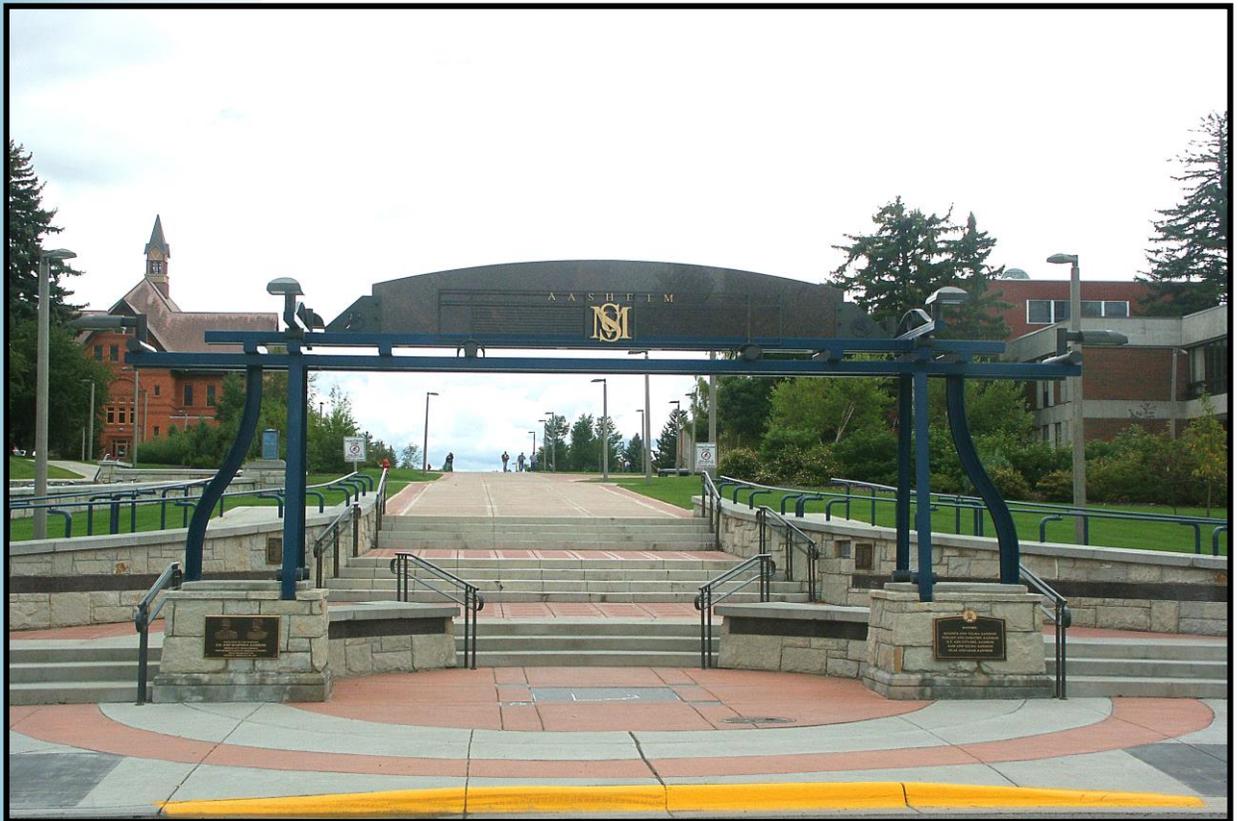




# 2011 MSU STUDENT RESEARCH CELEBRATION

April 14, 2011



*\*Photo Courtesy of Stephen Hunts, Montana State University*

MONTANA STATE UNIVERSITY



The Undergraduate Scholars Program Would Like to  
Thank the Following Organizations for Sponsoring the  
2011 Student Research Celebration:

GOLD SPONSORS (\$1,000-\$5,000)

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McNair Scholars Program  
Center for Biofilm Engineering  
Montana Space Grant Consortium  
Astrobiology Biogeocatalysis Research Center  
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American Indian Research Opportunities (AIRO)

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Special Thanks To:

*The Office of the Provost &*

*The Office of the Vice Provost for Graduate Education*

For their Assistance in Planning and  
Organizing Today's Event!

# The Undergraduate Scholars Program Would Like to Acknowledge the Following Organizations for their Continued Support of Undergraduate Research:



Montana INBRE Program

Montana EPSCoR Program



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AND

Montana State University



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\*College of Agriculture

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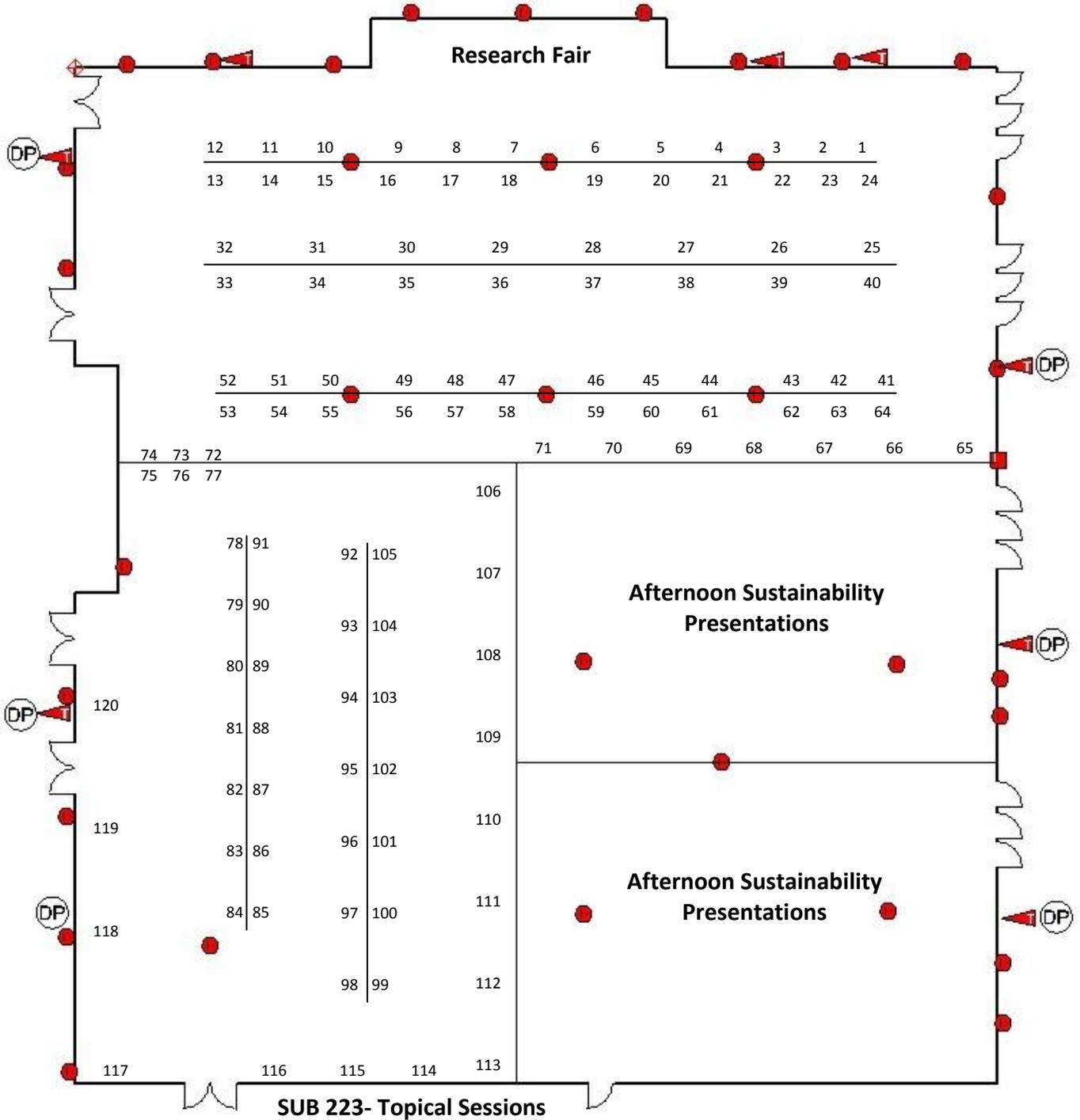
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# Conference Map





# Topical Sessions

Thursday April 14, 8:30am-3:40pm  
SUB Conference Room 233

## ANCIENT LANGUAGES AND MODERN VISIONS: PRAISE, FANTASY AND ANALYSIS IN THE HUMANITIES—8:30-9:50AM

*Humanities students explore diverse topics including discourse analysis of firefighting, an original song of praise sung in a vanishing language, the most ancient English poem and a new fantasy fiction opus.*

**8:30 - Angie Ford, English (Dr. Doug Downs)**

*Dynamic Activity Requires Dynamic Study: In Activity Analysis of Firefighting, Status Quo Methods Can't Take the Heat*

**8:50 - Diveena Marcus, Native American Studies (Dr. Matt Herman)**

*She Loves Us*

**9:10 - Jenny Thornburg, English (Dr. Jerome Coffey)**

*The Dream of the Rood*

**9:30 - Eric Lake, Math (Dr. Kris Ellingsen)**

*Rebirth*

## MCNAIR SCHOLARS PROGRAM—10:00-11:30AM

### RESEARCH SYMPOSIUM

*This year's oral session showcases the research accomplishments of a select group of McNair Scholars presenting an array of topics including sociology, biochemistry, engineering, resource conservation and ethics of international 'voluntourism'.*

**10:00 - Lotus Torre, Sociology (Dr. Graham Austin)**

*Thrifting: Secondhand Branding and Hedonic Consumption*

**10:15 - Kelsey Guffey, Natural Resources Conservation (Dr. Clayton Marlow)**

*Foraging Ecology of Bison in a Mixed Grassland-Steep Ecosystem*

**10:30 - Dewey Brooke, Biochemistry (Dr. Brian Bothner)**

*Analysis of Phospholipase Activity in Adeno-Associated Virus Particles by Liquid Chromatography/Mass-Spectrometry*

**10:45 - Jordan Kennedy, Engineering (Dr. Jennifer Brown)**

*Rheological Characterization of Thermally Reversible Gels*

**11:00 - Zac Morris, Engineering (Dr. Robert Mokwa)**

*Nondestructive Measurements of Geomaterials Using X-Ray Computed Tomography: Some Practical Applications*

**11:15 - Shelby Rogala, History (Dr. Kristen Intemann)**

*Establishing an International Voluntouring Ethic*

## HUGHES UNDERGRADUATE BIOLOGY PROGRAM—2:00-3:40PM

### EXTENDING UNDERGRADUATE RESEARCH THROUGH EDUCATION AND OUTREACH

*Some of MSU's top bioscience students share their experiences reaching out to novel or underserved populations through science.*

**2:00 - Dema Alniemi, Cell Biology and Neuroscience (Dr. Edward Dratz).**

*Working with Elementary Students to Explore Where Germs Grow and How They Are Shared*

**2:20 - Andy Freund, Cell Biology and Neuroscience (Dr. Frances Lefcort)**

*Analyzing Chick Embryos with Elementary Students to Understand How Organisms Develop*

**2:40 - Kate Morrissey, Chemical Engineering (Dr. Valerie Copié)**

*Connecting Undergraduate Students with Graduate Mentors in Science and Engineering Fields*

**3:00 - Alta Howells, Chemistry and Biochemistry (Dr. John Peters)**

*Introducing High School Students to Some of the College Opportunities Available to Students Pursuing Bioscience and Pre-Health Fields*

**3:20 - Sydney Reichhardt, Cell Biology and Neuroscience (Dr. Christa Merzdorf)**

*Exploring Genes And DNA with Participants in the Big Brothers/Big Sisters Program*

2011 Student Research Celebration  
 April 14, 2011

## MORNING POSTER PRESENTATIONS

SUB Ballrooms A and D  
 9:00am-12:00pm

Student, Mentor, Project	Poster #	Abstract Page #
<b>Kemal Akkoyun, Chris Allen:</b> Environmental Science and Environmental Engineering Catherine Zabinski, Otto Stein-- Land Resources and Environmental Studies, Civil Engineering <i>Determining the effect of carbon loading on denitrification rates in constructed wetlands</i>	1	41
<b>Gillean Arnoux:</b> Geology Todd Feeley-- Earth Sciences <i>Analysis of mafic enclaves in lavas from Uturunco Volcano, SW Bolivia to determine system heterogeneity</i>	2	68
<b>Christopher Carter:</b> Interdisciplinary Studies: Media and Geographic Identity Ann Bertagnolli-- Honors <i>Understanding Community Through Collaborative Visual Ethnography</i>	3	36
<b>Kevin Bangen:</b> Mechanical Engineering Chris Jenkins-- Mechanical and Industrial Engineering <i>Mechanical Properties of Biological Tissue with Repair</i>	4	50
<b>Edward Barge:</b> Biological Sciences Cathy Cripps-- Plant Science and Plant Pathology <i>The ectomycorrhizal genus <i>Lactarius</i> in the Rocky Mountain alpine zone</i>	5	68
<b>Alexandra Black:</b> Graphic Design Gesine Janzen-- Graphic Design <i>The American Influence</i>	6	35
<b>Lindsey Hanna, Brandon Norick:</b> Computer Science Izuritea, John Paxton-- Computer Science <i>Using Dashboard Indicators to Quantify College Effectiveness</i>	7	57
<b>Deborah Blanchard:</b> English Literature , Spanish Bridget Kevane-- Modern Languages and Literatures <i>Unmasking the Superhero: Analyzing Junot D'az's <i>The Brief Wondrous Life of Oscar Wao</i> as Multicultural Hybridity Literature</i>	8	69
<b>Caitlyn Brendal:</b> Cell Biology Neuroscience Jackson Gross-- Land Resources and Environmental Science <i>Evaluating the Effects of Cadmium on Liver Volumes of <i>Rana pipiens</i> using Magnetic Resonance Imaging</i>	9	70
<b>Tyler Bridges:</b> Paleontology David Varricchio-- Earth Sciences <i>Soft tissue or Biofilm?</i>	10	70
<b>Kristen Brileya:</b> Microbiology Matthew Fields -- Center for Biofilm Engineering <i>Colocalization of Syntrophs in a Methanogenic Biofilm</i>	11	26
<b>Daniel Barta, Krista Brundridge, Ashley Poust:</b> Paleontology, Earth Sciences David Varricchio-- Earth Sciences <i>Spheroolithid Eggs from the Cretaceous Tiantai Basin, Zhejiang Province, China</i>	12	69
<b>Jordan Drost, Chantell Bury, Ashley Poust:</b> Paleontology, Earth Sciences David Varricchio, Frankie Jackson-- Earth Sciences <i>Morphology and diagenetic alteration of an unknown oogenus from the Tiantai basin, China</i>	13	76
<b>Steve Bugni, Adie Phillips, James Connolly:</b> Environmental Engineering, Non Degree, Environmental Engineering Robin Gerlach, Al Cunningham -- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Controlling the Distribution of Microbially-Induced Calcium Carbonate Precipitation in 2-D Porous Media Reactors Under Pulse-Flow Conditions</i>	14	25

Student, Mentor, Project	Poster #	Abstract Page #
<b>Johnathan Rios:</b> Sociology and Liberal Studies Tamela Eitle, Leah Schmalzbauer, Scott Myers-- Sociology and Anthropology <i>Water Source Distance and Sustainability In Relation to the Effectiveness of Projects Conducted By the MSU Chapter of Engineers Without Borders</i>	15	88
<b>Sean Caskey:</b> Health Sciences Sheila Nielsen-Preiss -- Health Sciences <i>Osteogenic Sarcoma: A Comprehensive Review</i>	16	22
<b>Cameron Clevidence:</b> Organismal Biology, Microbiology Li Huang-- Plant Sciences and Plant Pathology <i>Identification of Gene Homologs Required for Lr21-Mediated Resistance Using Virus Induced Gene Silencing</i>	17	73
<b>David Coles:</b> Sociology Tamela Eitle-- Sociology <i>Understanding Intimate Partner Violence</i>	18	73
<b>Greg Doctor:</b> Cell Biology and Neuroscience Mentor: Christa Merzdorf, Elena Kalinina-Turner-- Cell Biology and Neuroscience <i>Investigating the Role of aqp-3b in Xenopus laevis Neurulation</i>	19	74
<b>Krista Drummond:</b> Electrical Engineering Randall Babbitt-- Physics <i>Structured Light Imaging for Deep Sea Exploration</i>	20	53
<b>Benjamin Duffus:</b> Chemistry Joan Broderick, John Peters -- Chemistry and Biochemistry <i>Carbon Monoxide and Cyanide Ligand Formation in [FeFe]-Hydrogenase Biosynthesis by the Radical AdoMet Enzyme HydG</i>	21	27
<b>Alisa Durkheimer:</b> Chemical Engineering Otto Stein-- Civil Engineering <i>Survival of Kenyans: Alternative Ways To Purify Water</i>	22	53
<b>Stefan Eccles:</b> Physics Charles Kankelborg, Christina Dunn-- Physics <i>Estimating Diffraction Effects through the Talbot Effect</i>	23	76
<b>Dustin Elliott:</b> Chemical Engineering Paul Gannon-- Chemical Engineering <i>Interfacial Interactions Among Lanthanum Strontium Manganite (LSM) and Cobalt Manganese Applied to Hitachi ZMG232L</i>	24	54
<b>Loribeth Evertz:</b> Mechanical Engineering Sarah Codd, Joe Seymour, Erik Rassi -- Mechanical and Industrial Engineering, Chemical and Biological Engineering <i>Oscillatory Flow Phenomena in Simple Fluids and Complex Fluids</i>	25	54
<b>Rebecca Fox:</b> Cell Biology and Neuroscience Laura Mentch-- Bridger Clinic <i>Sexual Health Needs Assessment of MSU College Students</i>	26	77
<b>Lauren Franco:</b> Microbiology Matthew Fields, Brent Peyton -- Center for Biofilm Engineering, Chemical & Biological Engineering <i>Molecular and Phenotypic Characterization of Three Scenedesmus Algal Isolates</i>	27	28
<b>Kathryn Gause:</b> Horticulture Mike Giroux-- Plant Science and Plant Pathology <i>Screening for Mutations in Starch Synthesis to Create High Amylose Durum</i>	28	43
<b>Pat Glatz:</b> Mechanical Engineering Ed Adams-- Civil Engineering <i>Modeling Snow Temperature in Complex Topography</i>	29	55
<b>Pat Glatz:</b> Mechanical Engineering Ed Adams-- Civil Engineering <i>Growing Atmospheric Snow</i>	30	56
<b>Isaac Griffith:</b> Computer Science and Philosophy Clemente Izuritea, John Paxton-- Computer Science <i>TrueRefactor: Towards a Completely Automated Refactoring</i>	31	56

