Pur-proteins involves binding of these repressors to transiently formed single-stranded regions of the muscle-specific CAT (MCAT) enhancer element of the SMaA promoter, and accomplishing repression by putatively displacing double-stranded DNA (dsDNA)-dependent transcriptional activators and/or interacting with factors that downregulate the transcriptional machinery. Despite the vast knowledge of mechanisms governing function of dsDNA binding transcription factors, mechanisms by which sequence-specific ssDNA binding transcription factors operate in a predominantly double-stranded genomic environment are lesser known. In the present study, we have used a thermodynamic approach to aid in describing the manner in which Pur-beta binds to ssDNA representations of the purine-rich strand of the SMaA MCAT enhancer element, as a model of sequence-specific ssDNA recognition by Pur-proteins. Qualitative electrophoretic mobility shift assays coupled to quantitative forms of the technique show that Pur-beta binds to single-stranded MCAT elements with a stoichiometry of 2:1, however obligate dimer formation does not appear to be necessary for binding. Quantitative electrophoretic mobility shift assay and quantitative DNaseI ssDNA footprinting both suggest that Pur-beta binds to the purine-rich strand of the MCAT enhancer element in a cooperative manner and in a protection order of binding to the 3' site followed by the 5' site.

Ren, Xiaolin

Major: Biomedical Engineering; Advisor: Ge Wu

Characteristics of Muscle Activities in Young and Elderly Group During Tai Chi Gait

Tai Chi, an ancient Chinese martial art, has become a popular therapeutic exercise for improving balance and postural control, and reducing fall risks in elders. However, we do not yet have a solid understanding of why Tai Chi is an effective form of exercise. In particular, we do not know the motor control strategies used during Tai Chi practice, and do not know if the motor control strategy changes in people with advanced age. This study was aimed to examine leg muscle activity patterns occurring while Tai Chi is practiced by young and elderly individuals. It was hypothesized that elderly people would have shorter duration of leg muscle activations than young people.

Richardson, Amanda

Major: CDAE; Advisor: Joshua Farley

Willingness-to-pay for watershed services: Case Study of the Fond D'or water

The Fond D'or Watershed in St. Lucia is the site of the Integrated Watershed and Coastal Areas Management (IWCAM) program funded through the Global Environment Facility (GEF) of the United Nations Development Program (UNDP). The primary goal of the IWCAM program is to improve water quality in the watershed. Reforestation is one method to improve water quality; forests provide many ecosystem services, such as consistent water supply, water filtration, soil stabilization and biodiversity. One possible financing mechanism for a reforestation program is through a benefits transfer program, or payments for ecosystem services (PES), where beneficiaries of watershed services compensate the providers of the service to ensure service provision. In order to establish a market incentive program, or PES mechanism, in the Fond D'or Watershed, economic information, such as the value of water to water users, is needed. Willingness-to-pay (WTP) for watershed services for direct water users (households) and indirect water users (tourists) was obtained using the contingent valuation method. Household surveys were conducted in five clusters of communities within the watershed; tourists were surveyed as they departed St. Lucia at Hewanorra International Airport in Vieux Fort. Approximately 300 household surveys and 80 tourist surveys were completed. Opportunity cost—the minimum amount necessary for farmers to keep their land free of agriculture and development—was obtained from the Ministry of Agriculture. The feasibility of funding a PES scheme in the Fond D'or Watershed can be determined using WTP and



Richardson, Amanda (cont.)

opportunity cost data. WTP represents potential funds available for financing the program and opportunity cost represents the minimum amount required for a farmer to participate. This research will be employed by the Ministry of Agriculture, Forestry and Fisheries of St. Lucia in future policy-making for integrated watershed management.

Roche, Erin

Major: CDAE; Advisor: Jane Kolodinsky

Good Habits Go Together: Regular Exercise and Good Nutrition are Related

Even at a relatively young age, good habits are not found in isolation, but in combination. As policymakers grapple with ways to address the problems of obesity in America, considering bans and labels to remind consumers what is good for them, exercise and good nutrition are largely treated as separate problems with separate solutions. Research shows that exercise is one component of maintaining a healthy weight, yet most obesity policies are designed to impact food consumption rather than energy expenditure. This study of first year college students at a Northeastern university shows even in a population of healthy weight individuals (BMI ranging from 19 to 23.5), amount and variety of exercise is not just related to calories consumed, but that those who exercise daily consume fewer calories on average. Further, those who engage in at least 1 daily exercise activity were more likely to report losing weight over the course of the study than those who do not engage in exercise daily. These students, as part of a larger study about nutrition, had their height and weight measured at the beginning of the study in order to calculate Body Mass Index (BMI). Daily food purchases were measured on four different occasions over the course of the six month study and calories, macronutrients and number of servings based on the Dietary Guidelines for Americans (DGA) were recorded. Students also completed a web-based survey at the outset and conclusion of the study to record their perceptions and opinions about nutrition and lifestyle.