<b>Student, Mentor, Project</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Isaac Griffith:</b> Computer Science and Philosophy Clemente Izuritea-- Computer Science <i>Concurrent Iteration Management in Ecological Systems Modeling</i>	32	56
<b>Kevin Lalli:</b> Physics Kevin Repasky-- Physics <i>Iris Student Solar Spectrograph Competition - Pilot Run</i>	33	82
<b>Rio Gonzalez:</b> Literature Michael Sexson-- English <i>Pedagogical Technology</i>	34	78
<b>Stephanie Johnson:</b> Dietetics Brian Bothner-- Chemistry and Biochemistry <i>Using Graphic Designs to Communicate Scientific Research</i>	35	48
<b>Riley Halligan:</b> Philosophy Sara Waller-- Philosophy <i>Extended Minds, Extended Technologies, and Extended Persons</i>	36	78
<b>Ryan Hannahoe:</b> Elementary Education Mary Leonard-- Education <i>Turning Eyes to the Big Sky Project</i>	37	48
<b>Jaron Hartman:</b> Physics and Biology Charles Kankelborg-- Physics <i>Characterization of the MOSES Hollow Cathode Lamp Light Source</i>	38	79
<b>Saiichi Hashimoto:</b> Computer Science Brendan Mumey-- Computer Science <i>Routing and Adaptive Power Control for Green Networking</i>	39	58
<b>Sonny Hawk:</b> Soil and Water Sciences Dr. Jackson Gross-- United States Geological Survey, Northern Rocky Mountain Science Center <i>Impacts of Sound Pressure Levels on Snake River Cutthroat Trout (<i>Oncorhynchus clarkii</i>) Life History Stages</i>	40	43
<b>Tyler Hinshaw:</b> Health Sciences Elizabeth Kinion, Sheila Nielsen-Preiss -- Nursing, Health Sciences <i>Diabetes and Periodontal Disease in Native American Communities</i>	41	23
<b>Elsa Howard:</b> Psychological Sciences Ian Handley-- Psychology <i>Placebo Effect, A Matter of Motivation?</i>	42	79
<b>Jordan Holsinger:</b> Microbiology Matthew Fields -- Center for Biofilm Engineering <i>Rate comparisons for phototrophic and heterotrophic growth in algal strain CHLOR-1 isolates</i>	43	28
<b>Logan Triplett:</b> Film James Joyce-- Film <i>Modern Exposure: The Art of Exposure for the Digital Sensor</i>	44	41
<b>Luke Humphrey:</b> Mechanical Engineering Ahsan Mian-- Mechanical Engineering <i>Investigation of the Sensor Properties of Two-Dimensional Graphene Sheets</i>	45	58
<b>Carla Hutson:</b> Pre-Veterinary Christa Merzdorf-- Cell Biology and Neuroscience <i>Are the "wings" of zic1 expression part of the premigratory neural crest?</i>	46	44
<b>David Arnar Runolfsson:</b> Photography Kyle Bajakian-- Film and Photography <i>Whaling: The Future of an Endangered Tradition</i>	47	39
<b>Cayman Irvine:</b> Physics Petrus Martens, Rafal Angryk-- Physics, Computer Science <i>Assessing the Accuracy of Computer Feature Recognition Methods for Solar Imagery</i>	48	80
<b>Zachary Krehlik:</b> Ecology and Evolution Robert Sharrock, Ted Clack-- Plant Sciences and Plant Pathology <i>Attempted Crystallization of the Histidine Kinase-Related Domain of Phytochrome B</i>	49	81

Student, Mentor, Project	Poster #	Abstract Page #
<b>Dustin Kuipers:</b> Liberal Studies Walter Fleming-- Native American Studies <i>Cosmology of Incarceration</i>	50	99
<b>Jamie Krushensky, Alice Hecht ,Drew Dewolf, Camilla Armijo-Grover, Heather Smart:</b> Sociology, Economics, Equine Science, Wendy Stock-- Agriculture Economics and Economics <i>Academic Student Success within an Introductory Economics Course: A Gender Based Study</i>	51	81
<b>Jamie Krushensky:</b> Sociology Tamela Eitle-- Sociology and Anthropology <i>Gendered Social Constraints on Leisure Participation</i>	52	82
<b>Trevor Lane:</b> Chemical Engineering Hugo Schmidt-- Physics <i>Transition Element Doping of Proton Conducting SOFCs</i>	53	59
<b>Cassandra Langr:</b> Molecular Biosciences Michael Babcock -- Psychology <i>Ischemic Gerbil Model: Object and Spatial Recognition</i>	54	29
<b>Aubrie Ler:</b> Cell Biology and Neuroscience, Health Science Sheila Nielsen-Preiss -- Health Sciences <i>Diabetic Retinopathy as an Ocular Manifestation of Diabetes Mellitus</i>	55	30
<b>Elyse Lovell:</b> Adult and Higher Education Marilyn Lockhart, Betsy Palmer, Carrie Myers -- Education <i>An Enhanced Understanding of Motivational Factors for Students Who Are Parents</i>	56	24
<b>Lauri McCarthy:</b> Nursing Elizabeth Kinion-- Nursing <i>Parents' Knowledge of Healthy Dental Habits for Pre-schoolers</i>	57	98
<b>Kyle Murray:</b> Geology Colin Shaw-- Earth Science <i>Study of the Savage Peak Shear Zone</i>	58	85
<b>James McKinney:</b> Cell Biology and Neuroscience and Biochemistry Sheila Nielsen-Preiss-- Cell Biology and Neuroscience <i>Candida albicans and the Effects of Low-Shear Modeled Microgravity on Virulence and Pathogenesis</i>	59	84
<b>Taisha McWilliams:</b> Cell Biology and Neuroscience Kristin Juliar, Renee Harris-- Health Sciences <i>Montana Health: Growing in Your Backyard</i>	60	84
<b>Elizabeth Miller:</b> Cell Biology and Neuroscience Lynn Hellenga, Elizabeth Bird-- Nutrition and Physical Activity Program (NAPA) <i>Montana Breastfeeding Initiative: The Extent of Implementation of the 2011 Surgeon General's Call to Action</i>	61	85
<b>Dewey Brooke:</b> Chemistry and Biochemistry Brian Bothner, Brad Poore, Navid Movahed, Mavis Agbandje-McKenna (University of Florida)-- Chemistry and Biochemistry <i>Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry</i>	62	71
<b>Kevin Murray:</b> Biochemistry Robert Szilagyi-- Chemistry and Biochemistry <i>PHYSICAL CHEMICAL STUDY OF Ni-S SYSTEM WITH PREBIOTIC RELEVANCE</i>	63	85
<b>Adam McClure, H. Li, P. Rugheimer, E. Arenholz:</b> Physics Yves Idzerda -- Physics <i>Magnetic Properties of Single Crystal Fe<sub>1-x</sub>Gax Thin Films</i>	64	31
<b>Katya Numbers:</b> Psychology Michelle Meade -- Psychology <i>Social Contagion and Item Credibility: Is Memory Accuracy Determined by Item Accuracy?</i>	65	32
<b>Kristen O'Brien:</b> Environmental Horticulture William Hoch-- Plant Sciences and Plant Pathology <i>Production of Tetraploid Russianolive (Elaeagnus angustifolia) for Use in Development of Sterile Horticultural Varieties</i>	66	45

Student, Mentor, Project	Poster #	Abstract Page #
<b>Patric O'Hara:</b> Physics Charles Kankelborg-- Physics <i>Updating Software for the Multi-Order Extreme Ultraviolet Spectrograph</i>	67	86
<b>Alison O'Neil:</b> Biochemistry Trevor Douglas -- Chemistry and Biochemistry <i>Genetically Programmed in vivo Packaging and Controlled Release of Protein Cargo from Bacteriophage P22</i>	68	32
<b>Kristen Orelup:</b> Biomedical Science Mensur Dlakic-- Microbiology <i>Detecting protein interactions in Bacteria using Gateway vectors and fluorescence complementation</i>	69	86
<b>Janice Ostermiller:</b> Nursing Karen Zulkowski-- Nursing <i>The Effect of Fluoride Levels in Public Water Supplies on Dental Caries</i>	70	98
<b>Elle Pankratz:</b> Biological Engineering Brent Peyton, Natasha Mallette-- Chemical and Biological Engineering <i>Ascocoryne sarcoides: Exploration of Hydrocarbon Production Potential</i>	71	61
<b>Mellie Park:</b> Biochemistry Hien Nguyen, Matt Mckay (University of Iowa)-- Chemistry <i>Urea-Linked Cyclodextrin Analogues</i>	72	87
<b>Nikitaben Patel:</b> Biotechnology, Veterinary Molecular Biology Dr. Katherine Gauss-- Immunology and Infectious Diseases <i>Develop PLAGL2 oncogenic myeloid cell line model</i>	73	45
<b>Steven Paulson:</b> Chemical Engineering Ross Carlson-- Chemical and Biological Engineering <i>Construction and Characterization of Metabolically Engineered Escherichia coli Biofilm Communities</i>	74	62
<b>Vladimir Perga:</b> Psychology Michelle Meade-- Psychology <i>Correct Contagion of Memory in Young and Older Adults</i>	75	87
<b>Shefah Qazi:</b> Biochemistry Trevor Douglas -- Chemistry and Biochemistry <i>Enhanced Relaxivity and In Vivo Imaging of Macrophage-Rich Carotid Lesions with Protein Cage Based T1-Contrast Agents</i>	76	32
<b>Kalen Ramey:</b> Civil Engineering Otto Stein-- Civil Engineering <i>Water Projects in Khwisero Kenya</i>	77	62
<b>Luke Rothschild:</b> Philosophy Mentor: Prasanta Bandyopadhyay-- Philosophy <i>Investigating a Pragmatic Account of Simpson's Paradox</i>	78	89
<b>Brett Sather:</b> Land Rehabilitation Catherine Zabinski-- Land Resources and Environmental Sciences <i>N<sub>2</sub>O Greenhouse Gas Losses from Three Forms of Nitrogen Fertilizer</i>	79	46
<b>Amy Servid:</b> Biochemistry Trevor Douglas -- Chemistry and Biochemistry <i>Protein Cage Nanoparticles and Associated Protection against Respiratory Viruses</i>	80	33
<b>Barinderjit Singh:</b> Biomedical Science Jamie Sherman-- Plant Sciences and Plant Pathology <i>Genetic Validation of Quantitative Trait Loci for Wheat Stem Sawfly Attraction in Montana Spring Wheat</i>	81	90
<b>Aaron Smith:</b> Health Sciences Sheila Nielsen-Preiss -- Health Science <i>Improving care and outcomes: A program to increase health care adherence among college students</i>	82	23
<b>Erin Smith:</b> Biochemistry Jean Starkey-- Microbiology <i>The Role of Mesenchymal Stem Cells in a Rabbit Transplantable Carcinoma</i>	83	90

Student, Mentor, Project	Poster #	Abstract Page #
<b>Joseph Steffens:</b> Chemistry, Cell Biology and Neuroscience Brian Bothner-- Chemisty and Biochemistry <i>Activity Based Protein Profiling with Sulfolobus solfataricus</i>	84	91
<b>Caleb Stoltzfus:</b> Physics Randall Babbitt-- Physics <i>Mid-IR DIAL</i>	85	91
<b>Aaron Street:</b> Chemical and Biological Engineering Robert Cramer-- Immunology and Infectious Diseases <i>Metabolism Modeling of Aspergillus fumigatus</i>	86	65
<b>Michael Tarrant:</b> Music Technology Kristi McGarity-- Music <i>Recording Soundscapes: Butte</i>	87	40
<b>Kamlynn Thomas:</b> Physics and Mathematics Aleks Rebane-- Physics <i>Relationship Between Two-Photon Absorption and Dipolar Properties in a Series of Fluorenyl-Based Chromophores</i>	88	91
<b>Jacob Trudnowski:</b> Chemcial Engineering Zeb Barber-- Spectrum Lab <i>Pressure Induced Wavelength Shift Calibrations</i>	89	66
<b>Elizabeth Van De Grift:</b> Cell Biology and Neuroscience Laura Mentch-- Bridger Clinic <i>Clinic Efficiency</i>	90	92
<b>Laura Villegas:</b> Economics and Political Science Linda Young-- Political Science <i>Developing under the curse of Coltan</i>	91	93
<b>Tristany Wagner:</b> Land Resources and Environmental Sciences Jackson Gross-- USGS <i>The Impacts of Seismic Technologies on Fisheries</i>	92	47
<b>Ana Baselga:</b> Aeronautical Engineering Chris Jenkins—Mechanical and Industrial Engineering <i>Ballistic Spore Dispersal as a Bio-Inspired Concept for Satellite Cluster Deployment</i>	93	50
<b>Christina Watts:</b> Mathematics Elizabeth Burroughs-- Mathematical Sciences <i>Modeling the Effects of Predator Exclosures on the Western Snowy Plover</i>	94	94
<b>Hannah Willis:</b> Biology David McWethy-- Earth Sciences <i>Fire and climate history of central Mozambique during the past 100-200 years</i>	95	95
<b>Thomas Wright:</b> Biochemistry Martin Teintze-- Chemistry <i>Antibacterial Activity of Guanides, Biguanides and Phenylguanides</i>	96	96
<b>Kaysha Young:</b> Mechanical Engineering and Mechanical Engineering Technology Laura Stanley-- Mechanical and Industrial Engineering <i>Hands Free Texting While Driving - Is it Safer than Conventional Texting While Driving?</i>	97	67
<b>Oliwia Zurek:</b> Immunology and Infectious Diseases Trevor Douglas, Allen Harmsen -- Chemistry and Biochemistry, Veterinary Molecular Biology <i>Letting Viruses Do the Work: In Vivo Selection for a P22 Capsid with Long Blood Half-life and Lung Residency</i>	98	22
<b>Dema Alniemi:</b> Cell Biology and Neuroscience Edward Dratz-- Chemistry and Biochemistry <i>Development of a Method for Isolation of Phosphoproteins Using Alkaline Phosphatase Mutants</i>	99	67
<b>Andrew Freund:</b> Cell Biology and Neuroscience Frances Lefcort-- Cell Biology and Neuroscience <i>Characterization of Vascular Endothelial Growth Factor in the Developing Nervous System</i>	100	77

<b>Student, Mentor, Project</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Alta Howells:</b> Chemistry John Peters-- Chemistry and Biochemistry <i>Structural and Functional Studies of Nuclear Associated Lamin 1 Protein, Nar1, a Homolog of Lower Eukaryotic, Algal and Bacterial [FeFe] Hydrogenase</i>	101	79
<b>Sydney Reichardt:</b> Food and Nutrition Christa Merzdorf-- Cell Biology and Neuroscience <i>Expression Patterns of tnrc4, XI.25952, and XI.8933 in Early Neural Development</i>	102	49
<b>Kathryn Morrissey:</b> Chemical Engineering Valerie Copie, Laura Jennings, Pat Secor-- Chemistry and Biochemistry <i>NMR Metabolite Profiling of Bacterial Biofilms in Chronic Pressure Ulcers</i>	103	61
<b>Kathryn Morrissey:</b> Chemical Engineering Otto Stein-- Civil Engineering <i>Orange Water and Water Quality Testing in Khwisero, Kenya</i>	104	61
<b>Justin Krohn:</b> Computer Science Hunter Lloyd, John Paxton, Brock Lameres-- Computer Science, Electrical and Computer Engineering <i>Design &amp; Implementation of Communication, Control &amp; Monitoring Systems &amp; Software for MSU's 2011 NASA Lunabotics Competition Robot</i>	118	59
<b>Mark Chumrau, Scott Mooney:</b> Mechanical Engineering Vic Cundy-- Mechanical and Industrial Engineering <i>Sustainable Greenhouse Heating System</i>	119	51

2011 Student Research Celebration  
 April 14, 2011

## AFTERNOON POSTER PRESENTATIONS

SUB Ballrooms A and D  
 1:00 – 4:00 pm

Student, Mentor, Project	Poster #	Abstract Page #
<b>Anuar Morales-Rodriguez, Aracely Ospina-Lopez:</b> Plant Science, Entomology Kevin Wanner-- Plant Science and Plant Pathology <i>Evaluation of four different bait traps to sample wireworms (Coleoptera: Elateridae) infesting wheat and barley crops in Montana</i>	1	21
<b>Lydia Anderson:</b> Organismal Biology David Sands, Alice Pilgeram-- Plant Sciences and Plant Pathology <i>Enhancing the virulence of a biocontrol agent</i>	2	68
<b>Taylor Bezek:</b> Political Science Linda Young-- Political Science <i>Ethnic Diversity, Oil, and Party Politics: The Evolution of three Post-Soviet States</i>	3	69
<b>Travis Craft, Melissa Dale:</b> Computer Science, Japanese, Spanish John Paxton, Clem Izurieta, Michelle Meade-- Computer Science, Psychology <i>Learning a New Language: A Technological Approach</i>	4	52
<b>Anna Bergstrom:</b> Land Resources Analysis and Management Brian McGlynn-- Land Resources and Environmental Sciences <i>Watershed and stream network geometry: Implications for water and solute fluxes from watersheds</i>	5	42
<b>Kendra Kaiser:</b> Soil and Water Sciences and Environmental Biology Brian McGlynn-- Land Resources and Environmental Sciences <i>Ecohydrology: Disturbance and the intersection of vegetation pattern and landscape structure</i>	6	44
<b>Steven Powell:</b> Fine Art Independent Project-- <i>Bio-ID Project</i>	7	38
<b>Quinn Bloom:</b> Sociology Tamela Eitle-- Sociology and Anthropology <i>Gender, water collection, and other household chores in Western Kenya</i>	8	70
<b>Genna Boland:</b> Photography Michael Ivie-- Plant Sciences and Plant Pathology <i>Photo-Documentation of the Coleoptera of Saba</i>	9	35
<b>Rosemary Cunningham:</b> English Danell Jones, Kirk Branch-- English <i>The Literary Work and Legacy of Manazar Gamboa</i>	10	74
<b>Lisa Bullard:</b> English Lisa Eckert, Doug Downs, Robert Petrone-- English <i>Influencing Others to Care about Social Justice</i>	11	27
<b>Jared Bowden:</b> Biochemistry Edward Dratz-- Chemistry and Biochemistry <i>Investigating the mystery contained in the cargo of human serum albumin</i>	12	26
<b>Katherine Burbank:</b> Chemistry Robert Szilagyi-- Chemistry and Biochemistry <i>Molecular Basis of U Toxicity</i>	13	27
<b>Abraham Burnett:</b> Economics Joseph Atwood-- Agricultural Economics and Economics <i>Traders in the Sugarscape: The Efficacy and Efficiency of Using R and Fortran for Agent-based Modeling</i>	14	72
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# 2011 STUDENT RESEARCH CELEBRATION

## *GRADUATE ABSTRACTS*

*\*Sorted by Student Major\**

### COLLEGE OF AGRICULTURE

**Anuar Morales-Rodriguez, Aracely Ospina-Lopez: Plant Science, Entomology**

**Mentor: Kevin Wanner -- Plant Science and Plant Pathology**

***Evaluation of four different bait traps to sample wireworms (Coleoptera: Elateridae) infesting wheat and barley crops in Montana***

Wireworms are the most important soil insect pest of wheat and barley in Montana. Baited pitfall traps have been used in several studies in North America for sampling wireworms in soil. Wheat, wheat/corn mixtures, oatmeal, and grain sorghum seeds as well as pieces of carrot and potato have been used as bait in underground pitfall traps. In general, wireworms were equally attracted by all baits. Baited pitfall traps used to assess absence/presence of wireworms in crops and grassland is a more labor efficient method compared to sampling soil cores. We compared underground classical pitfall, pot, stocking and canister traps in spring wheat and barley fields during the spring and summer of 2010. A total of 3245 wireworm larvae were collected from all locations and with the four pitfall traps baited with a wheat/barley mixture. Among the four traps, pitfall and stocking collected more wireworms followed by pot and canister. Seasonal distribution of the different species that were collected will be summarized.

**Jerome Schleier, Collin Preftakes: Ecology, Environmental Sciences**

**Mentor: Robert Peterson -- Land Resources and Environmental Sciences**

***The joint toxicity of three pyrethroid types to *Drosophila melanogaster****

Regulatory agencies assess the risk of pesticides based on single toxicant experiments. However environment exposures to pesticides are rarely constrained to single chemicals, but are rather a result of exposure to multiple chemicals. Generally the combinations of toxicants with similar modes of actions are modeled with additive toxicity models, however recent studies have shown that pyrethroid mixtures may have greater or less than additive toxicity in the environment. Therefore we tested the toxicity of three different pyrethroid types: type I permethrin, type II cypermethrin, and pseudopyrethroid etofenprox alone and in all combinations on *Drosophila melanogaster*. We found reduced toxicity when pyrethroid types are mixed with another type of pyrethroid. Our results support the argument that the pyrethroids are not simply modeled by additive models. Thus these concentration addition models are not appropriate for the assessment of the cumulative exposure and concomitant risks associated with multiple different pyrethroid types in the environment.

**Anna Snapp: Plant Science**

**Mentor: Chaofu Lu -- Plant Sciences and Plant Pathology**

***Camelina sativa as a platform for the production of oils with enhanced lubricant properties***

*Camelina sativa* (false flax) is an emerging *Brassicaceae* oilseed crop with potential for biofuel (biodiesel and jet fuel) production. It is also being evaluated as a platform for the production of lubricants and high-value industrial oils. Camelina is a good candidate to fill this niche because it is not widely grown in the US for food use. In addition, genetic transformation of camelina can be achieved by a simple floral vacuum infiltration of agrobacterium. To this end, we have initiated a biotechnological pipeline to generate camelina lines with improved oxidative stability (e.g., high oleic acid) and enhanced lubricant properties (e.g. novel hydroxy fatty acids and wax esters). The three FAD2 genes in camelina are characterized, and high oleic acid lines have been achieved by

antisense or RNAi repression of FAD2 in camelina seeds. In addition, mutants in camelina fad2 alleles, which show increased oleic acid content, have been isolated and are being used for genetic crossings. To enhance the lubricity of camelina oils, camelina lines expressing castor hydroxylases, jojoba wax synthase, and combinations of these have also been generated.

**Oliwia Zurek: Immunology and Infectious Diseases**

**Mentor: Trevor Douglas, Allen Harmsen -- Chemistry and Biochemistry, Veterinary Molecular Biology**

***Letting Viruses Do the Work: In Vivo Selection for a P22 Capsid with Long Blood Half-life and Lung Residency***

While virus-derived nanoparticles continue to revolutionize disciplines ranging from cancer therapy to imaging, there is still a large need to identify nanomaterials that are not cleared immediately upon entering the circulatory system. Our previous data suggest that mice subjected to five immunizations of P22 phage capsids develop inducible bronchus associated tertiary lymphoid tissue (iBALT), which has been shown to protect animals from lethal doses of influenza, SARS, and RSV. Based on these findings, our goal is to identify P22 capsids, from a library of mutants, with long blood circulation-life and the observed protective effect at a lower dosage by generating a randomly mutated library of P22 phages via UV mutagenesis. Mice subjected to  $2 \times 10^{10}$  particle forming units (PFUs) of mutated P22s were sacrificed 1 and 24 hours post-immunization. P22 species that resided in the body were recovered from tissues and amplified for subsequent in vivo selections. We hypothesize that re-circulating P22 species that stayed in the body at 24 hours will result in identifying phages with long blood half-life and lung residency. Our unique method will identify virus-based nanomaterials that can be further modified for drug delivery and investigating nanoparticle immunomodulating properties that result in full protection against infectious agents.

## DIVISION OF HEALTH SCIENCES

**Sean Caskey: Health Sciences**

**Mentor: Sheila Nielsen-Preiss -- Health Sciences**

***Osteogenic Sarcoma: A Comprehensive Review***

Osteogenic sarcoma is a malignant neoplasm of the bone characterized by extensive, uncontrolled, and aggressive differentiation of osteoblasts. It is the most common primary bone malignancy in children and adolescence. It can be present in any bone but most frequently originates in the long bones. Initial diagnosis is made by conventional radiography and confirmed by biopsy. Other imaging techniques play an important role in evaluating the extent of tumor growth, determining the presence of metastases, and assessment of treatment modalities. Current treatment regimens involve combinations of neoadjuvant chemotherapy, full resection of the tumor, and post-operative chemotherapy. Prognosis has improved dramatically in the last three decades and overall 5-year survival is 68%. Due to the multiple genetic and environmental factors that contribute to the development and complexity of osteosarcoma, it is difficult to characterize molecularly. Cellular karyotypes and genetic profiles exhibit a large degree of variation, although there are several genetic aberrations associated with a predisposition for osteosarcoma. The identification of specific gene signatures with regards to chemotherapy resistance and metastases could significantly improve outcome measures and are areas of current clinical research. A comprehensive review of the epidemiology, etiology, pathology, diagnoses, treatments, and active areas of research is presented.

**Brandon French: Health Sciences**

**Mentor: Sheila Nielsen-Preiss -- Health Sciences**

***Using Sociometer Theory to Understand Obesity: A Basis for Intervention Design***

Being overweight and obese are significant health concerns in the United States, contributing to numerous diseases and illnesses of high morbidity and mortality. Medical treatment of these illnesses and diseases is

extremely costly and has varying levels of success, placing an unnecessary burden on a plagued healthcare system. As the instance of being overweight and obese continues to rise, healthcare professionals are looking for new and innovative ways to deal with this issue at the forefront of medicine. While there are several factors which contribute to being overweight and obese, sedentary lifestyle is commonly implicated in the rising rates in the United States. Thus, designing interventions to deal with sedentary lifestyle provide hope for challenging this health concern. Sociometer theory provides a basis for gaining a better understanding of the rising rates of overweight and obese people in the United States. Furthermore, the theory may help direct healthcare professionals toward possible directions for future interventions. The interventions derived from sociometer theory may prove to be more effective and cost-efficient methods for dealing with overweight and obese people.

**Rebecca Gleason: Health Sciences**

**Mentor: Suzanne Christopher -- Health Sciences**

***Improving Participation in Safe Routes to Schools Programs for Montana Native American Communities***

Safe Routes to Schools (SRTS) Programs encourage children to walk and bicycle to and from school. SRTS programs may be one part of the solution to decrease childhood obesity and improve health. More than 32 districts on the seven Montana Indian reservations are eligible for SRTS funds. Since 2005, only three tribal districts have applied for SRTS funding compared to 98 non-tribal communities. This project is a partnership between three Montana Indian reservations, Montana State University, The University of Montana and Montana's SRTS coordinator. Project goals are to learn how to increase SRTS funding to tribal communities and sustain SRTS programs in Montana tribal communities. This project will identify strategies that could be implemented to make program funding more even across tribal and non-tribal communities. Tribes and funding agencies can learn from each other and work together to improve participation in SRTS programs to help meet tribal health priorities. This project began in February 2011 and will be complete in February 2012.

**Tyler Hinshaw: Health Sciences**

**Mentor: Elizabeth Kinion, Sheila Nielsen-Preiss -- Nursing, Health Sciences**

***Diabetes and Periodontal Disease in Native American Communities***

Development of diabetes, a chronic disease, may lead to a number of detrimental complications. One complication, periodontal disease, was the focus of this review. A cause and effect relationship between diabetes and periodontal disease has been established. Yet, the biological mechanisms relating the two diseases remain unclear. Studies on diabetes related inflammation and hyperglycemia have provided some clues as to how the two diseases may be linked. Further study of diabetes and periodontal disease may provide useful insight in order to develop preventative strategies and treatments. With the increasing prevalence of diabetes in the U.S., greater knowledge of diabetes and periodontal disease may prove to be especially useful. Among populations within the U.S., some groups have experienced higher rates of diabetes and periodontal disease than others. Such is true of the Native American population. For this group and others, environmental influences may play a significant role in the development of disease. Therefore, environment must also be taken into account when designing methods for prevention and treatment.

**Aaron Smith: Health Sciences**

**Mentor: Sheila Nielsen-Preiss -- Health Science**

***Improving care and outcomes: A program to increase health care adherence among college students***

The purpose of this research is to better understand the reasons for non-adherence in order to develop a program that can be used as a basis of intervention by the university and student health services to combat student non-adherence. Non-adherence is an issue of concern in many aspects of one's lifestyle and is a source of billions of dollars in unnecessary healthcare costs. Though most often associated with prescribed medications, it encompasses numerous aspects of health-care that affect college students. Examples of these issues are safe sex practices, vaccinations, and diet while causes involve simple reasons such as age and sex to more complex causes such as self-efficacy, disease knowledge, and social support. The program addresses specific issues and causes of

non-adherence by working with both student and providers. By supporting adherence, we can provide better care and promote better outcomes for students.

**Joshua Stenseth: Health Sciences**

**Mentor: Sheila Nielsen-Preiss -- Health Science**  
***Healthcare Reform in the West Bank***

This scholarly project attempts to identify a viable healthcare reform model for Palestinian refugee camps. The target demographic offers an interesting perspective on restructuring as risky behaviors are closely related to the sociological and political environment. Due to the fact that many of the camps have existed for decades and minimal international support has been allocated to their cause, a number of challenges exist in creating a health model proposal. To address these concerns, several models are proposed that can be used with smaller resources, albeit with adequate projected results. Among these models are the Precaution-Adoption Model for health (PAPM) and the Health-Behavior Model (HBM). The findings suggest that HBM is superior to PAPM for this empirical study. By examining a variety of factors that led to their establishment, as well as the components that have furthered the longevity of these camps, several viable health reform options can be identified.

**Atty Timothy: Health Sciences**

**Mentor: Sheila Nielsen-Preiss, Jane Shelby -- Health Sciences**  
***Efficacy of Holistic Approaches to Native American Health***

The United States spends 15.3% of its Gross Domestic Product (GDP) on health care, \$6714 per capita, more than any other industrialized nation in the world. With these numbers one would expect that the U.S. offers the best, most comprehensive and widely spread health coverage in the world. Unfortunately this is not the case. There are many populations with health discrepancies: minorities, the uninsured, illegal immigrants and the poor to name a few. Unfortunately, the first inhabitants of our country remain one of the most underserved populations in our health care system. Health disparities have existed within the Native American population for hundreds of years and we still have yet to find a good solution. This multimedia presentation will show the health status, care structures and efficacy of holistic treatments of Native Americans, specifically the Navajo, which is the largest Indian nation in the Continental United States, and other Indian populations of the Southwest U.S.

## COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

**Elyse Lovell: Adult and Higher Education**

**Mentor: Marilyn Lockhart, Betsy Palmer, Carrie Myers -- Education**  
***An Enhanced Understanding of Motivational Factors for Students Who Are Parents***

Students who are parents (single, partnered, married and grandparents raising grandchildren) described their academic motivation to attain a degree; this resulted in the discovery of a phenomenon based on their childrens' ages. First, for those with young children (through age six), the roles and responsibilities of student and parent were intertwined in defining academic motivation. Secondly, as children grow (through teen years), more clearly defined roles emerged and mothers described their purpose of self in academics and meeting their childrens' needs. Thirdly, as children mature (teen and adult), the mother's personal growth of academic accomplishment became her primary focus with a secondary mention of children. Feeling like an outsider on a college campus, finding services limited on campus with familial balance, socioeconomic statuses, and support systems were each mediators and predictors of motivation. Student-parents describe fierce determination to maintain balance and attain their degree. A teen parent returning seventeen years after quitting college describes the pursuit of her academic dreams, "It broke my heart when I had to quit 18 years ago, and so I would never do it again for another reason, I don't care if I was living in a cardboard box."

**Laurie Rugemer: Science Education**

**Mentor: Irene Grimberg, Elisabeth Swanson, Peggy Taylor -- Education, Intercollege Program of Science Education (MSSE)**

***Online Learning: A Study of Beginning Science Teachers and How They Participate in a Content-Based Online Mentoring Program***

Research indicates that teacher mentoring and induction programs are helpful in improving the practice of novice teachers and can help to overcome first year obstacles (Feaster, 2002). The eMSS (e-Mentoring for Student Success) program was established in 2002 to provide online/asynchronous mentoring for beginning science and math teachers. In this study, Rugemer looked at reading habits of science mentees in different content discussion areas on eMSS, and examined differences between seemingly active and inactive participants. Because there are many lurker mentees who log in but do not post, it is hard to gauge what they find valuable in eMSS. Results of this study indicate that mentees read more than they post; high posters do read more on average than the low posters, but the low posters are still reading significant amounts. The majority of these beginning teachers felt that reading was at least as helpful, if not more helpful, than posting messages in the online discussion and receiving feedback from other participants. The invisible participants on eMSS are using the site and feel that they are growing as teachers by participating in this program and by learning in terms of collaborating with other teachers and like-minded professionals.

## COLLEGE OF ENGINEERING

**Steve Bugni, Adie Phillips, James Connolly: Environmental Engineering, Non Degree, Environmental Engineering**

**Mentor: Robin Gerlach, Al Cunningham -- Chemical & Biological Engineering, Center for Biofilm Engineering**  
***Controlling the Distribution of Microbially-Induced Calcium Carbonate Precipitation in 2-D Porous Media Reactors Under Pulse-Flow Conditions***

In situ calcium carbonate precipitation has many potential applications, including carbon capture and storage in geologic formations, strontium decontamination, soil stabilization, and enhanced oil recovery. The ability to control the distribution and precipitation of calcium carbonate is important to prevent detrimental effects such as plugging. Microbially-induced calcium carbonate precipitation by *Sporosarcina pasteurii* was studied in 2-D porous media reactors. A pulse-flow method was developed to prevent preferential plugging in the influent region of the reactors. Ureolytic  $\text{CaCO}_3$  precipitation was induced by flowing a growth medium containing high levels of  $\text{Ca}^{2+}$  and urea (50 g/L and 20 g/L, respectively) through 2-D reactors inoculated with *S. pasteurii*. A relatively high flow rate (0.1 pore volumes per minute) was used to introduce high levels of calcium into the reactors before preferential precipitation occurred at the inlet. A second medium containing no calcium was then flowed into the inlet region to further prevent  $\text{CaCO}_3$  precipitation. Calcium carbonate distribution along the length of the reactors were observed using stereoscopy. Influent and effluent calcium, urea, and ammonium concentrations were measured to determine the effectiveness of ureolysis and  $\text{CaCO}_3$  precipitation. Finally,  $\text{CaCO}_3$  was dissolved during destructive sampling to determine the distribution of calcium carbonate along the reactor.

**James Connolly: Environmental Engineering**

**Mentor: Robin Gerlach, Al Cunningham -- Chemical & Biological Engineering, Center for Biofilm Engineering**  
***Imaging Biofilm and Microbially Induced Calcium Carbonate Precipitation in 2D Porous Media Reactors***

Biological processes in the subsurface environment are important to understand in relation to many engineering fields including groundwater remediation, geologic carbon sequestration, and petroleum production. Two biological processes studied here are biofilm formation and microbially-induced calcium carbonate precipitation. Many analytical tools are available to researchers to study these processes but supplementing microscopic imaging adds additional information and validation to these data sets. Confocal laser scanning microscopy (CLSM), field emission scanning electron microscopy (FEM) and visible light stereoscopy were used to study processes in two

dimensional reactors with regular etched pore structures. Two kinds of reactors were used. The first has uniform 1.0mm square pore structures and is designed for direct observation under a stereoscope or destructive sampling and imaging with other techniques. The second reactor has 100 μm pore structures and is specifically designed for CLSM imaging. Samples imaged under CLSM are generally prepared by staining the biofilm with various fluorescent stains. However, since staining may cause deleterious changes to metabolic processes, organisms with fluorescent protein are also imaged with CLSM so as to study basic biofilm functions. Finally, CLSM and FEM imaging are used in conjunction to obtain the most complete sets of images and data from a sample.

## COLLEGE OF LETTERS & SCIENCE

**Jared Bowden: Biochemistry**

**Mentor: Edward Dratz -- Chemistry and Biochemistry**

***Investigating the mystery contained in the cargo of human serum albumin***

An investigation into the hydrophobic cargo of human serum albumin, a carrier protein for 99% of free fatty acids in blood, has unusual findings. We found that the total free fatty acids bound to abundant carrier proteins were down regulated in Type II Diabetic subjects by 24% compared to a matched control group ( $p < 0.02$ ). Two prominent unknown peaks were also observed on the gas chromatography mass spectrometry under negative chemical ionization that did not match either the retention time of any fatty acid-pentafluorobenzyl ester or the mass of the molecular ion of any known fatty acid. These unknown peaks were found to be up regulated by 200% in Type II Diabetic subjects ( $p < 0.005$ ). Using the quadrupole time of flight accurate mass and collision induced disassociation fragmentation patterns the unknown masses were identified as pentafluorobenzyl-glycine and di-pentafluorobenzyl-glycine. This identification was confirmed by derivatizing glycine to form pentafluorobenzyl-glycine and di-pentafluorobenzyl-glycine and matching fragmentation and retention times on gas chromatography mass spectrometry. Free glycine was not detected in the hydrophobic extracts of the abundant plasma protein fractions, prior to pentafluorobenzyl derivatization. 97% of the unknown pentafluorobenzyl-glycine species are accounted for as being contained in an affinity-purified human serum albumin fraction. The identification of the parent hydrophobic compound is under investigation by mass spectrometry.