Rockefeller, Rebecca

Major: Natural Resources; Advisor: Curtis Ventriss

Liquid Biofuels Policy: A Report to the Maine State Legislature

In May 2007, the Maine State Legislature passed two resolves asking for recommendations and draft legislation to stimulate the production, distribution and consumption of biofuels in Maine. This thesis project responds to those resolves. Written on behalf of the Maine Office of Energy Independence and Security, the report addresses biofuels and policy options to promote biofuels in light of their potential impact on economic development, energy independence and the environment. It compares various biofuels policies – it does not compare biofuels against other means of achieving similar goals. Information gathered from interviews, a stakeholder workshop, a detailed study of other state policies, and a literature review of white papers, scientific studies and past research in the region contributed to the eight policy recommendations presented in the report. These recommendations encourage the State to: capitalize on existing policies by increasing implementation capacity; build capacity for future instate production through supporting research and development; maximize the benefits of biofuels by instituting sustainability measures; and diversify Maine's fuel market by supporting and removing barriers for all clean fuels. The Utilities and Energy Committee received the final report on January 15, 2008. I presented recommendations to the Committee in February and subsequently added an addendum in light of emerging scientific information. Legislators are interested in carrying some policy recommendations forward.

Roering, Andrew

Major: Chemistry; Advisor: Rory Waterman

New Bond Forming Reactions with Triamidoamine-Supported Zirconium Complexes

Triamidoamine ligands have been used extensively in a variety of aspects of chemistry. Several publications have shown the versatility of this ligand and its ability to bind to a host of different metal centers. Most popularized for its use in metal-ligand multiple bonding, the catalytic capability of triamidoamine-supported metal complexes has not been thoroughly investigated. Recently, triamidoamine-supported zirconium catalysts have been explored in our laboratories. It was determined that zirconium complexes catalyze dehydrocoupling of primary and secondary phosphines to form P-P bonds. It was further shown that dehydrocoupling catalysis of arsines was also facile, while silanes and germanes were readily heterodehydrocoupled with phosphines expanding the chemistry of heterodehydrocoupling and affording unique



Roering, Andrew (cont.)

hydrogen-rich silyl and germylphosphines. Syntheses of triamidoamine-supported zirconium complexes were first developed by Scott and coworkers building on seminal work by Verkade and coworkers. Utilizing some of the chemistry observed for the dimethylbutylsilyl-substituted triamidoamine ligand, we have developed a general synthesis of zirconium-element bonds. These complexes, forming a complete family of metal-ligand bonds, have allowed investigation of a rich new variety of bond-forming catalytic reactions. One of the most valuable chemical reactions in the synthesis of fine chemicals and pharmaceuticals is the addition of an element-hydrogen bond across a carbon-carbon double or triple bond. Hydrophosphination, addition of a phosphorus and hydrogen atom across a carbon-carbon double or triple bond, is one of these reactions, which is central in the production of pharmaceuticals. This presentation will present the general preparation of zirconium complexes and fundamental investigations into catalytic hydrophosphination of terminal alkynes.

Ross, James

Major: Civil and Environmental Engineering; Advisor: George Pinder

Approximate Reasoning in Hydrogeological Modeling

The accurate determination of hydraulic conductivity is an important element of successful groundwater flow and transport modeling. However, the exhaustive measurement of this hydrogeological parameter is quite costly and, as a result, unrealistic. Alternatively, relationships between hydraulic conductivity and other hydrogeological variables less costly to measure have been used to estimate this crucial variable whenever needed. Until this point, however, the majority of these relationships have been assumed to be crisp and precise, contrary to what intuition dictates. The research presented herein addresses the imprecision inherent in hydraulic conductivity estimation, framing this process in a fuzzy logic framework. Because traditional hydrogeological practices are not suited to handle fuzzy data, various approaches to incorporating fuzzy data at different steps in the groundwater modeling process have been previously developed. Such approaches have been both redundant and contrary at times. This research proposes a consistent rubric for the handling of fuzzy data throughout the entire groundwater modeling process. This entails the estimation of fuzzy data from alternative hydrogeological parameters, the sampling of realizations from fuzzy hydraulic conductivity data, including, most importantly, the appropriate aggregation of expert-provided fuzzy hydraulic conductivity estimates with traditionally-derived hydraulic conductivity measurements, and utilization of this information in the numerical simulation of groundwater flow and transport.