**Kristen Brileya: Microbiology**

**Mentor: Matthew Fields -- Center for Biofilm Engineering**

***Colocalization of Syntrophs in a Methanogenic Biofilm***

Transfer of reduced carbon and electrons between microbial community members is of interest in methanogenic systems which represent natural mediators of atmospheric carbon flux. Methanogenic communities are ubiquitous in anaerobic niches including waste digestors, anoxic sediment, guts and rumens, heavy metal contaminated sites, peat bogs and terrestrial hot springs. Microbial consortia may be found in the aqueous phase, but it has been shown that natural communities often attach to surfaces as biofilm. The current work uses a dual culture approach to examine the structure of a syntrophic biofilm formed by the sulfate-reducing bacterium *Desulfovibrio vulgaris* Hildenborough and the methanogenic archaeon *Methanococcus maripaludis*. In the absence of an exogenous electron acceptor such as sulfate, *D. vulgaris* couples lactate oxidation to proton reduction. The reaction remains favorable as *M. maripaludis* maintains low hydrogen partial pressure, using these electrons to reduce carbon dioxide to methane. It was hypothesized that biofilm structure would reflect the energetic benefits of living in close association. The aim of this study has been to visualize intact 3-dimensional biofilm structure and cellular associations in order to make testable predictions of structure-function relationships.

**Lisa Bullard: English**

**Mentor: Lisa Eckert, Doug Downs, Robert Petrone -- English**

***Influencing Others to Care about Social Justice***

This project works towards answering one tiny part of a life-long question: how do people influence others to care about social justice? To narrow this question down, I focused on the classroom as a potential site for change, and researched pedagogical practices and classroom materials that could help teachers achieve a goal of teaching for social justice. Using Action Research, I examined the effect of using learner-centered teaching methods and relevant social justice themed content with my Writing 101 students, to assess if they would be influenced to care about a specific social justice issue. Students examined the dominant use of Standard English in the classroom, and the effect that can have on students who do not speak Standard English as their home language. I asked students to question whose language is allowed in the classroom, whose is not allowed, and who decides whose language gets to be spoken. I administered a pre and post survey, collected student writing, and used my observations to assess results. This study adds to the small body of knowledge about teaching practices and materials that work towards social justice, but also points to the need for more qualitative research in this area.

**Katherine Burbank: Chemistry**

**Mentor: Robert Szilagyi -- Chemistry and Biochemistry**

***Molecular Basis of U Toxicity***

Hexavalent Uranium (U) is a common environmental contaminant when reacted with water to form the dioxo-uranium cation,  $UO_2^{2+}$  or uranyl. A combination of in vivo, in vitro, and in silico studies have been presented demonstrating that uranyl nearly completely inhibited microbial activity at very low concentrations by strongly binding to pyrroloquinoline quinone (PQQ), a non-covalently bound ortho-quinone cofactor required for a number of bacterial dehydrogenases. This site is known to be normally occupied by a  $Ca^{2+}$  ion, which serves both a catalytic functional role, and a structural role by anchoring the PQQ within the haloenzyme. Accordingly, acute metal toxicity results from the complexation of the metal with active binding sites as well as the exclusion of the competing ion  $Ca^{2+}$ . Using the PQQ/uranyl interaction as a model system, this project aims to gain computational insight for uranium toxicity on a molecular basis. Investigation of the biological mechanism for  $Ca^{2+}$  displacement by the uranyl cation will be completed.

**Benjamin Duffus: Chemistry**

**Mentor: Joan Broderick, John Peters -- Chemistry and Biochemistry**

***Carbon Monoxide and Cyanide Ligand Formation in [FeFe]-Hydrogenase Biosynthesis by the Radical AdoMet Enzyme HydG***

The [FeFe]-hydrogenase enzymes catalyze the reversible reduction of protons to yield dihydrogen at the complex inorganic H-cluster cofactor. This unique organometallic active site cluster contains a [4Fe-4S] cubane linked to a 2Fe unit coordinated by a bridging dithiolate, two  $CN^-$ , and three CO ligands. The biosynthesis of this H-cluster requires the activity of a GTPase that serves as a scaffold (HydF), as well as the activities of two radical S-adenosylmethionine (AdoMet) enzymes (HydE and HydG). Recently, HydG has been shown to synthesize the diatomic ligands through a radical-mediated mechanism involving defragmentation of the substrate tyrosine, yielding the products CO,  $CN^-$  and p-cresol. HydG contains a canonical  $CX_3CX_2C$  motif observed in radical AdoMet enzymes, as well as a C-terminal cysteine motif that can potentially bind a second iron-sulfur cluster. While both motifs have been shown as essential in the decomposition mechanism, a molecular mechanism for produced CO/ $CN^-$  remains not well understood. Stoichiometric differences in the amount of CO/ $CN^-$  produced have prompted *in vitro* optimization of assay conditions to identify parameters that stimulate or inhibit product formation. These results open up new avenues in developing a defined, molecular-level understanding of complex metal cofactor biosynthesis mediated by radical AdoMet enzymes.

**Lauren Franco: Microbiology**

**Mentor: Matthew Fields, Brent Peyton -- Center for Biofilm Engineering, Chemical & Biological Engineering**  
***Molecular and Phenotypic Characterization of Three *Scenedesmus* Algal Isolates***

Algal isolates from Yellowstone National Park and wastewater treatment sites are being studied to evaluate their potential for biofuel production. Identification of these isolates at a species level using DNA sequencing of selected genes is essential to the organization of the in-house culture collection and for differentiation between closely related, but distinct algal isolates. Partial sequences of the 28s, 23s, and 18s ribosomal DNA, the Internal transcribed spacer region (ITS2), *psaA*, and *atpB* were obtained from three closely related isolates belonging to the genus *Scenedesmus*. These sequences were compared to each other and published to determine appropriate regions to routinely sequence as isolates are brought into the lab. The isolates were also characterized phenotypically with growth rate, nitrogen consumption, and pH. The 18s and ITS2 region are recommended for sequencing due to the high variability in the ITS2 region (as low as 70% sequence ID within a genus) that can distinguish between species and the lower variability in the 18s region (> 95% sequence ID within a genus) that identifies strains at the genus level. Routine sequencing of these genes may provide insight into the algal community of the environments that are regularly sampled.

**Jordan Holsinger: Microbiology**

**Mentor: Matthew Fields -- Center for Biofilm Engineering**

***Rate comparisons for phototrophic and heterotrophic growth in algal strain CHLOR-1 isolates***

Green alga strain CHLOR-1 has previously been studied and found to accumulate lipids under various growth conditions. These lipids are important for possible biofuel research applications. The original CHLOR-1 was isolated from a drainage ditch in Colorado in the 1970s and was obtained for this study from the Hawaii Culture Collection (Honolulu, HI). Upon streaking on Bold's Minimal Media, six morphotypes were observed and isolated, PC-2 through PC-7. Phenotypic variation within the isolates included differences in colony morphology, growth responses to pH shifts, and lipid accumulation. Genotypic variation was also observed in SSU rDNA, LSU rDNA, ITS region, and genomic fingerprinting. In this study a growth rate comparison was performed for each of the six isolates under both phototrophic and heterotrophic conditions (i.e. grown in the light or dark). Each isolate was grown in Bold's Minimal Media amended with 0.1% acetate and growth curves were constructed using direct microscopic counts. Exponential growth rates were calculated for each isolate for both dark and light treatments for comparison.

**Lauren Kay: Earth Sciences**

**Mentor: David Lageson -- Earth Sciences**

***Tectonic deformation as a taphonomic process: using dinosaur bones as strain indicators***

Highly strained tectonically deformed dinosaur bones have been found in the Lower Jurassic McCoy Brook Formation of the Fundy Basin in Nova Scotia, Canada, and in the mid-Cretaceous Blackleaf Formation near Lima, Montana. These bones will be used to investigate the early stages of continental rifting and orogenic development in a fold-and-thrust belt using new techniques of finite strain analysis adapted to homogeneously deformed bones. Strain analysis techniques typically overlook massive fossils as having deformed inhomogeneously with respect to the matrix. However, these bones appear to have deformed homogeneously and may be good indicators of internal strain that will contribute to regional structural analyses. Finite strain analysis has never been performed on large, massive bones before and is only possible due to high-grade, semi-penetrative deformation of the host rocks. Mapping of structural features will further refine the deformational history and elucidate the early stages of structural inversion of compressional orogens into extensional rift basins. Tectonic deformation is ignored as a taphonomic process in paleontology but may be especially important for fossil beds deposited within, or marginal to orogenic belts or extensional basins. Quantitative analysis of the taphonomic histories of bones will help interpret the effects of tectonic deformation on fossils.

**Gal Keren-Aviram: Biochemistry**

**Mentor: Edward Dratz -- Chemistry and Biochemistry**

***The Proteomics of Human Epilepsy***

Epilepsy is a severe, chronic neurological disorder that affects approximately 1% of the population. Brain tissue become epileptic by a mechanism that is poorly understood. Anti-epileptic drugs benefit many patients with epilepsy, however, in drug-resistant epilepsy, surgical procedure may be considered. Resective surgery is successful in stopping seizures in a large fraction of cases, where the epilepsy foci (region that triggers the seizures), as well as some surrounding healthy brain tissue (control), are removed. It also provides unique sample pairs from the same patient, eliminating biological variation. This study, which is part of Systems Biology of Epilepsy Project, looks for proteomic differences between an epileptic brain area and proximal healthy control tissue from the brain of the same patient. We used cell fractionation and 2D-Differential in Gel Electrophoresis (DiGE), to resolve the brain proteome and reveal which proteins change significantly in the epileptic foci. In the soluble protein fraction, 80 proteins of interest were identified using Liquid chromatography- tandem mass spectrometry (LC-MS/MS). Using a combination of proteins cluster analysis (Progenesis SameSpot PCA) with DAVID bioinformatics resources, we were able to find enriched gene ontology annotations that point to biochemical pathways involved in epileptogenesis and suggest new and perhaps better drug targets.

**Cassandra Langr: Molecular Biosciences**

**Mentor: Michael Babcock -- Psychology**

***Ischemic Gerbil Model: Object and Spatial Recognition***

Transient cerebral ischemia occurs when there is not enough blood flow to the brain for metabolism, resulting in neurological dysfunction commonly characterized as a stroke. Transient cerebral ischemia in gerbils produces damage to the pyramidal cells of the CA1 region of the hippocampus similar to that observed in humans; however, cognitive impact has not been sufficiently evaluated in the gerbil model. In the present study, we utilized the gerbil model of cerebral ischemia to evaluate the effect of ischemic episode duration on locomotor and object recognition. Control or ischemic (5 or 10 min occlusion) gerbils were tested in open field apparatus to evaluate changes in locomotor activity. Next, changes in exploratory behavior were examined following the introduction of novel objects to the environment. Preliminary results suggest that there is impact to locomotor activity as well as object recognition. The data are pertinent to future research on neurological dysfunction and understanding of impairment due to transient cerebral ischemia.

**Mort Larsen: Geology**

**Mentor: David Lageson -- Earth Sciences**

***Structural inversion of the southern Madison-Gravelly arch by the Hebgen-Red Canyon normal faults, SW Montana***

The Madison Range in SW Montana is characterized by geologically young tectonic inversion from shortening (Paleogene) to extension (late Pliocene-Quaternary). On August 17, 1959 the area experienced the largest recorded earthquake in the Intermountain West ( $M_s$  7.5, intensity X) that ruptured two SW-dipping normal faults, the Hebgen-Red Canyon normal faults. These faults occupy an overlap zone between Laramide contractile structures (Ancestral Madison-Gravelly Arch) and extensional structures at the eastern margin of the northern basin-and-range province. A proposed geometric model based on new geological mapping, coupled with balanced cross-sections, suggests that lateral ramps in the Laramide Beaver Creek-Wells-Rapids-Divide (BWRD) thrust system played an important role in the development of subsequent Neogene-Quaternary extensional structures. Lateral-oblique thrust ramps mark relatively sharp boundaries between structural highs and lows of the BWRD thrust surface, compartmentalizing the up-dip portions of Neogene-Quaternary normal faults to produce a distinct pattern of en echelon extension at the south end of the Madison Range. We further propose that 1959 reactivation of the BWRD thrust system was a relatively shallow phenomenon in which the main rupture propagated up-dip to reactivate leading-edge imbricate splays of the BWRD thrust system and the overturned limb of an associated Laramide fold on Kirkwood Ridge.

**Aubrie Ler: Cell Biology and Neuroscience, Health Science**

**Mentor: Sheila Nielsen-Preiss -- Health Sciences**

***Diabetic Retinopathy as an Ocular Manifestation of Diabetes Mellitus***

Diabetes mellitus is a result of persistent and high quantities of glucose in the blood in response to insufficient levels of insulin in the body or having an insulin resistance. Epidemiological studies indicate that 2.8% of the population worldwide suffers from diabetes. Diabetic retinopathy is a complication of diabetes mellitus that causes blindness in 80% of affected individuals. In chronic and persistent diabetes, diabetic retinopathy can present in two ways, proliferative retinopathy or macular edema. It is characterized by thickening of the basement membrane resulting in the ineffectiveness of the vascular walls which make the retinal blood vessels more permeable causing fluids to leak into the macula. Additionally vision loss can ensue from a rapid proliferation of blood vessels within the eye and along the retina. Presented here is data compiled on etiological, epidemiological, pathological, and management for both diabetes mellitus and diabetic retinopathy to help determine appropriate methods of preventative medicine.

**Janice Lucon: Chemistry**

**Mentor: Trevor Douglas -- Chemistry and Biochemistry**

***Polymers Inside the P22 Protein Cage Architecture***

Virus capsids and other protein cages have been extensively employed as nanoscaffolds for the size constrained synthesis of minerals and polymers, presentation of antibodies and glycans, and transport of contrast agents and dyes with materials, catalytic, and medical applications. To accomplish polymer cross-linking and introduce addressable sites in few steps within a protein cage, we have turned to atom transfer radical polymerization (ATRP) which allows us to create a polymer in a single quick reaction. Because the polymer grows from a specific initiation site, the growth can be directed to the interior or exterior of a cage-like protein through selective attachment of the initiator to interior or exterior sites on the capsid. Herein we demonstrate that ATRP can be applied to the 60 nm diameter P22 virus capsid. Two monomers are used as examples, with a TRIS-acrylamide based strand pursued as a segue into internally cross-linked capsids, while the 2-aminoethyl methacrylate (AEMA) based strand introduces primary amines that can be labeled with active agents such as fluorescent dyes or MRI contrast agents. This is the first report to our knowledge of ATRP being applied to the formation of linear polymers synthesized within the confines of a protein cage architecture.

**Helen Lynn, Whitney Treadway: Earth Sciences**

**Mentor: Dave Lageson -- Earth Sciences**

***Structural Controls on Fluid Migration Through Thrust Faults of the Stewart Peak Culmination***

The Stewart Peak Culmination is a structural culmination in the Sevier fold-and-thrust belt in western Wyoming that was likely a large trap for CO<sub>2</sub> and other fluids prior to late Cenozoic uplift and breaching. The culmination lies structurally up-dip from known accumulations of CO<sub>2</sub> in SE Idaho. Because the culmination has been exhumed, it allows for direct measurement of those fractures and faults that served as fluid conduits during and after development of the duplex. Understanding the geometry of fractures and faults that facilitate fluid migration is essential for evaluating similar subsurface traps as potential sites for carbon sequestration or enhanced oil recovery. Field and petrographic analysis indicate that fractures and fault damage zones served as conduits for multiple episodes of fluid flow including hydrocarbons, CO<sub>2</sub>, and hydrothermal brine fluids. Mode I dilation fractures that generally parallel the thrust transport direction (ENE) are the dominant set. These were the main conduits for fluid flow in the culmination. CO<sub>2</sub>-charged hydrothermal brines enhanced permeability by dolomitization of the host rock and isothermal boiling of CO<sub>2</sub>. The latter process resulted in hydro-fracturing and dilational brecciation. Crack-seal vein textures and multiple overprinting breccia textures suggest episodic seismic rupture and fluid flow in the system.

**Diveena Marcus: Native American Studies**

**Mentor: Matt Herman, Geoff Gamble, Kristin Ruppel -- Native American Studies, Sociology & Anthropology, Native American Studies**

***She Loves Us***

This song was created as a gift for the Hopi Nation in 1995 as a quick cassette taped recording during the Uranium controversy and later presented in English at the University of Ottawa in Canada at a Women in Religion symposium/conference in 2000. My ancestral tongue is Coast Miwok (Tamal Machchaw) and is an endangered California aboriginal people's language with no fluent speakers left. All California aboriginal people's languages are critically endangered and are presently in an aggressive revivalist movement. While at MSU I've been fortunate through the Native American Studies department and through Advocates of Endangered California Indian Languages and the Master Apprentice Program to work with a tribal mentor to study my ancestral language. The need for more of Tamal Machchaw exposure has given the song its final touches. I am working on a sound recording of it at present but would be honored to present it live or as a sound recording with a power point presentation of the cultures of Native Peoples represented within our NAS program. If they are willing to allow me to include them.

**Adam McClure, H. Li, P. Rugheimer, E. Arenholz: Physics**

**Mentor: Yves Idzerda -- Physics**

***Magnetic Properties of Single Crystal Fe<sub>1-x</sub>Ga<sub>x</sub> Thin Films***

Molecular beam epitaxy (MBE) was used to deposit single crystal Fe<sub>1-x</sub>Ga<sub>x</sub> thin films on MgO(001) and ZnSe/GaAs(001) substrates. The crystal quality of the substrate surface and each deposited layer was monitored in-situ by reflection high energy electron diffraction (RHEED). The magnetic properties of the samples were characterized by vibrating sample magnetometry (VSM), angle dependent ferromagnetic resonance (FMR), and element specific X-ray magnetic circular dichroism (XMCD). The magnetization as a function of Ga concentration decreases more rapidly than a simple dilution effect, and is attributed to a decrease in the Fe moment and an induced moment in the Ga that is anti-aligned to the Fe moment. Depositions on the ZnSe buffer layer feature a strong uniaxial anisotropy, while depositions on MgO(001) substrates result in a purely cubic anisotropy. Additionally, the increase of FMR linewidth with increasing Ga content indicates that the precessional damping of these materials can be modified in a controllable manner.

**Anita Moore-Nall: Geology**

**Mentor: David Lageson, David Mogk -- Earth Sciences**

***Mineralized Uranium Vanadium deposits in the Pryor Mountains, South central Montana and the Little Mountain Mining District, north central Wyoming may provide a link to the elevated lead and mercury in the Bighorn River***

The Little Bighorn River is a designated 303d impaired waterway once it passes through the Crow Reservation due to elevated lead and mercury. Past productive abandoned uranium/vanadium mines are located near the Crow Reservation in the Pryor Mountains west of the Bighorn River and just south in the Little Mountain area of the northwestern Bighorn Mountains. Streams from both districts contribute to the greater Bighorn hydrologic basin. The deposits are mineralized collapse breccia features with the primary ore being the calcium-uranium vanadates tyuyamunite and metatyuyamunite. Both districts are hosted in Madison Limestone located along the crest of Laramide structures. A similar structure located at the present day Bighorn River level near Lovell, Wyoming, the Little Sheep Creek Anticline, hosts hydrothermal fluids with radioactive muds and water. This structure may serve as a modern day analogue to the mode of mineralization for these districts. Characterization of the mode of mineralization of the deposits may show a relationship of uranium and vanadium to structural migration of fluids and hydrocarbons from the Bighorn Basin. Characterization of fluid migration along structural features is important for evaluating the possibility of capture and storage of CO<sub>2</sub> or geologic carbon sequestration.

**Katya Numbers: Psychology**

**Mentor: Michelle Meade -- Psychology**

***Social Contagion and Item Credibility: Is Memory Accuracy Determined by Item Accuracy?***

We presented younger adult dyads, consisting of one naïve subject and one confederate, with common household scenes and asked them to recall items from those scenes together. Critically, we manipulated the proportion of correct and incorrect information provided by our confederate (0%, 33%, 66%, 100%) during a collaborative recall phase, modifying the original social contagion paradigm. In general, participants who encountered errant items during group recall were significantly more likely to write down false items during individual recall than participants who heard no false items. Importantly, we did not obtain a significant decrease in contagion when participants encountered higher proportions of false information as predicted. It appears item accuracy alone is not enough to alert participants to item discrepancies in the social contagion paradigm. We argue there is something unique about another person's physical presence which overrides the ability to detect discrepant items typically seen in other false memory paradigms where the biasing source is not present.

**Alison O'Neil: Biochemistry**

**Mentor: Trevor Douglas -- Chemistry and Biochemistry**

***Genetically Programmed in vivo Packaging and Controlled Release of Protein Cargo from Bacteriophage P22***

The natural viral system of specific nucleic acid encapsulation, cell targeting, and controlled release has inspired many to mimic this scheme for nano-material synthesis. Salmonella typhimurium bacteriophage P22 assembles into a T = 7 capsid with the assistance of a scaffold protein (SP) resulting in a procapsid packaged with SP. By exploiting this naturally occurring encapsulation, we have engineered a molecular system through which the C-terminal 162 amino acids of the SP (the C terminus being essential for assembly) are fused to a fluorescent protein cargo. The SP acts as an encapsulation signal and templates accurate assembly in vivo while bringing the cargo with it. Here, we demonstrate the in vivo encapsulation of the easily detectable green fluorescent protein (GFP) and red fluorescent protein, mCherry, inside of P22. These cargo filled capsids are able to undergo the interesting morphological changes available to P22: an expanded icosahedral form and the wiffle ball form which is an icosahedral capsid transected by 12 10nm pores. The designed molecular system will allow for easy genetic manipulation to encapsulate any protein of interest and control its release from the capsid.

**Shefah Qazi: Biochemistry**

**Mentor: Trevor Douglas -- Chemistry and Biochemistry**

***Enhanced Relaxivity and In Vivo Imaging of Macrophage-Rich Carotid Lesions with Protein Cage Based T1-Contrast Agents***

Contrast agents enhance T1 relaxivity, providing sensitive imaging and lower gadolinium dosage. Gd-DTPA chelates tethered to a supramolecular platform reduce rotational correlation times of lanthanide ions, improving T1 relaxivity. Small heat shock protein cage (Hsp), with an exterior diameter of 12nm and interior cavity of 9nm, was used as the platform. Azide-alkyne click chemistry was cycled to produce branched polymer (BP) inside of Hsp. Quantitative analysis of Gd and protein concentration shows there are approximately 160 Gd-DTPAs per cage. At 0.73T, the ionic (per Gd)  $r_1$  value is 25mM<sup>-1</sup>sec<sup>-1</sup> and particle  $r_1$  value is 4,200mM<sup>-1</sup>sec<sup>-1</sup>. Gd-DTPA on Hsp-BP exhibits high  $r_1$  (ionic and particle) relaxivity. At 3T, the ionic  $r_1$  value is 9.7 mM<sup>-1</sup>sec<sup>-1</sup>, 3 times higher than Magnevist, and the particle  $r_1$  value is 1630 mM<sup>-1</sup>sec<sup>-1</sup>. Macrophage-rich lesions have been imaged with low Gd dosage, 1/5th the clinical dosage. Thus, Hsp-Gd-BP holds promise to detect atherosclerosis at an early stage. This synthetic strategy has been successfully extended to the P22 bacteriophage capsid, a 55nm protein cage. This protein cage nanoparticle has 230 times greater interior volume than Hsp. At generation 3.5, P22-BP accumulates 4,200 Gd ions, maintaining a high ionic relaxivity of 23mM<sup>-1</sup>sec<sup>-1</sup> and particle relaxivity of 96,600mM<sup>-1</sup>sec<sup>-1</sup>.

**Melissa Robertson: Molecular Biosciences**

**Mentor: Kevin Wanner -- Plant Sciences and Plant Pathology**

***Sequencing, Assembling and Annotating BAC Clones from a Genomic Library to Identify Sex Pheromone Receptor Genes.***

Moth species in the genus *Ostrinia* are used as models to study the evolution of sex pheromone communication. The males of the species have highly sensitive and specific receptors to detect specific blends of pheromones. A small difference such as the ratios of two pheromones in the blend, or the placement of a double bond alone will cause mating isolation. A bacterial artificial chromosome (BAC) genomic library constructed from the European corn borer, *Ostrinia nubilalis* was screened to identify clones encoding the 7 genes that are thought to encode sex pheromone receptors. The 14 identified BACs were purified and pooled into two groups in equal amounts. The two BAC pools were pyrosequenced at the University of Illinois genomics center. The sequences from each pool were used to assemble unique contigs using MIRA software, 411 contigs averaging 2,175 bases were obtained for Pool A and 446 contigs averaging 2,023 bases for pool B. The major finding was that several pheromone receptor genes were clustered close together on the same contigs, receptors 1 and 8, and receptors 4 and 5. The contigs will provide a resource for future work to identify regulatory elements and promoters of these genes.

**Daniel Ross: Earth Sciences**

**Mentor: David Lageson -- Earth Sciences**

***Structural Geology of the North-Half of the Swift Reservoir Culmination, Northern Sawtooth Range, Montana***

The Swift Reservoir Culmination (SRC) is located in the Sawtooth Range of northwest Montana, just south of Glacier National Park, where it forms an anomalous outcrop zone of imbricated and tightly folded Cambrian rocks, approximately 20 km long x 5 km wide. The anomalous nature of the SRC is underscored by the fact that Cambrian strata are not exposed elsewhere along the Sawtooth front. The SRC may be an excellent outcrop analogue to the Waterton Gas field just to its north, which produces approximately 5.5 million m<sup>3</sup> of raw sour gas daily. Furthermore, Devonian strata of the SRC may prove to be adequate reservoir rocks for CO<sub>2</sub> sequestration. Studying the SRC will contribute to a much better understanding of the structural geometry involved in the inner foothills of the Rocky Mountain Front, which continues to be an area of high exploration interest. Finally, deep subsurface CO<sub>2</sub> sequestration is becoming a viable solution to greenhouse gas emissions from coal-fired power plants. This research will assist in predicting CO<sub>2</sub> storage capacity and the permeability pathways of injected CO<sub>2</sub> at Kevin-Sunburst dome (just east of the SRC), which is currently being targeted as a large CO<sub>2</sub> sequestration site for coal-fired power plants.

**Amy Servid: Biochemistry**

**Mentor: Trevor Douglas -- Chemistry and Biochemistry**

***Protein Cage Nanoparticles and Associated Protection against Respiratory Viruses***

Protein cage nanoparticles (PCNs) are hollow, roughly spherical architectures that self assemble from identical protein subunits. Viral capsids, ferritins, and small heat shock proteins are a few examples of PCNs. It has been shown that administration of non-infectious PCNs is associated with formation of inducible bronchus-associated lymphatic tissue (iBALT) in murine lungs and offers non-inflammatory protection against serologically distinct influenza viruses. Inducible bronchus-associated lymphatic tissue (iBALT) is described as clusters of lymphoid cells in close proximity to blood vessels and the airway epithelium. No obvious deleterious effects, such as respiratory hypersensitivity, are observed as a result of PCN-induced iBALT formation in the animals. Our efforts focus on understanding the bio-physical properties of these PCNs that contribute to the phenotypes of iBALT formation and influenza protection. This work will summarize recent experiments in which we investigated the roles of size, structural stability, particle number of PCNs in relation to iBALT and influenza protection. These studies provide a foundation for understanding the role of PCNs in protection from respiratory viruses, and are the first step toward vaccination strategies that could offer broad spectrum, non-inflammatory protection against respiratory viruses.

**Bradley Towey: Chemistry**

**Mentor: Robert Szilagyi -- Chemistry and Biochemistry**

***Probing the Mo site of FeMo-co by Synthesis, Spectroscopy, and Theory***

The molybdenum site of the iron-molybdenum cofactor (FeMo-co) of nitrogenase has been proposed as the catalytic center where biological nitrogen fixation and reduction to ammonia occurs. Toward the creation of functionally active biomimetic compounds that catalyze ammonia production for fertilizer, a one pot-synthesis of a single cubane  $\text{MoFe}_3\text{S}_4(\text{S}_2\text{CNET}_2)_5$  cluster was conducted. To understand the electronic structure of this  $\text{MoFe}_3\text{S}_4$  cluster,  $\text{MoS}_4^{2-}$  and  $\text{M}(\text{S}_2\text{CNET}_2)_2$  ( $\text{M} = \text{Cu}, \text{Zn}$ ) compounds were synthesized and analyzed using multi-edge X-ray absorption spectroscopy (XAS) and density functional theory (DFT). The XAS data yields information about  $\text{MoS}_4^{2-}$  and  $\text{M}(\text{S}_2\text{CNET}_2)_2$  electronic properties, and when coupled with DFT can determine the electronic structure of the  $\text{MoFe}_3\text{S}_4(\text{S}_2\text{CNET}_2)_5$  cluster. The  $\text{MoFe}_3\text{S}_4(\text{S}_2\text{CNET}_2)_5$  cluster will then serve as a template for obtaining other  $\text{MoFe}_3\text{S}_4$  clusters, which will also be studied with XAS and DFT. The electronic structures of catalytic  $\text{MoFe}_3\text{S}_4$  clusters are important for being able to understand the molecular basis of dinitrogen binding and reduction.

**Whitney Treadway, Helen Lynn: Earth Sciences**

**Mentor: Dave Lageson -- Earth Sciences**

***Fracture Assessment of a Laramide Uplift in the Rocky Mountain Foreland, Thermopolis Anticline, WY***

Carbon sequestration is a method currently being studied in order to decrease atmospheric  $\text{CO}_2$ . Understanding geologic storage sites for  $\text{CO}_2$  is necessary before carbon sequestration can be completed safely and effectively. This includes studying fluid migration and fracture networks as these can lead to  $\text{CO}_2$  leakage at the surface. The Thermopolis Anticline in the southern Bighorn Basin, WY is an anticlinal uplift in the Rocky Mountain Foreland and is the target field area for this project. In order to assess fracture networks and fluid migration pathways, fracture measurements were collected from fifty-two stations at various locations along the Thermopolis anticline. At each station, data were collected for an average of thirty fractures, including length, orientation, and vein fill. Samples of vein fill material of measured fractures were collected. Orientation data were plotted and analyzed based on location on the anticline and formation. Detailed lab analyses on vein material samples are currently being conducted. These analyses include preliminary petrographic work, carbon and oxygen isotope analysis and fluid inclusion analysis to determine temperature, origin, and composition of original fluid. Differences between generations of cement can indicate possible  $\text{CO}_2$  migration patterns based on the results of these analyses.

## UNIVERSITY COLLEGE

**Jeffrey W. Hostetler: American Studies**

**Mentor: Susan Kollin -- English**

***Why is Fly Fishing So White?***

North America has experienced an abundant growth in outdoor recreation. For example, all one has to do in the Western United States is google fly shops, ski resorts, or bow hunting stores, and endless options surface. Additionally, the literature, periodicals, and videos that promote, and describe these outdoor activities are abundant. However, most participants in these activities are Caucasian, upper middle class or higher, and predominantly male. This research is currently exploring areas where this hegemony is either being challenged and de-centered, or reinforced and entrenched. Women have begun fishing much more, and are pursuing careers as guides and fly shop owners. In the Sierras a website owner has dedicated its existence to African American Fly Fishing and even Oprah Winfrey visited Yosemite National Park this summer and hired Bozeman guides to take her fly fishing. Other interests include overseas fly manufacturing, international travel, and a thorough examination and analysis of fly fishing fiction and memoir, and their roles in fly fishing culture. Worldwide fishing legend, Montana native, and inspiration behind the Renne Library's Trout and Salmonid Collection, Bud Lilly is dedicated to creating access for disabled veterans and developing opportunities for non-dominant American cultures to enjoy fly fishing.

# 2011 STUDENT RESEARCH CELEBRATION

## *UNDERGRADUATE ABSTRACTS*

*\*Sorted by Student Major\**

### COLLEGE OF ARTS AND ARCHITECTURE

**Alexandra Black: Graphic Design**

**Mentor: Gesine Janzen-- Graphic Design**

***The American Influence***

I am studying the influence that American Tourism has had on the population of Puerto Penasco, Mexico. There is a high number of Americans who lease property for 50-100 years, due to laws against non-citizens owning land, and financing construction developments. Over the past ten years, this has drastically altered the town and brought in a larger number of tourists. One of the downfalls of this is that a lot of the revenue being made from the developments is going into the hands of Americans. I will spend 1-2 weeks in Puerto Penasco in May to finalize my research. For presentation of my research, I will create a magazine article and design a layout. A portion of my research will also be dedicated to studying Mexican printmaking artists. While I am in Mexico, I will emulate a Mexican printmaker to develop artwork for my magazine layout. This will give me insight to the Mexican culture, which will help me to identify the American influence on the small town.

**Genna Boland: Photography**

**Mentor: Michael Ivie-- Plant Sciences and Plant Pathology**

***Photo-Documentation of the Coleoptera of Saba***

Saba is the northernmost of the Volcanic Caribees that form the inner arc of the Lesser Antilles. Saba has received scant attention from entomologists, due to its small size and difficulty of access. In 2007 and 2008, Conservation International and the Saba Conservation Foundation sponsored an entomological survey of Saba. The West Indian Beetle Fauna Project at Montana State University took the lead in working up the Coleoptera from the two expeditions. Until 2005, only 14 published records of Coleoptera were known from Saba. So far, 277 species have been documented, many undescribed. In order to make the information available while formal publication and descriptions are worked up, it was decided to photo-document the entire fauna. As a photography student my job is to digitally document the coleopterans collected in Saba. Using a PC-MOUNT KY-F75U, JVC camera I am able to photograph the beetles without the distortion and optical restrictions of typical cameras. The resulting digital archive will be used to promote awareness of the biodiversity on Saba and will make the accumulated information available to the scientific community and the people of Saba.

**David Carron: Environmental Design**

**Mentor: Ralph Johnson-- Architecture**

***Sustainable Residential Design***

Working toward sustainable design strategies is becoming an important part of architectural design, because buildings consume a lot of resources. This is not only in the initial construction costs, but primarily concerns the entire life cycle of the structure, because lighting, HVAC, and even routine maintenance of various assemblies dwarf the initial cost in significance. Building cost is defined as being both monetary and environmental. The process itself becomes very comparative, because newer structures utilize older structures as a benchmark. Benchmarking becomes especially important in

sustainable design, because certain strategies and products create new standards, and through innovation and technological advances, these standards rise. This research concerns itself by taking existing building typologies in Bozeman and comparing them to a prototypical design of the same type, utilizing various design strategies that work towards sustainability. Several benchmarks include: energy and water consumption, water runoff and retention, construction materials, ideal solar orientation, and cost. This is but a single piece of a larger project comparing many building typologies, and this particular piece concerns itself with the design of large residential homes.

**Christopher Carter: Interdisciplinary Studies: Media and Geographic Identity**

**Mentor: Ann Bertagnolli-- Honors**

***Understanding Community Through Collaborative Visual Ethnography***

Spanning two seasons in the northern foothills of the Beartooth Mountains, this ongoing research seeks to better understand the inter-generational relationships of a sheepherding community through collaborative means. In exploring and documenting this way of life, this research seeks to explore the role of facilitating visual capture by members of a community to better understand individual perceptions of place and people; notions of relative geography and interpersonal relationships. Exploring the history, geographic identity and socio-economic realities of modern highland shepherding practices in south-central Montana, this study seeks to gather multiple visual perspectives to better understand this human experience. Exploring social science fieldwork methods such as participatory video, participant observation, and the principals of visual anthropology, this study seeks to examine effective and culturally competent methods of qualitative research design in a community research environment. While this research remains unfinished, these research findings may provide insight into the design of ethnographical fieldwork in community based projects and public health research.

**Jake deNeui: Architecture**

**Mentor: Ralph Johnson-- Architecture**

***Energy Conscious Commercial Design***

This project will be completed in a two stage process, the first being identification and analysis of a set benchmark project. Through the help of Bozeman city staff and Professor Ralph Johnson, I will identify a local suburban office building that closely follows the typical characteristics of other such buildings in the Bozeman area belonging to the same category. Once this benchmark building has been identified, I will then begin a thorough study and analysis of that building. This research will include, at a minimum, site plans, a perspective image of the building, the project's construction cost, site information, and energy and water consumption data. Once this segment of the project has been completed, I will begin the process of creating a viable and economical alternative to my chosen benchmark. Such research might include sustainable water conservation and recycling, availability of high energy performance materials such as insulation and windows, or mechanical systems that comply with local environmental conditions and energy demands. The information gathered on this proposal will creatively illustrate methodologies and systems that could potentially change the way resources and available space are used in our region of the country.