Saha, Madhurima

Major: Biology; Advisor: Bryan Ballif

The molecular interaction of phosphorylated Synapsins with 14-3-3 ϵ

Synaptic connections enable the nervous system to relay critical information within the Central Nervous System and to tissues throughout an organism's body. Essential to this process is the generation and regulation of neurotransmitter-filled synaptic vesicles in pre-synaptic cells. Genetic and biochemical experiments have identified an important role for the Synapsin family of proteins in maintaining an appropriate pool of readily-releasable pre-synaptic vesicles. The molecular mechanism for this is unknown. Synapsins are known to be phosphorylated and pharmacological modulation of kinases and phosphatases affects the trafficking of pre-synaptic vesicles. Using affinity chromatography and liquid chromatography tandem mass spectrometry (LC-MS/MS), we show that Synapsins from embryonic murine brain interact with the phosphoprotein regulator 14-3-3 ϵ . Furthermore, we identified a number of phosphorylation sites in Synapsins when Synapsins were complexed with 14-3-3 ϵ . Our data suggest that the interaction between Synapsins and 14-3-3 ϵ is dependent on the phosphorylation state of Synapsins. A portion of Synapsin III expressed in Human Embryonic Kidney 293 Cells can interact with 14-3-3 ϵ . This provides a system to study the effect of site-specific mutagenesis of putative sites of phosphorylation in Synapsin III that may be critical for its interaction with 14-3-3 ϵ . Once critical phosphorylation sites are identified, the role these sites may play in the trafficking of pre-synaptic vesicles will be examined.



Scudder, Jennifer

Major: Animal Science; Advisor: Matthew Waldron

Colicin and EDTA have Additive Antimicrobial Effects Against E.coli in Milk

Mastitis is an inflammation of the mammary gland of cows that costs the dairy industry about 2 billion dollars per year. Colicins are antimicrobial proteins produced by some strains of E. coli that are toxic to other strains of E. coli. Some milk components can inhibit colicin activity; however, these can be displaced by the addition of EDTA. The objective of the current study was to determine the efficacy of purified colicin E1 (ColE1), EDTA, and a ColE1/EDTA combination against mastitis-causing E. coli strains in several media. When E. coli were incubated in growth medium, whole or skim milk, certain combinations of ColE1 and EDTA resulted in killing and complete growth inhibition of bacteria. Taken together, these results show that a ColE1/EDTA combination is an effective antimicrobial in bovine milk.

Sitnikov, Lilya

Major: Psychology; Advisor: Jill Holm-Denoma

Internalization of the Thin Ideal among Ethnically Diverse Women

The current study highlights the importance of considering cultural variables in the assessment and diagnosis of eating disorders. Historically, women from ethnic minority groups, particularly Black women, were thought to be buffered against the thin ideal standards of American culture. Hispanic and Black women were expected to experience less body dissatisfaction, both due to cultural identity that espouses larger and more attainable body ideals and to less cultural pressure to conform to the White thin-ideal standards of American culture. Further, it has been suggested that rates of eating disorders among women from ethnic minority groups are also impacted by acculturation. Prior research indicates that acculturation may propel the adoption of mainstream U.S. body type ideals among Hispanic and Black women, such that eating disorder symptoms increase as levels of acculturation increase. The present study examined the interrelationships among body image ideals, acculturative stress, and eating pathology in a sample of ethnically diverse college women. Preliminary analyses revealed that White women, as compared to Black and Hispanic women, selected slimmer body figures for their ethnic group's ideal and were at a higher risk for eating disorder symptoms. Black and Hispanic women who had personal ideal body shapes that were congruent with their perception of their ethnic group's ideal shape endorsed fewer bulimic symptoms and were less likely to strive to attain the White thin-ideal standards of American culture than Black and Hispanic women who endorsed a personal ideal body shape that was slimmer than their ethnic group's ideal. Moreover, among Black and Hispanic women, higher levels of acculturative stress were associated with higher rates of bulimic symptom endorsement. Findings underscore the importance of considering level of acculturation and internalization of the U.S. majority group's thin ideal as risk factors for eating pathology among women from ethnic minority groups.