**Caitlin Field: Graphic Design and Honors**

**Mentor: Meta Newhouse-- Art**

***Gustav Klutskis: A Proper Gander at Propaganda***

Gustav Klutskis, soviet photographer, designer, and photomontage artist, created many propagandist works that furthered the aims of communist Russia from the age of its birth through its early existence. His prolific body of revolutionary work in the burgeoning field of photomontage contributed greatly to the personality cult of Stalin. Yet, the recognition his work receives today pales in comparison to that of his world-renowned contemporaries, Lissitzky and Rodchenko. Klutskis has been so seemingly forgotten despite his service to the State, as his work, ideals, and the ever-tightening restrictions on expression

made his position a precarious one. In 1937, his career and life were cut short by a mysterious arrest and his subsequent death, by which Klutis and his work were purged entirely from soviet society. Much can be learned from bringing Klutis' relatively unacknowledged life and death to light. His work and story are important to understanding soviet Russia and its turbulent development and in realizing the power of propaganda, particularly upon its maker.

**Tammi Heneveld, Megan Sullivan: Graphic Design, Liberal Studies**

**Mentor: Florence Dunkel-- Graphic Design**

***Mali Children's Book***

The conservation of unique indigenous cultures outside of the modern world is incredibly important. Many anthropology experts agree that language is the most fundamental part of a culture, particularly oral narration. In Mali, the lack of implementation of their native tongue is inhibiting members of the Bambara culture from being informed and reminded about their linguistic heritage. Our goal is to create a children's book detailing a traditional Bambara folktale, entitled *The Two Orphans and the Baobab Tree*. We will translate the story into French and English from Bamanakan (a common Bambara dialect), and use images drawn by the Sanambele school children to illustrate the story. Once the book is printed, students from the village in grades 1-6 will be given copies written in two versions (Bambara and French, and French and English), and students in U.S. public schools in the state of Virginia will be given the opportunity to learn about the Bambara culture by reading the book as part of their curriculum. French high school and college students in Montana will also be given copies, enabling them to practice the French language and learn about its historical impact in African society.

**Josh Henning: Film and Photography**

**Mentor: Theo Lipfert-- Film and Photography**

***Advanced Visual Effects***

The increasingly chaotic and competitive world of the motion picture industry requires much of any aspiring freelancer. Widely known as one of the most competitive job markets, the film industry has only become more difficult to enter into as a result of a globalizing talent pool and the squeeze on jobs created by the recession. To better understand what would be required of a freelance video effects agency, I have endeavored to create a set of projects that a creative professional might face in the current world of film and video. The projects, scaling up in difficulty, attempt to simulate what a freelance visual effects artist would face in getting a business off the ground and through it's first set of assignments. Pricing out equipment, contacting clients, and creating a number of finished videos are all included in the process. The anticipated result of these experiences is to evaluate how well the current curriculum in the School of Film and Photography has prepared me for the final test- getting a job in the industry.

**Jacob Hunter: Architecture**

**Mentor: Chris Livingston-- Architecture**

***Memorial Garden***

My research involves a memorial garden design project expected to be completed this summer at Heart of the Valley Animal Shelter in Bozeman, Montana. I was introduced to the project by former Executive Director Tracy Weller, and quickly set to establishing a fundamental understanding of memorials. I first had to research how memorials work, and what elements make them successful. I wrote a research paper about memorials and specifically looked at the Little Bighorn Battlefield monument, the Vietnam Veterans Memorial, and the New England Holocaust memorial. Then I researched the site itself in an effort to utilize its natural advantages. I looked at sun angles, wind directions, views, and the existing landscape. The design process is ongoing and tedious, but coming to a close, and soon ground will be broken. Ultimately, I intend to volunteer my labor and see this project through full circle; from idea, through design, and into reality.

**Milenka Jirasko: Architecture**

**Mentor: Ralph Johnson-- Architecture**

***Sustainable Building Alternatives for Bozeman Rowhouses***

This project will provide a side-by-side analysis of existing duplexes and an alternative design driven primarily by sustainability. The chosen case study is a set of duplexes on Tempest Court, off North 27th Street. These connected residences have garages to the East and large windows to take in mountain views, but the line of duplexes is oriented North-South and so does not take advantage of passive solar heat with either South windows or massive elements to control temperature fluctuations. The residences also do not utilize night flushing, a highly effective passive cooling strategy with Montana's cool summer nights. The alternative design of row houses incorporates not only passive solar design in both glazing and trombe walls but also rainwater collection, xeriscaping, night flushing, and radiant floor heat with heat exchangers instead of blown-air heating systems. The goal is that this project becomes one in a future library by multiple students, providing graphic and written information to both residents and planners; in this way sustainable design will be more easily understood and accessible, and more widely used in Bozeman.

**Caroline Nelson: Liberal Arts**

**Mentor: Nelleke Beltjens-- Liberal Arts**

***An Investigation In Repetition***

I pursue the new, that is, new ways of seeing and new ways of thinking, and new ways of interpreting and experiencing the world. My work is an expression of my curiosity. I choose repetition of ubiquitous shapes and materials not usually used in an art experience. I use the material as a muse for what can take form. The repetition of uniform material is critical to my work. I use organization as my strategy to compose a piece, balanced with or even opposed to an intuitive process. My strategies include using non-traditional art materials as a way to construct an art experience through the transformation of the materials. Examples of my materials include: drinking straws, roofing nails, cupcake cups, zip ties and pipe cleaners. My goal for this project is to produce a strong body of work that will help me move to the next point in my career after graduation. Further, I am interested in the role my work plays in the world. I believe my pieces are incomplete until a viewer has interacted with or has been challenged by my work. The viewer's experience is the final stage of the work.

**Steven Powell: Fine Art**

**Mentor: Independent Project--**

***Bio-ID Project***

The Bio-ID is the most comprehensive forensic identification device available. It is a strong crime deterrent and a life saving device in the event of a missing child. The goal of this independent project is to provide this state-of-the art identification device to every school-aged child in the country, beginning in Gallatin County. The Bio-ID Project provides community sponsors so the Bio-ID's can be provided to all school children at no cost to the children or their parents. This project has been supported by many across Montana as well as the Bozeman community. It involves several Students and Faculty at Montana State University. These gracious individuals have helped in whatever way they can and have been invaluable in the research and development of this project which will be launched this year. They include: Art Department Faculty, Business College Faculty, as well as students majoring in Engineering, Computer Science, and Photography.

**Jordan Roberts: Photography and Environmental Studies**

**Mentor: Kyle Bajakian-- Photography**

***Sustainable Food Systems: A photographic journal***

As a photographer and someone that is interested in matters of societal concern, it was imperative to create images that represent sustainable food systems and the localized grassroots movement that is bridging the gap between the producer and consumer. This past summer the One Thousand New Garden's Initiative came to Bozeman, MT and offered community members a friendly resource for growing their own produce. The student run effort established a non-conventional link between Montana State University and the community that supports it. In my research I have found that on average food consumed in the United States travels a distance of 1300-2000 miles, and with transport relying heavily on finite resources it is inevitable that the cost of such systems will cause great inflation in the cost of food. This negative externality that subscribes to paradigms of old, attempts to bind our decision making capacity as consumers to the wallets of companies whose ultimate bottom line turns a blind eye to the ethical and moral concerns of the people it grows food for. The sustainable food movement facilitates an intimate connection to the consumer while ensuring a higher quality product that has less ecological impact.

**David Arnar Runolfsson: Photography**

**Mentor: Kyle Bajakian-- Film and Photography**

***Whaling: The Future of an Endangered Tradition***

The country of Iceland recently started commercial whaling after a 20 year moratorium. This decision has met much resistance by the international community. Iceland has a long whaling history but it is widely regarded that given the international resistance this revival of the whaling tradition will be short lived. Still there is much interest in the community and the new jobs are celebrated. Whaling ships that have been tied up for 20 years are sailing again with some of the same crews that worked on them before the moratorium. But much has changed during this time. Iceland has now built up a lucrative business of tourism, and specifically whale watching. There are mixed feelings in the community about whether this will benefit or hurt Iceland in the long run. This project provides a photographic documentary of the current whaling practices in Iceland and explores some of the attitudes and thoughts of whaling within the community. The project does not try to answer the scientific question of whether whaling is sustainable or many of the other concerns associated with whaling worldwide. It is a visual exploration into a tradition and its struggle to stay alive.

**Rory Schulte, Jake Brown: Motion Picture Video Theatre**

**Mentor: Tom Watson-- Film and Photography**

***Connect the Dots***

My USP funding went towards my senior thesis film called "Connect the Dots," a fictional film about the effects of Post Traumatic Stress Disorder in today's military. The piece is nearly ten minutes long and explores the effects of the disease and also offers a unique perspective through the eyes of both today's and yesterday's soldier. The funding went to cover certain budget items like set construction, Middle Eastern costume research and design and the cost of the film stock. The research portion of this project was a two part process. First we had to learn about Middle Eastern culture and customs. We studied architecture, design, color palettes and writing. We researched male and female garb as well as the language. This all came together to build an Iraqi street market in downtown Bozeman, MT, which was quite a challenge. This leads me to the second part of the research process. We had to learn film techniques that would allow us to make a place like Bozeman seem like it was a world away. All in all it was a great learning experience and easily one of the most ambitious films I have ever been a part of at MSU.

**Julia Sharrock, Colton Knudsen: Film**  
**Mentor: Dennis Aig-- Film & Photography**  
***The Hollow***

Film is a unique art form because it combines so many aspects of sensation in one medium at one time to promote a single story or idea. Through the combination of ambient sound, music, dialogue, and the selectivity of visual material allowed by camera work and editing, motion pictures are able to affect individuals on an extremely deep and psychological level. "The Hollow" is a short experimental narrative film that explores the ability of Film, as a medium, to affect the emotional state of viewers. Through the use of imagery, sound design, and editing techniques "The Hollow" is designed to bring its audience into the turbulent mental state of the main character, Tabitha. In doing this the film hopes to expose viewers to a state of mind that they have never experienced before and to breach some of the taboos that surround public discussion of mental instability and illness.

**Blair Sorlie: Environmental Design**  
**Mentor: Ralph Johnson-- Architecture**  
***Sustainable Housing***

The goal of this research project is to compare the physical characteristics and cost, both monetary and environmental, of normative building types with comparable designs created to minimize environmental degradation. Part one of the research is to research a single family home on a medium sized lot and record information on it such as its physical characteristics, initial cost, operational expenses, water, and energy consumption. Part two of the project will require a new design of a zero-energy home alternative to the normative building type. Its projected physical characteristics, initial cost, operational expenses, water, and energy consumption will then be recorded. With these two sets of data to compare, it will eventually be put into a computer program that is being developed by an outside organization that developers can use to plan subdivisions. They would be able to put in the normative and zero energy homes and see how much energy and resources that the development would use compared to one that is just made up of the normative house.

**Michael Tarrant: Music Technology**  
**Mentor: Kristi McGarity-- Music**  
***Recording Soundscapes: Butte***

A soundscape is the combination of sounds from a specific environment or location. This combination of sounds can vary greatly from place to place. Different people, wildlife, and actions dramatically influence the sounds of a location. Through soundscapes, one can experience the flavor of a certain place. Recording soundscapes captures the feel of particular locations, and that makes them very appealing to me. I want others to be able to feel and hear and go to places to which they have never traveled. I have recorded soundscapes in the Dominican Republic and Chile, but I wanted to compare these recordings to ones in Montana. I recorded soundscapes in Butte, Montana throughout the summer of 2010. I wanted to document the flavor of Butte, in the recorded combination of sounds specific to this historical city, and the various locations all over the city where I recorded. I hope to record the essence of Butte in sound, so others could hear and experience this Montana city in a soundscape.

**Kelsey Tessier: Architecture**  
**Mentor: Ralph Johnson-- Architecture**  
***Rethinking Design***

The primary goal of the research project is to create two design boards which compare energy use and appearance of an existing Bozeman building and a redesigned, eco-friendly alternative. The presentation format will be two design boards, one with the baseline building and another with the proposed design. The baseline building is the Village Downtown condominium complex. The Village Downtown will be

analyzed for energy performance in addition to any effective sustainable strategies currently being used. After this initial data is gathered, a new, alternative building will be designed with the goal of a net energy of zero. Perspective drawings will be done of both existing and alternative buildings, to capture the aesthetic qualities which have attracted tenants to the Village Downtown and which may attract future Bozeman tenants to the eco-friendly alternative. Both boards will be displayed side by side to allow comparison of energy use and building aesthetics. The goal is for this project to be added to a visual database of sustainable design alternatives which the public will be able to access.

**Logan Triplett: Film**

**Mentor: James Joyce-- Film**

***Modern Exposure: The Art of Exposure for the Digital Sensor***

Sensitometry, or the study of light sensitive materials, is a highly regarded science for the study of cinematography. Throughout the years, photographic film has proven itself time and time again through various advancements. Film itself is a very complex makeup of halide crystals, and chemicals. If the film plane is exposed to light, then such crystals begin to react, imprinting a "negative" image upon the film plane. Sensitometry deals with the complete study of this "negative," and how light can, and will react upon it. But what about in today's digital world? Well, believe it or not, digital, despite being the "latest" technology, is still trying to catch up to the beauty of film. My study explores the modern sensor, how it works, and how to best manipulate it. With new advancements in technology, it is nearly impossible to keep up with the science behind today's latest and greatest video cameras. What's more, such standards such as ASA are being challenged daily by "variations" that occur within "company standards." Join me in exploring the modern sensor, in what will soon challenge the the dominating quality of film: Welcome to the world of modern sensitometry.

**Kluane Weibel: Architecture**

**Mentor: Ralph Johnson-- Architecture**

***Re-developing the Single Family Residence***

Design strategies for effective zero-energy building in the Northern Rockies has not been researched and documented for public access. The information compiled with this research project will be available to the public around the greater Northwest Rockies. The public will then have the ability to make informed design decisions; comparing and contrasting normative design solutions to energy conscious design solutions. Research will begin with understanding the normative conditions of a baseline single family residence; which then will be improved upon to create an approximate zero-energy residence. The normative data will be gathered through interviews with the City of Bozeman, local residents and builders. From this research a benchmark energy consumption and aesthetic qualities associated with this energy consumption will be presented. The benchmark house will be redesigned by incorporating an energy conscious design scheme. This design will focus on water and energy conservation, heating and cooling loads, site planning, landscaping, materials, products and construction costs.

## COLLEGE OF AGRICULTURE

**Kemal Akkoyun, Chris Allen: Environmental Science and Environmental Engineering**

**Mentor: Catherine Zabinski, Otto Stein-- Land Resources and Environmental Studies, Civil Engineering**

***Determining the effect of carbon loading on denitrification rates in constructed wetlands***

Constructed wetlands are used around the globe to treat a wide range of wastewater types, from point source industrial effluents to agricultural runoff. Microbes assisted by wetland plants are responsible for breaking down organic wastes and taking up nutrients. Nitrogen removal is often a goal of treatment

wetlands but incomplete breakdown of nitrogen compounds can result in the emission of nitrous oxides, which are a potent greenhouse gas. This project is part of a larger study to determine the efficiency of nitrogen removal through microbial pathways. Because microbes that contribute to denitrification use carbon as a substrate, optimal nitrogen removal will require a specific ratio of carbon to nitrogen concentrations in wastewater. I conducted a greenhouse experiment using established constructed wetland mesocosms planted in monocultures of three plant species (*Carex utriculata*, *Typha latifolia*, and *Schoenoplectus acutus*) or left un-planted. Three carbon-nitrogen ratios were tested representing zero, two and six times the stoichiometric requirement for complete denitrification. The results will help us to identify the optimal concentration for efficient wastewater processing without the production of high quantities of greenhouse gases.

**Anna Bergstrom: Land Resources Analysis and Management**

**Mentor: Brian McGlynn-- Land Resources and Environmental Sciences**

***Watershed and stream network geometry: Implications for water and solute fluxes from watersheds***

Landscape influences on the timing and magnitude of water delivery from watersheds are poorly understood. Watershed and stream network geometry (topography and topology respectively) may play a significant role in controlling fluxes of water from catchments. Stream network shape and topology as well as riparian and upland watershed structure can each influence the timing and magnitude of water delivered to watershed outlets. Here, we analyzed six watersheds in the Sawtooth Mountains of central Idaho ranging in size from 11 to 63 km<sup>2</sup>. We performed detailed terrain analysis on 10m resolution digital elevation models for each watershed. We calculated an array of watershed metrics including: frequency distributions of slope, aspect, distance from creek (DFC), elevation above creek (EAC), gradient to creek (GTC), median subcatchment size, and lateral inflows. We also calculated stream network indices: drainage density and distance from outlet (DFO). Metrics including drainage density, DFO, local inputs, and slope show differences across the watersheds indicating differences in watershed and stream network structure. We suggest that these metrics, among others, can be considered quantitative metrics of watershed and stream network geometry and aid elucidation of landscape characteristics that partially control the timing and magnitude of water and solute fluxes from watersheds.

**Jake Flentie: Environmental Horticulture Science**

**Mentor: Chaofu Lu-- Plant Sciences and Plant Pathology**

***Genetic screen of mutant fatty acid composition in seeds of *Arabidopsis thaliana****

Considerable changes to seed oil quality have been achieved by plant breeding or selection of natural or induced mutations during the latter part of the twentieth century. The best-known example is the development of canola from rapeseed. More recently, variation in fatty acid compositions has also been obtained in many oil crops including soybean, flax, safflower, and sunflower. Molecular tools of biotechnology provide a rapid and efficient means to alter seed fatty acid compositions in transgenic plants, for example, the creation of high oleic soybean. These achievements are largely due to the understanding of lipid metabolism in oilseeds and the availability of genes for key enzymes for fatty acid synthesis and modifications. Current knowledge of oil metabolism in oilseeds has largely been obtained from genetic analysis of *Arabidopsis thaliana*, a model plant. Although much has been known for the biochemical and genetic factors controlling lipid metabolism, new discoveries continue emerging. An example is the discovery of a new enzyme involved in oil synthesis by Dr. Chaofu Lu and collaborators last year. Complete understanding of this important process is essential for efficient engineering of tailor-made plant oils for different uses.

**Kathryn Gause: Horticulture**

**Mentor: Mike Giroux-- Plant Science and Plant Pathology**

***Screening for Mutations in Starch Synthesis to Create High Amylose Durum***

Durum wheat is used for pasta; durum seeds with a higher amylose yield firmer pasta that is resistant to overcooking and healthier for the general public. Amylose is composed of straight chains of glucose bound to lipids. The pasta made with increased amylose would have increased firmness because the lipid restricts starch swelling. Amylopectin is composed of highly branched chains of glucose which is readily digestible and swells more upon gelatinization. Starch granule proteins are responsible for the production of these chains of glucose. To increase amylose production the SGPII gene which makes amylopectin must be knocked out. We screened durum varieties to find SGPIIA mutations; they were crossed with the variety Mountrail. The SGPIIA mutants were selected then mutagenized with EMS. My goal is to find the SGPIIA and SGPIIB mutants in the SGPIIA double genotypes and sequence them. I performed flour swelling power tests screening for the possible mutations. I isolated the DNA from these seeds, performed PCR tests and ran protein gels to determine if the gene is present, coding for the proteins involved in amylose production. I then figured the DNA primers for the genes and sequenced them. I am currently screening the sequences for mutations.