Stebbins, Emily

Major: CDAE; Advisor: Qingbin Wang

Feasibility of Small-Scale, On-Farm Biodiesel Production: A Vermont Case Study

Rising prices of diesel fuel, No. 2 heating oil, and livestock feed are threatening the viability of many Vermont farms. As a result, more and more farmers, communities, policymakers, and entrepreneurs are beginning to explore the local production of substitutes for petroleum-based fuels and imported livestock feed. Vermont-grown oilseed crops, such as soybeans, sunflowers, and canola, can provide local feed, fuel, and food products for local use. Locally owned, community- and/or farm-based biofuels and feed/food projects could generate revenue and alternative sources of livestock feed and liquid fuel for farmers, while helping to create job opportunities, localize energy production, and protect and improve Vermont's natural and social environments. Although some Vermont farmers have grown soybeans for feed for quite some time, growing other oilseed crops, and in quantities sufficient for biodiesel production and/or livestock meal, is very new in Vermont. Farmers and biodiesel enthusiasts have been excited about the potential for local oilseed products, but the full extent of the equipment, capital, and acreage needed to successfully grow, harvest, and process these crops has been unknown. This oilseed technical and economic feasibility study explores whether Vermont farmers could



Stebbins, Emily (cont.)

sustainably, economically, and competitively produce some portion of Vermont's liquid fuel and livestock feed demand. This research investigates technical questions related to producing oilseeds and biodiesel on Vermont farms, and estimates costs and returns for oilseed, livestock meal, and biodiesel enterprises based on current market prices and on-farm data.

Stevens, Tucker

Major: Civil and Environmental Engineering; Advisor: Britt Holmen

Kinetics and species formation for the heterogeneous reaction of PAHs and ozone on glass fiber filters and diesel particulate matter

Particulate matter (PM), found in high concentrations in diesel exhaust, is harmful to human health and the natural environment. Polycyclic aromatic compounds (PAHs), a class of organic compounds formed during combustion, are present on the surface of vehicle-derived PM and some PAHs are carcinogenic. Once emitted into the atmosphere, "aging" of these PAH chemicals adsorbed to diesel particles can occur to form more carcinogenic or more mutagenic species. A thermal desorption / gas chromatography / mass spectrometry analysis technique was used to quantify: (1) PAH concentrations and (2) new species formation via heterogeneous PAH/ozone reactions on Teflon-coated glass fiber filters. The kinetics of PAH degradation is a function of individual compound properties. Four more polar species were identified. Future work will apply the technique to "real world" diesel exhaust, and is aimed at developing a more comprehensive understanding of diesel particle aging and its associated toxicity. A comparison of PM emissions from biodiesel to petroleum-diesel will quantify: the types of PAH compounds formed (because toxicity varies between individual compounds), kinetics of PAH reactions, and chemical species formed via PM surface heterogeneous reactions with atmospheric species such as ozone.

Tran, Tri Minh

Major: Computer Science; Advisor: Byung Lee

Adaptive Join Query Processing on Distributed Data Streams

We address the problem of processing a join query over distributed data streams. If the stream statistics and system conditions change significantly in the distributed environment, an optimal distributed join execution plan generated by the query optimizer may become sub-optimal. Thus, to maintain the optimality of the join execution plan, it is necessary to adjust the plan adaptively as the changes occur. Using a centralized optimization approach for this would incur a significant communication overhead, as it requires the individual nodes to send the information about the environment change to the optimization node and the optimization node to disseminate the modified plan to the individual nodes. Thus, we use a distributed local optimization approach. In this approach, each node monitors the environment and, if and when the changes exceed certain thresholds, sends a message and the necessary information to neighboring nodes which then make a local decision on whether and how to adjust its portion of the join execution plan. For this, specifically, we introduce the notion of a node operator set, which is the set of operators needed at each node to execute the distributed join query, and present two distributed local optimization algorithms for individual nodes: to generate the initial node operator set and to adjust the set locally when the changes exceed the thresholds. Both algorithms guarantee a globally optimal join execution plan. We also discuss the technique for migrating the local node operator set to a new set when the local plan changes.

Trotman, Winifred

Major: Pathology; Advisor: Ted Bovill

Valves of the Deep Venous System: An Overlooked Risk Factor

The valves of the deep venous system were identified as major sites of initiation of deep venous thrombosis in the 1950s. Stasis in the valves has been associated with increased hematocrit, lower pO₂ and the presence of local eddy currents. However, the contribution of venous endothelium to thrombosis risk has received little attention. In recent years, several publications have emphasized the importance of endothelial heterogeneity in different vascular beds. We hypothesized that the endothelium of the valve sinuses would differ from the non-valvular venous wall, with up-regulation of anticoagulant and down-regulation of procoagulant activities, thus acting as a deterrent to venous thrombosis. In pursuit



Trotman, Winifred (cont.)

of this hypothesis, we used laser scanning confocal microscopy to investigate the immunofluorescent labeling of endothelial protein C receptor (EPCR), thrombomodulin (TM) and von Willebrand Factor (VWF) in saphenous veins obtained from cardiac bypass surgery (CABG). Representative areas of each vein specimen, including valvular and non-valvular venous wall, were chosen for paraffin embedding. Six areas of vessel wall, measuring 150 μm in length were demarcated on captured images using MetaMorph image analysis software. Observational fluorescent intensity scores (0-5) were assigned to each of 6 representative areas, including venous vessel wall just distal to the valve and two adjacent segments at the junction of the valve leaflet and venous wall at the bottom of the valve sinus. Preliminary data indicate that the procoagulant / anticoagulant balance differs significantly between the valvular and non-valvular venous wall; the venous sinus shifted to a thromboresistant phenotype. Variation in venous sinus thrombo-resistance may be an important factor in venous thrombogenesis. Further studies of this overlooked risk factor appear to be warranted.

Wardell, Chris

Major: CDAE; Advisor: Ken Bauer

Effectiveness of a Grassroots Soccer Curriculum in St. Lucia

St. Lucia is a small Caribbean Island in the West Indies with a total land area of 616 sq km and a population of approximately 160,000 people. Currently, St. Lucia's HIV prevalence rate is at .12%, but due to gross underreporting it is estimated that this rate is much higher. As of 2006, there have been 452 reported HIV infections in St. Lucia in which 238 persons (53%) have progressed to AIDS. 217 persons (91%) have died from AIDS related illnesses. This research aims to analyze the appropriateness of a HIV/AIDS education campaign in St. Lucia modeled after the very successful Grassroot Soccer program that has been implemented in other countries throughout the world. Grassroot Soccer uses soccer as a medium to educate youth with knowledge and skills to live HIV free. Currently, there is a variety of HIV/AIDS prevention programs that are being implemented in St. Lucia by various government and non-government organizations. By interviewing and surveying individuals involved in these ongoing programs, it will be determined how this Grassroot Soccer program will fill current gaps in HIV/AIDS prevention in St. Lucia. From January 7-10, 2008, a small introductory Grassroot Soccer program was implemented in two schools in St. Lucia. In the summer of 2008, a full scale Grassroot Soccer program will be implemented on the island for approximately four weeks. After all potential stakeholders been through or observed the implementation the HIV/AIDS prevention program, they will be able to determine the effectiveness of the program. Results from this research will be of use to ministry officials, schoolteachers, community leaders, parents, and children seeking to address the needs of HIV/AIDS prevention/education. The results will also serve as a monitor on how effective the Grassroot Soccer program is in St. Lucia

Wilkerson, Galen

Major: Natural Resources; Advisor: Austin Troy

Heredia Declaration on Payment for Ecosystem Services

Ecosystem services, (ES) are the benefits humans derive from ecosystem functioning, and the natural capital assets that produce them. ES represent a significant contribution to sustainable human well-being - larger than the contribution of marketed goods and services. The dominant economic paradigm does not adequately recognize these contributions and we therefore need to develop a new, more comprehensive paradigm. ES are being threatened and degraded by human activities. As ES cannot (or should not) be privately owned, numerous ES are therefore ignored by conventional markets. Many ES are such that providing benefits to one person does not reduce the amount of benefits available for others (they are "non-rival"), and therefore they should be provided cooperatively and not competitively. There are and will remain enormous uncertainties about how ES are provided, the magnitude of their benefits, and how human activities affect their provision. Stakes are high, the potential for irreversible outcomes are high, and a precautionary approach to decision-making should therefore be adopted. Adaptive institutions need to be developed to adequately deal with ecosystem services and trade-offs among services so that their contributions to human well-being can be sustained and enhanced. Systems of payment for ecosystem services (PES) can be one effective element in these institutions.