**Kelsey Guffey: Animal Science**

**Mentor: Clayton Marlow-- Animal and Rance Sciences**

***Foraging Ecology of Bison in a Foothills Grassland-Steppe Ecosystem***

Reproductive rates of semi-free ranging bison cows (Bison, bison) at the National Bison Range in Moiese, MT have declined 54% in the last decade. Understanding habitat selection can be used in conjunction with other distribution tools for sustaining ecological condition and herd reproduction. Ocular observations and habitat analysis indicate disproportionate utilization of available landforms and forages, high selection pressure on highly selected forages, and observable behaviors subject to temporal and/or spatial variation. These patterns suggest a high degree of selectivity in response to nutritional stress during the postpartum recovery period and may partially explain the recent decline in herd productivity.

**Sonny Hawk: Soil and Water Sciences**

**Mentor: Dr. Jackson Gross-- United States Geological Survey, Northern Rocky Mountain Science Center**

***Impacts of Sound Pressure Levels on Snake River Cutthroat Trout (*Oncorhynchus clarkii*) Life History Stages***

Seismic air guns are the most common tool developed for oil exploration in water, but there are concerns about the effects of pressure waves produced by these technologies on threatened and endangered fishes. Results from preliminary studies investigating the effects of sound pressure waves on fish mortality suggest a significant reduction in juvenile pallid sturgeon survival. Using Snake River cutthroat trout as surrogates, we designed a dose response study to determine mortality and organ damage that occurs with exposure to a range of pressure differentials, depths and distances from a hydro gun. Hydro guns were selected as they are modified air guns, but removed from use by oil industries as they were shown to be considerably more lethal to fish. Unfortunately there are limited methodologies to control and eradicate invasive fish species, so we are testing the ability of these seismic technologies to suppress invasive species at various life history stages. The objective of this project is to develop underwater sound technologies that utilize a broad spectrum of frequencies and create large pressure differentials to impede and suppress invasive juvenile and adult fishes.

**Carla Hutson: Pre-Veterinary**

**Mentor: Christa Merzdorf-- Cell Biology and Neuroscience**

***Are the "wings" of zic1 expression part of the premigratory neural crest?***

Zic1, a gene critical to early neural tube development, is expressed along the edges of the neural plate in *Xenopus laevis* embryos. The expression of zic1 can be described as a "horseshoe" with "wings" extending from either side. The "horseshoe" area of zic1 expression is along the edges of the neural plate, but it is not known what the "wings" area represents. The literature suggests that the wings area where zic1 is expressed contain migrating neural crest cells, but this contradicts the fact that, in *Xenopus laevis*, neural crest cells do not migrate until after neural tube closure is complete. *en-2* and *slug* are genes also important to neural development. *en-2* is expressed at the midbrain-hindbrain boundary, while *slug* is expressed in pre-migratory neural crest cells. Preliminary single in situ hybridizations suggest that zic1 expression overlaps *en-2* and *slug* expression. We compared the expression patterns of *slug*, *en-2*, and zic1 using double in situ hybridizations. By comparing these genes our aim is to better understand what the "wings" of zic1 expression are.

**Amanda Hyman: Environmental Biology**

**Mentor: Geoffrey Poole-- Land Resources and Environmental Sciences**

***Stream Metabolism Following Restoration and Remediation of Silver Bow Creek, Montana, USA***

Streambed metabolism is an indicator of a stream's potential for storing and processing solutes including nutrients, dissolved carbon, and bio-reactive pollutants. Silver Bow Creek, Montana is undergoing remediation for past mine tailing contamination and provides an excellent opportunity to investigate effects of channel restoration on streambed metabolism. The restoration entails replacement of streambed and floodplain surface deposits with clean sediments, followed by construction of a meandering channel. We measured open-channel dissolved oxygen concentrations to document differences in metabolism prior to, and at intervals of ~1 week, ~1 month, and ~1 year following restoration. We then compared metabolism rates calculated via Odum's (1956) methodology and predicted values from single- and two-station inverse Bayesian metabolic models. Results document recovery of streambed metabolism after intensive restoration, differences in estimated metabolism from alternative methods of data analysis, and the predictive power of inverse modeling schemes. Preliminary results show a substantial augmentation of pre-restoration respiration and gross primary productivity rates one year following restoration.

**Kendra Kaiser: Soil and Water Sciences and Environmental Biology**

**Mentor: Brian McGlynn-- Land Resources and Environmental Sciences**

***Ecohydrology: Disturbance and the intersection of vegetation pattern and landscape structure***

Watershed ecohydrology is a function of the intersection of vegetation pattern and landscape structure. The hydrologic implications of vegetation disturbance depend on the spatial extent and pattern of change on this ecohydrologic template. We investigated this intersection with a focus on the mountain pine beetle (*Dendroctonus ponderosae*) epidemic that is increasingly affecting areas in the Rocky Mountains. We calibrated QuickBird remote sensing imagery by developing a spectral library for vegetation in our study area. The spectral library was used to determine which vegetation indices were optimal for differentiating between stages of infestation; thereby maximizing the information obtained from the QuickBird image. These indices were applied to the QuickBird imagery to establish baseline mortality, and the extent of infestation across the watershed. We also calculated LiDAR based topography and vegetation indices for topographic, vegetation, and disturbance analyses. We seek to determine which forest stands are most susceptible to beetle infestation, and how these infestation patterns are related to hydrologic, topographic, and forest ecosystem compositional characteristics. Our efforts to monitor vegetation mortality across space and time provide a context for assessing the drivers of mountain pine beetle infestation and how outbreak patterns may affect watershed ecohydrology via energy, water, and biogeochemical cycles.

**Priyanka Kudalkar: Plant Biotechnology**

**Mentor: Gary Strobel-- Plant Biosciences**

***Muscodor sutura, a Novel Endophyte Making Bioactive Volatile Compounds***

Endophytic microorganisms are a significantly rich source of natural products that display myriad biological activities. An endophyte CA-22D was isolated from a medicinal plant *Prestonia trifida*, from the tropical rainforest of the Columbian Amazon region and exhibits unique biological, morphological and chemical characteristics. The fungus described as *Muscodor sutra* is a novel fungal species. It is active in the gas phase against most plant pathogenic fungi such as *Pythium ultimum*, *Phytophthora cinnamoni*, *Sclerotinia sclerotinium* etc. Various data support the conclusion that it is a novel species including scanning electron microscopy (SEM) showing a rather unusual morphology of the fungus as its hyphae weaves in and out of its supportive agar medium. The volatile organic compounds produced are *Thujopsene*,  $\beta$ -Chamigrene, Benzocyclobutene etc. and these suites of compounds are different than those of all other *Muscodors*. Furthermore, the rDNA sequence of its ITS region shows that it is closely related to *Muscodor vitigenus*, but unlike this organism it does not make naphthalene. In addition it has antifungal activity, and produces a pinkish pigment when cultures are placed in the dark. Its relationship to its host is not known.

**Kristen O'Brien: Environmental Horticulture**

**Mentor: William Hoch-- Plant Sciences and Plant Pathology**

***Production of Tetraploid Russianolive (Elaeagnus angustifolia) for Use in Development of Sterile Horticultural Varieties***

The escape and establishment of exotic plants from ornamental landscapes is causing significant ecosystem and environmental damage throughout much of the United States. The Russianolive (*Elaeagnus angustifolia* L.) is one such ornamental, which has become a major invasive pest in riparian habitats throughout much of Montana. This project is focused on producing the first tetraploid individuals of *E. angustifolia* for use in the development of sterile triploid clones via 2x x 4x crosses. Meristematic tips of 1,000 newly-germinated seedlings were treated with 25  $\mu$ L of one of two mitotic spindle inhibitors, trifluralin or oryzalin, at either 40  $\mu$ M or 120  $\mu$ M concentrations with 1% dimethyl sulfoxide (DMSO) as an adjuvant. Treated seedlings were covered with a plastic dome to prevent drying and placed in the dark for 24 hrs. The seedlings were then rinsed and moved to the greenhouse. While no significant phytotoxicity was observed, stunting of the apical meristems, particularly from the 120  $\mu$ M concentrations, indicated that the mitotic spindle inhibitors had affected the meristems. When the treated meristems reorganize and resume growth, ploidy will be determined using flow cytometry. The availability of sterile triploid cultivars will allow for the continued use of this durable tree without concern of escape into natural areas.

**Nikitaben Patel: Biotechnology, Veterinary Molecular Biology**

**Mentor: Dr. Katherine Gauss-- Immunology and Infectious Diseases**

***Develop PLAGL2 oncogenic myeloid cell line model***

PLAGL2 is a zinc-finger transcription factor that has been shown to have both oncogenic and tumor suppressor activity. Previous studies have identified PLAGL2 as a cooperating oncogene in acute myeloid leukemia, as well as a target for amplification in a subset of AMLs, myelodysplastic syndromes (MDS), and malignant gliomas. There is additional evidence that PLAGL2 functions as a tumor suppressor by initiating cell cycle arrest and apoptosis, although little is known regarding the role of PLAGL2 in any of these physiological processes. We have generated a stable, PLAGL2-expressing myeloid cell line (U937) where PLAGL2 functions as a tumor suppressor, as they undergo cell cycle arrest and apoptosis with PLAGL2 expression. Our current goal is to identify a human myeloid cell line that demonstrates a growth advantage with PLAGL2 expression, thus generating a PLAGL2 oncogenic model. We will generate PLAGL2-expressing retrovirus and transduce human myeloid cell lines to rapidly screen for PLAGL2-induced proliferation. Having both PLAGL2 oncogenic and tumor suppressor models will allow us to

compare these two opposing phenotypes and gain a better understanding of the mechanisms of PLAGL2 oncogenic and tumor suppressor activity.

**Brett Sather: Land Rehabilitation**

**Mentor: Catherine Zabinski-- Land Resources and Environmental Sciences**  
***N<sub>2</sub>O Greenhouse Gas Losses from Three Forms of Nitrogen Fertilizer***

Improved understanding of soil N<sub>2</sub>O emissions derived from nitrogen fertilizer is important to minimize the impact of agriculture on greenhouse gas accumulation in the atmosphere. This study was conducted to measure the out-gassing of N<sub>2</sub>O from three different forms of nitrogen including urea, KNO<sub>2</sub> and KNO<sub>3</sub>. Nitrogen was applied at a rate of 100 kg/ha to a bare ground as well as a straw covered treatment on a cultivated field west of Bozeman, MT. Gas samples were collected and analyzed for N<sub>2</sub>O every 2-3 days from May 12th to July 7th 2008 and gas emission flux measurements were taken using a gas chromatograph. N<sub>2</sub>O emissions from the nitrite treatment were forty times greater than the control within the first week. No significant raised emissions were measured from any of the other treatments. Two weeks after fertilization, emissions from the urea treatment were up to seven times greater than the control. This study shows that a significant loss of nitrogen fertilizer due to outgassing occurs in agricultural systems and intelligent practices to limit losses should be pursued.

**Heather Smart: Equine Science and Economics**

**Mentor: Myles Watts, Doug Young-- Agricultural Economics & Economics**  
***The Impact of Sales Taxes on R.V. Sales***

Do you want to pay a national sales tax? What if that sales tax meant paying no income taxes? Answering questions like these begins with examining how sales taxes impact purchasing a single good. This study is a spring-board to looking at the impacts of sales taxes on purchasing behavior by examining recreational vehicle (R.V.) purchases. An R.V. is a substantial investment and they are purchased by individuals who choose R.V. travel over the alternatives of plane or car with hotel accommodations. Sales taxes vary by state. Montana, for example, has no sales tax while Wyoming has a 4 percent sales tax. Information from the 2002 and 2007 Economic Census, the Current Population Survey, and annual state tax and vehicle registration data is used to study the relationship between R.V. sales and sales taxes. The results of the study are explained using the economic theories of elasticity of demand and the income effect.

**Max Smith: Sustainable Foods and Bioenergy Systems**

**Mentor: Mary Stein-- Health & Human Development**  
***Three Ways to Measure a Neighborhood Supported Model of Agriculture***

A Gallatin Valley Food Bank-led study laid the foundation for a student-led project promoting household organic vegetable gardening in Bozeman. Twenty percent of food bank clients could feasibly "grow their own food at home." The implications of the study were that 464 households could build and grow gardens in their homes. This led to a simple research question. If food bank clients can feasibly grow their own food, why aren't they? In partnership with the food bank, 1000 New Gardens addressed this question by tracking the successes and challenges of four low-income gardeners who grew produce at home for the first time. Project organizers also measured the barriers faced by the community by surveying 37 households and the project's value by surveying student volunteers. The results suggest volunteers strongly agree in the project's ability to provide a worthwhile community education. They extended the project by identifying new solutions to community issues they had discovered in classes. Low-income families did not identify a common barrier to growing food while time, knowledge and physical limitations plagued the neighborhood survey group. Altogether, respondents shared motivations for volunteering and growing food, which will help organizers attract low-income gardeners in the future.

**Max Smith: Sustainable Crop Production**  
**Mentor: Mary Stein-- Health and Human Development**  
***The Organizer's Guide to Replicating Urban Agriculture Projects***

1,000 New Gardens originated in Missoula, Montana in 2009 as a student-led project promoting neighborhood supported sustainable agriculture by organizing everything households need to begin growing vegetables. As the project spread to Bozeman in 2010, students wrote several successful grants to improve our internal capabilities and the grassroots project has provided for the needs of more than 105 families and we intend to double the number of families receiving volunteer services in 2011. Exposing detailed narratives of how 1,000 New Gardens and other successful models have come to promote agriculture in urban areas around the world will give other organizers an opportunity to implement and adapt them in their own communities. Organizers in Brazil, Egypt, France, Kenya, South Africa and the United States were prompted to describe the urban agricultural model they developed in their natural settings. Each organizer who wrote for the handbook drew upon observations of their natural setting - the neighborhood they've helped to redevelop. The resulting personable narratives have given future student leaders at spring conferences in 2011 the tools they'll need to critically assess their likelihood for replicating the projects and the desired impact in their urban area.

**Tristany Wagner: Land Resources and Environmental Sciences**  
**Mentor: Jackson Gross-- USGS**  
***The Impacts of Seismic Technologies on Fisheries***

In the 1980s oil exploration companies began using hydro and air gun arrays in order to explore the composition of the ocean floor. These guns emit pressure waves as a means of estimating the properties of the ocean bottom from reflected seismic waves. Since the introduction of this method of oil exploration, research has been conducted to examine the effects of these technologies on sea life. The majority of published data studies the effects of pressure waves on marine mammals, our research is designed to determine the effects of these technologies on multiple fish species such as Cutthroat trout, Northern pike, Asian carp and Pallid Sturgeon. Preliminary experiments conducted in Leadville Colorado, Soldotna Alaska, Morris Illinois and Lake Sakakawea North Dakota evaluate the effects of sound pressure waves produced by seismic equipment on fish mortality. To promote the understanding of the effects of these technologies on fish species further experiments will be conducted during the 2011 field season. Behavioral and physiological responses will be measured in fishes during exposures to pressure waves of different intensities to establish species specific pressure levels that will herd, divert and eradicate invasive species.

## COLLEGE OF BUSINESS

**Justin Zarecor: Management**  
**Mentor: Minette Jessup-- Business**  
***The Influence of Perceived Risk on Capital Allocation***

Risk is an increasingly important factor within business in light of social, economic, environmental, and political factors. Modern business leaders must take into account an increasingly treacherous and uncertain risk climate as they manage their corporate assets and determine what level of capital reserves to keep accessible through short term cash. The recent economic downturn has highlighted the importance of capital reserves to weather unexpected business conditions. Beginning in December 2007, the United States entered the worst economic period since the Great Depression; which occurred from 1929-1941. This economic environment has changed the way corporations allocate cash and invest in the short term. This study will determine the major causes of hesitancy with regard to corporate capital

reinvestment through research, data analysis, and interactions with Standard and Poor's (S&P) 500 executives, shareholders, and stakeholders. Design: Research, data analysis, and telephone interviews with S&P 500 executives through Profitable Ideas Exchange (PIE). Interview and facilitate interactions with key executives who influence decisions regarding capital allocations. Additionally, conduct analysis of relevant data on the impact of capital allocation decisions on shareholders and other corporate stakeholders.

## COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

**Ryan Hannahoe: Elementary Education**

**Mentor: Mary Leonard-- Education**

***Turning Eyes to the Big Sky Project***

The Turning Eyes to the Big Sky Project (TEBSP) focuses on strengthening 4th through 9th grade science instruction in light and optics. It was implemented in 15 classrooms in southwestern Montana, reaching 380 students. TEBSP implemented a nationally established informal science curriculum on light and optics, the Terrific Telescopes Curriculum (TCC), into the formal classroom setting. The project's rationale addresses the following research questions: (1) how did participating teachers respond to the curriculum and what would they change about it, (2) what was the relationship between student learning outcomes and their teachers' knowledge and experience in teaching science, and (3) how well did students learn and what science concepts and principles did they grasp best through TCC? In October 2010, 15 public-school teachers were trained to implement the curriculum in their classrooms. The implementation is currently underway and will be completed by the end of the academic year. We are collecting student and teacher data on the curriculum implementation and student learning. TEBSP will contribute to our understanding of how students learn key light and optics-related principles, as well as document the learning outcomes of the TCC.

**Stephanie Johnson: Dietetics**

**Mentor: Brian Bothner-- Chemistry and Biochemistry**

***Using Graphic Designs to Communicate Scientific Research***

Jargon is often required for scientific discussions, but can build a barrier between scientists and the public. Breaking down barriers that inhibit public access to science is important because; public research funding is supported by taxation which relies on broad support, the public is the end-user/benefactor of most science, and we live in a technologically driven society. As an example of bridge building between cutting edge science and the public, we are creating graphics that explain the use of virus particles as nanomachines for gene therapy and the importance of nutrition for every individual. An illustration of Adeno-Associated Virus cell entry demonstrates how the virus enters the cell and releases a hidden enzyme that allows it to break into the cell. This process is being investigated as a way to introduce genes and anti-viral drugs into cells. By designing a large distorted poster of Marilyn Monroe, we capture the attention of passers by and deliver information on body image, nutrition, and eating disorders. By creating pleasing and understandable diagrams for journal articles, presentations and advertising, people may take an extra moment to read what they are about. This generation of interest may help bring scientists and the public together.