**Wo, Songtao**

Major: Physics; Advisor: Randall Headrick

Large Grain Size Solution Processed TIPS-pentacene Thin Films

We present a study of the mobility of TIPS-pentacene thin film transistor using a novel hollow pen solution method. By using this method we can control the orientation of the thin film crystal and the crystal grain size, thus we intentionally arrange the crystal to be across the channel or parallel with the channel. Microscope with polarized and dark field was used to study the morphology and structure of the thin film transistor. We demonstrate that large domains are obtained for TIPS-pentacene films deposited from 0.5 - 4.0 weight percent solutions with toluene. Crystalline grains with (001) orientation are observed to grow with sizes that can exceed one millimeter along the writing direction. TIPS-pentacene film grown by this method yielded significant variations in morphology by tuning the concentration and speed, resulting in different mobility that could be correlated with the crystal structure and orientation. A preferred azimuthal orientation is also selected by the process, resulting in anisotropic field effect transistor mobility in the films. The anisotropy of the mobility of different orientation for TIPS-pentacene is between 3~10. The best field effect mobility we got is $0.11 \text{ cm}^2/\text{v.s.}$ Atomic force microscope was used to investigate the grain boundary, layer by layer structure was found indicating the growth mechanism.

Woodward, John

Major: CDAE; Advisor: Joshua Farley

Opportunity in Crisis: The Dollar Standard Demise and Local Finances

State and Municipal budgets are forecasted and enacted largely without reference to trends in international financial flows. Yet the ability of state and local governments to tax, borrow and spend always depends on monetary policy that must consider exchange rate fluctuations caused by deficit spending and corresponding balance of payments surpluses. The entrenchment of the dollar as the primary reserve currency for international trade and finance has enabled the United States to run chronic current account and government deficits without a proportional depreciation in its currency's international exchange value. The recycling of dollar surpluses by foreign investors and Central Banks into US Treasury securities simultaneously keeps extreme foreign currency appreciation in check and frees domestic savings to be invested in financial assets like stocks, real estate, and securitized debt instruments. State and local fiscal management has come to rely increasingly on the asset inflation enabled by these financial flows, which keep American interest rates low and reduce the need for federal tax revenues to cover continued government spending. But "dollar hegemony" rests on shaky ground, having already persisted beyond the ability of the US to repay its foreign creditors, short of monetizing its obligations. As Treasury Security investments by foreign dollar holders return progressively less value in local currencies, we can expect the gradual dissolution of the de facto dollar standard of the post-Bretton Woods "non-system." The aim of this paper is to explain the linkages between local budgeting and international monetary dynamics and to analyze the range of possible impacts a flight from the dollar will have on the finances of Vermont towns and cities. Budget forecasts and policy recommendations will be made for a variety of anticipated scenarios, the worst of include the unpayable debts and drastically reduced tax bases associated with a deflating money supply.

Yang, Chun

Major: Biology; Advisor: Rona Delay

The involvement of chloride channels in pheromone response of mouse VSNs

In many mammals, the main olfactory epithelium (MOE) and vomeronasal organ (VNO) are the organs that detect general odorants and pheromones. In the olfactory sensory neurons (OSNs), up to 90% of the odor-induced response is carried by a calcium-activated chloride current. Here, we are interested in investigating if this current is also present in vomeronasal sensory neurons (VSNs). Vomeronasal neurons detect pheromones or odorants by G-protein coupled receptors present in the microvilli. Following the pheromone or odorant binding, these GTP bound G proteins activate phospholipase C (PLC), which transduces signals downstream via the second messenger diacylglycerol (DAG). DAG activates transient receptor potential isoform 2 (TRPC2) channels and an influx of cations depolarize the cell. Arachidonic acid (AA) which is catalyzed by DAG lipase from DAG, directly activates the calcium-dependent nonselective cation channel (CaNS channel) and causes a further amplification of the signal. Our preliminary studies show VNOs possess a voltage activated chloride current. Further, application of diluted urine (1:500) elicited a response that was partly carried by chloride ions



Yang, Chun (cont.)

since two chloride channel blockers, niflumic acid (300uM) and 4,4'-diisothiocyanatostilbene-2,2'-disulfonic acid (DIDS) (300uM), significantly decreased the urine induced response. In addition, chloride imaging using isolated VSNs also showed changes of intracellular chloride concentrations in response to diluted urine or 20uM 1-oleyl-2-acetyl-sn-glycerol (OAG). These results suggest that chloride current plays a role in modulating the signal from pheromones or odorants. Our future studies would focus on determining if the chloride current is calcium dependent.

Yoon, Yone Jung

Major: Biology; Advisor: Miguel Martin-Caraballo

Effect of pharmacological blockade of synaptic activity on motoneuron

Ongoing electrical activity plays a critical role in the functional development of the nervous system. In the chick lumbar spinal cord, spontaneous electrical activity begins at embryonic day (E) 4, before target innervation of hindlimb muscles. The neuronal circuits generate spontaneous activity at early stages of development (between E4-E6) rely solely on cholinergic and GABAergic neurotransmission. At later stages of development (>E8), however, network activity is driven by glutamate and GABA, suggesting that there is a developmental switch in neurochemical transmission in the spinal cord. In this study, we examine the role of chemical transmission in the chick spinal cord and its effect on motoneuron survival. Chemical neurotransmission was altered by various receptor inhibitors including CNQX, MK-801 and mecamylamine during E5-E10. Control was treated with saline solution used for dissolving each drug. Motoneuron survival was assessed at E8 or E10 by counting the number of islet-positive neurons in the ventral spinal cord. Our results show that application of the AMPA receptor blocker CNQX causes a significant increase in motoneuron survival when applied between E5 and E8, but not between E8 and E10. On the other hand, inhibition of NMDA receptor function with MK-801 between E5 and E8 did not have any effect on the number of islet-positive neurons. Application of MK-801 between E8 and E10 caused a significant decrease in motoneuron survival, suggesting that glutamate activation of NMDA receptor promotes motoneuron survival at later stages of development. In addition, we observed a significant increase in motoneuron survival following application of the neuronal acetylcholine receptor blocker mecamylamine. Application of the GABA receptor agonist muscimol causes a significant increase in motoneuron survival by E10. These experiments demonstrate that blockade of chemical neurotransmission in the chick spinal cord plays a critical role in the regulation of motoneuron survival at different stages of development.

Yu, Chunxiao

Major: MMG; Advisor: Keith Mintz

Structural Analysis of a Collagen Binding Protein of a Periodontopathogen

Bacterial adhesion to host tissue is an essential step to initiate infections. Collagen is the most abundant protein of the human body. The binding of bacteria to collagen is an established virulence factor. Recently, EmaA (extracellular matrix protein adhesin A), (202kDa) was identified as a collagen binding protein of *Aggregatibacter actinomycetemcomitans*, a bacterium associated with localized aggressive periodontitis and other serious human infections such as endocarditis. Electron microscopy studies from negatively stained whole mount preparations of bacterial cells have shown that EmaA oligomers form antenna-like appendages on the surface of the bacteria. The appendages contain an ellipsoidal-end domain of axial dimensions 2.8 nm by 4.6 nm and a stalk of at least 150 nm in length and 4.1 nm in diameter, which often bends at about 24 nm from the ellipsoidal domain. The functional analysis of in-frame mutants of EmaA has localized the collagen binding activity to the N-terminal domain (amino acids 70-386), which forms the ellipsoidal structure at the distal end of the appendages. Electron tomography studies of negatively stained whole mount bacteria are being pursued to acquire 3D structural information on these surface antenna-like appendages to obtain a better understanding of the interaction mechanism of EmaA with collagen. Specimens were visualized on an electron microscope, operating at 42,000 nominal magnification. Single-axis tilt-series, covering an angular range from -70° to $+70^\circ$ in 2° angular increments, were recorded on a CCD camera. All the images in each tomographic series were aligned to a common origin, and 3D tomograms of the bacteria were reconstructed for each series using weighted backprojection algorithms. Volumes containing single EmaA structures were windowed out and the EmaA appendages were segmented from the volumes. EmaA appendages are being aligned to a common orientation and merged to obtain a higher resolution 3D structure of the EmaA adhesin.



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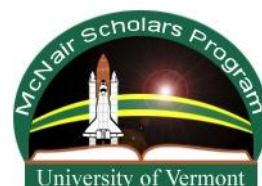
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