**Kilani Morris: Food and Nutrition**

**Mentor: Darcy Hunter-- WIC Office**

***Evaluation of WIC fruit and vegetable benefits on children consumption rates and benefit utilization***

Fruits and vegetables provide essential nutrients which impact the growth and development of children. Children from low income households are at highest risk for developing health disparities and nutrition related diseases due to their low consumption rates of fruits and vegetables. To increase these intakes, the Supplemental Nutrition Program for Women, Infants, and Children (WIC) strives to safeguard the health of children ages 1-5 by providing them with food packages. In 2009, WIC food packages evolved to encompass fruits and vegetable benefits. Since the implementation of the fruit and vegetable benefits, no evaluation of the extended program has been conducted to determine its effectiveness on fruit and vegetable intake patterns of children. Therefore, the purpose of this study was to evaluate the effectiveness of the fruit and vegetable benefit program by analyzing store redemption rates through quantitative data on usage and by conducting survey analysis to obtain qualitative data on family perceptions of their children's fruit and vegetable intakes after receiving the benefits. This study gathered data through random sampling of 30 WIC families with children receiving fruit and vegetable benefits as well as through analysis of benefit redemption rates from WIC participating grocery stores throughout Bozeman, MT.

**Sydney Reichardt: Food and Nutrition**

**Mentor: Christa Merzdorf-- Cell Biology and Neuroscience**

***Expression Patterns of *tnrc4*, *Xl.25952*, and *Xl.8933* in Early Neural Development***

Early embryonic development of the nervous system is relatively similar in most vertebrates. Through the use of laboratory procedures, this process can be explored in the model species *Xenopus laevis*. The intention of my research is to (1) determine the expression patterns of the genes *tnrc4*, *Xl.8933*, and *Xl.25952* throughout the stages of neural development, (2) explore the effects that inhibition of translation of these genes has on neural development, and (3) determine the roles of these genes during early development of the nervous system. The specific locations of gene expression are determined using in situ hybridization, in order to determine variances in gene expression throughout embryonic development. The stained embryos are then evaluated in whole mount and cryosections. At this point, my results suggest that *tnrc4* and *Xl.25952* may be expressed in regions that are closer together in the neural plate, while *Xl.8933* may be expressed further away from the midline of the neural plate. The process of inhibiting gene translation will be achieved by injecting *Xenopus laevis* embryos with morpholino oligonucleotides (MOs) specifically designed to the *tnrc4* and *Xl.25952* genes. The proposed experiments will contribute to the overall understanding of the process of nervous system development.

**Beth Renick: Community Health**

**Mentor: Mary Miles-- Health and Human Development**

***Mindfulness-Based Stress Reduction (MBSR) as a Strategy for Lowering Perceived Psychosocial Stress and Disease Risk Variables***

The purpose of this study was to determine whether mindfulness-based stress reduction (MBSR) lowers perceived stress, C-reactive protein (CRP), an estimate of insulin resistance (IR), and BMI. Overweight individuals participated in MBSR training or a control condition for 16 weeks. Pre- to post-intervention changes in CRP and IR were similar between groups, and associated with changes in body mass index (BMI). We conclude that changes in BMI have the most influence on these variables. Data from more participants is needed to determine whether MBSR has an influence. Mindfulness Based Stress Reduction (MBSR), originally introduced in 1979 at the University of Massachusetts, Worcester, is a methodical patient-centered educational approach to teach people how to create positive behavior change. Increased levels of stress have been connected to many chronic health conditions. When stress triggers a response by the body's endocrine systems, hormones are released that can influence many biological systems, including the immune system. The effects of stress on the regulation of immune and

inflammatory processes have the potential to influence depression, autoimmune, and coronary artery disease, and at least some (e.g., viral) cancers. Therefore, practicing a behavior or lifestyle change that lowers stress levels may prove to reduce chronic disease.

## COLLEGE OF ENGINEERING

**Kevin Bangen: Mechanical Engineering**

**Mentor: Chris Jenkins-- Mechanical and Industrial Engineering**

***Mechanical Properties of Biological Tissue with Repair***

The objective of this study was to determine the mechanical properties of biological tissue when these tissues contain repairs, namely sutures and adhesive. With a better understanding of what causes suture tear out in hospital patients, the likelihood of occurrence can be reduced or even eliminated; less tear out will then result in more effective patient recovery. Samples tested consisted of pig skin with latex being used as an occasional substitute. Variables explored in this study include extension rate, temperature, humidity, methods of loading, suture thread quantity, and suture thread size. Equipment used for testing included an Instron uniaxial tensile tester and an ARAMIS 3D digital image correlation system. Results showed that biological tissues are most effectively repaired when they are strained slowly, and are kept warm and moist. Results also showed that a large number of small sutures is more desirable than a few large sutures.

**Ana Baselga: Aeronautical Engineering**

**Mentor: Chris Jenkins—Mechanical and Industrial Engineering**

***Ballistic Spore Dispersal as a Bio-Inspired Concept for Satellite Cluster Deployment***

Clusters of small satellites are of current interest for a variety of applications. For example, military satellite systems for situational awareness have traditionally been costly. A cluster of micro-satellites that could achieve similar resolution and/or accuracy as larger satellites, but at lower cost, would be highly desirable. Several challenges exist, however, in maturing cluster technology. One of these is a deployment system that accurately places the individual small satellites a sufficient distance from the payload shroud but is also cost-effective. Nature has devised inventive methods for deploying small "satellites". In this paper, we review the ballistic spore deployment of the fungi *Pilobolus* as a possible paradigm for satellite cluster deployment. Sporangioophores of *Pilobolus*, a fungus belonging to the Zygomycota, are discharged under pressure toward a source of light with amazing accuracy. *Pilobolus* uses very high speeds to counteract the influence of viscous drag on the flight of these microscopic projectiles. Indeed, spores can reach an acceleration of  $210 \text{ km/s}^2$  after launch, with ranges over the 2.5 meters. This fungus presents as well an interesting positive tropism to blue light. Our study included experiments to determine the trajectory parameters of the spores after discharge and we report results of those observations in this paper. In particular, we show how deployment accuracy can be improved through the use of light. Finally, we discuss a more general application of small satellite propulsion inspired by *Pilobolus*.

**John Blaskovich: Chemical Engineering**

**Mentor: Robin Gerlach, Erin Field-- Chemical and Biological Engineering**

***Biological Reduction of Hexavalent Chromium***

Low-level waste and superfund sites existing within the United States and abroad contain numerous toxic materials including heavy metals and radionuclides within the subsurface such as hexavalent chromium (Cr(VI)) present in the form of chromate ion. Hexavalent chromium is a toxic highly mobile metal cation introduced to soil through industries pertaining to leather tanning, textile production, dyes, pigments, stainless steel, cement, and paint. These properties are detrimental in that they lead to the substance

polluting large areas in a relatively short period of time dependent on the velocity of ground water in the system of interest. Mitigation strategies for remediating soils affected by Cr(VI) are reduction to its trivalent form through either chemical or biological means. Of several isolates obtained from a low-level waste test site located at the Idaho National Laboratory, *Arthrobacter sp.* was selected for further studies involving aerobic growth of the isolate upon various carbon sources represented at the site, due to the degradation of present cellulosic waste, in the presence of hexavalent chromium. Variations in toxicity and reduction of Cr(VI) were observed for each respective carbon source, and trends were identified among sugars, organic acids, and alcohols.

**Noelle Carpenter: Chemical Engineering**

**Mentor: Paul Gannon-- Chemical and Biological Engineering**  
***Solid Oxide Fuel Cells Thermal Barrier Coatings***

I have been working with thermal barrier coatings for interconnects of solid oxide fuel cells (SOFC). A (SOFC) converts the chemical energy into electrical energy by combining oxygen and hydrogen which react with one another to create electrons; this is used to create clean energy. The interconnect of a solid oxide fuel system, electrically and physically connects the anode of one fuel cell to the cathode of the adjacent fuel cell in the stack. This project investigates metallic alloys for use as interconnects in SOFC. This project is designed to determine and increase the suitability of metallic alloys with and without coatings for the interconnect. The interconnect materials must be electronically conducting, oxidation resistant, impermeable to the diffusion of gases, and chemically stable with fuel cell materials. The importance of increasing the interconnect's ability not to be oxidized is that oxidization causes lower efficiency of the fuel cell. Fuel cells are low emissions, and effective at a relatively low cost; fuel cells are becoming our world's future energy.

**Mark Chumrau, Scott Mooney: Mechanical Engineering**

**Mentor: Vic Cundy-- Mechanical and Industrial Engineering**  
***Sustainable Greenhouse Heating System***

The objective of this project was to create a fully sustainable greenhouse heating system that will be utilized in the seeding greenhouse at the MSU Towne's Harvest Community Garden. This heating system will allow for seedlings to be placed in the greenhouse earlier in the season, making the farm's renting of a greenhouse unnecessary. The nighttime temperatures in the early spring and late fall in Montana can be very cold, even when it is warm during the day. Seedlings, even in greenhouses, cannot survive in these types of extreme temperature changes, but with the implementation of a greenhouse heating system the seedlings can grow to their full potential even during the cold nights. The heating system includes a combination of a solar heat collector, a hot water storage tank, pumps and radiators. The system also requires a set of controls that allow for optimal temperature in the greenhouse at all times. This project focused on fabricating and testing this heating system.

**Bryce Clark: Chemical Engineering**

**Mentor: Paul Gannon-- Chemical Engineering**

***Fundamental Thermodynamic Study of Nickel's Reaction with Silicon and Silicon Containing Gases at Relatively Low Temperatures***

In both the high temperature corrosion resistant materials market and the semiconductor industry, practical applications for nickel silicide formation have been observed and taken advantage of. Meanwhile, in the polycrystalline silicon production industry, where various nickel alloys are used as materials of construction exposed to high concentrations of gaseous hydrochloric acid, hydrogen, and chlorosilane gases, this phenomenon has been found to be deleterious to the process. In both cases, the availability of reliable and accurate thermodynamic data at relatively low temperatures (200-700°C) is scarce and in vast demand. The objective of this study was to elucidate the fundamental transport mechanisms governing the transport of silicon and silicon containing gases into nickel and the reactions

that form the various Ni-Si crystalline phases. A parametrical investigation of this phenomenon was carried out utilizing a combination of three cohesive techniques: comprehensive examination of the Ni-Si binary system, thermodynamic computer simulations of the interaction between the two elements, as well as the generation and analysis of Ni-Si samples under various physical conditions. A complete analysis utilizing this parametrical approach provided insight into the fundamental mechanisms responsible for the observation of this phenomenon at relatively low temperatures.

**Travis Craft, Melissa Dale: Computer Science, Japanese, Spanish**

**Mentor: John Paxton, Clem Izurieta, Michelle Meade-- Computer Science, Psychology**

***Learning a New Language: A Technological Approach***

With the amount of international exchange in today's world, communicating effectively between cultures is of the utmost importance. For students of modern language, the acquisition of a new set of vocabulary can take many hours of practice and determination. In the past, traditional techniques have involved tools such as basic flashcards. This method only provides a simple text-to-text translation with little real world connotation. Our project will work with a more contextually based methodology that will strive to form a deeper connection with new vocabulary words. Software programs in recent years have become popular with consumers to help in their acquisition of new languages. These packages generally include audio and visual aids to immerse the user in their target language. However, these packages are costly and do not allow for the study of targeted vocabulary sets. Based on psychological concepts of memory retention, our website and research hopes to help show that studying with more stimulating techniques will increase a student's retention rate and thus should become the new standard in not only language study, but in other academic studies and beyond as well.

**Eric Dietrich: Civil Engineering**

**Mentor: Leah Schmalzbauer-- Sociology and Anthropology**

***Khwisero's Context: Local Perception of Development Efforts in Rural Western Kenya***

Water development efforts across sub-Saharan Africa have shown disappointingly little long-term success over the past half-century. Wells implemented by Montana State University's Engineers Without Borders chapter (EWB-MSU), which has worked in Western Kenya's Khwisero district since 2004, have had a mixed success record, with only some beneficiary primary schools effectively managing and maintaining their infrastructure. Both trends create a need for more sophisticated approaches to facilitating the development of community-based management committees to oversee projects. This investigation sought deeper insight into the social dynamics surrounding community members perceptions of water projects in Khwisero, particularly with regard to factors affecting project's success and failure, the importance and nature of community participation in development efforts and the impact of white outsider's involvement in projects. Employing in-depth formal interviews, it found that community members saw financial mismanagement, tribalism and insufficient involvement of community members as the primary causes of failure associated with projects and provided some insight into a sense of disempowerment that seems to result from the region's colonial and post-colonial history. This latter finding underscores the importance of conducting development efforts in a way that serves to empower beneficiary communities instead of reinforcing dependent mindsets.

**David Driscoll: Mechanical Engineering**

**Mentor: Stephen Sofie-- Mechanical Engineering**

***Investigation of Engineered Pore Structures in Powdered Metals by Means of Freeze Tape Casting***

Engineered metal foams have strong potential in applications such as fuel cell electrodes, sensors, differential springs, filtering media, and composite structures. In this study the variation in mechanical and electrical properties were characterized in engineered porous metal foams with aligned porosity. Utilizing the freeze tape casting process, aqueous 440SS metal powder suspensions were drawn onto a freeze bed. After directional solidification, the solvent was sublimed from the ~1mm thick tapes, yielding

porous green metal compacts which were sintered in a vacuum furnace from 900 1100°C. Densification was shown to begin at 1000 deg C yielding shrinkage variations relative to pore alignment. The resulting disks exhibit highly ordered acicular pores with substantial anisotropy in the mechanical and electrical properties. DC conductivity testing revealed up to 62% variation depending on direction of measurement relative to the alignment of pores. Rigidity testing demonstrated 89% directional variations. Applying this traditionally ceramics processing technique to metals resulted in a unique and novel material.

**Krista Drummond: Electrical Engineering**

**Mentor: Randall Babbitt-- Physics**

***Structured Light Imaging for Deep Sea Exploration***

In low light deep sea environments, animal behavioral analysis is difficult to achieve when we introduce light for human visual observation. This introduced light corrupts the natural environment, changing the demeanor of the aquatic inhabitants. The following research plays a vital role in allowing marine biologists to observe the natural behavior of deep sea dwellers. A device was designed that utilizes structured light and compressive sensing techniques in a feature specific imaging system that will minimize light interference. A single pixel camera is used to record the reflections off objects of structured light patterns (Hadamard, Fourier, and Wavelet) that are built by a MATLAB program and executed by a digital micro-mirror device (DMD) and a picoprojector. This project determines which light matrices are best at achieving specific tasks; for example, scanning the field of view looking for a specific creature, or reducing the ambiguity between objects of interest and background material. This technology will advance the understanding of these deep sea ecosystems, and promote the care of this resource.

**Alisa Durkheimer: Chemical Engineering**

**Mentor: Otto Stein-- Civil Engineering**

***Survival of Kenyans: Alternative Ways To Purify Water***

The majority of Eastern Africa is struggling with poverty and lack of access to clean water. Contaminated water is a huge problem, and many people die everyday from drinking water that's toxic with parasites, bacteria, and viruses such as, E. coli, cholera, and typhoid fever. Sadly, this is usually the only water that is available to them since access to clean water is so scarce. Water samples were collected from springs and boreholes in Khwisero, Kenya. The two toxins that were tested for were coliforms and E. coli. Coliforms are a specific type of bacteria not normally present in groundwater. E. coli is a type of coliform bacteria found in the gastrointestinal tract of warm-blooded animals. To test for these organisms, IDEXX Colilert reagent was added to the water sample, then placed into an incubator so the bacteria could easily multiply if present. All water samples collected from springs were positive for both coliforms and E. coli. Currently the only forms of water purification used in Khwisero are boiling, and Water Guard, a chlorinated product available at most local markets. However, problems exist with the use of both of these methods, so the need to find an alternative method of purification is crucial. Yet, before any substitute is replaced, the people of Khwisero need to be educated in the dangers of drinking untreated water from their local springs. Many still believe that they will never get sick from diseases in the water. With this thought their actions will not change and they will not take the time or effort to purify the water.

**Brian Ellingwood: Chemical and Biological Engineering**

**Mentor: Paul Gannon-- Chemical and Biological Engineering**

***Oxidation Behavior of Ferritic Stainless Steels at 800° C in Single (Air/Air) and Dual Atmosphere (Air/Hydrogen) Exposures and the Effects of Utilizing Pre-Oxidation Treatments***

Several types of ferritic stainless steel (FSS) are commonly used as solid oxide fuel cell (SOFC) interconnects. In an SOFC stack, interconnects are used to separate and connect individual cells in a series. In a working cell the interconnect is simultaneously exposed to air on one side and fuel on the other at high temperatures (~800°C). It has been speculated that the dual environment causes the

interconnect to oxidize and corrode much more significantly compared to an interconnect exposed to air only. Efforts are currently being done to limit this corrosion as much as possible. A custom made testing apparatus capable of mimicking the dual environment of a normal working SOFC was utilized to oxidize specified types of FSSs. The samples were analyzed with the objective of further understanding the oxidation characteristics of the steel. The oxide scale grown on each sample was analyzed for surface morphology, elemental composition, and oxide scale thickness using a field emission scanning electron microscope.

**Brian Ellingwood: Chemical and Biological Engineering**

**Mentor: Steve Holmgren-- Chemistry**

***Molecular Dynamics Study of Water-Hematite Interactions and the Effects of Dissolved Carbon Dioxide***

A molecular dynamic, constant-temperature algorithm from MDynaMix package of Lyubartsev and Laaksonen was used to simulate water-hematite surface interactions in order to simulate actual interactions in a carbon sequestration vessel. A thermodynamic analysis was done to determine the effects of carbon dioxide on the chemical potential of water. The experiment involved two major simulations: one of only water and the other of hematite and water with dissolved carbon dioxide. The simulations were run for 100 hours at a temperature of 277 K (~4°C) and 150 bar, similar to that of the ocean floor where the majority of carbon sequestration pipelines are located. In both cases, the positive hydrogen molecules of water were oriented over the negative oxygen molecules of hematite, as expected. The major difference, however, was that significantly more hydrogen bonds between molecules were formed in systems containing carbon dioxide, suggesting the addition of carbon dioxide lowers the chemical potential of water. Conversely, the calculated intermolecular energies in the carbon dioxide containing system were higher than that of the water only system. Further investigations on both phenomena should be investigated more thoroughly to fully understand what is happening.

**Dustin Elliott: Chemical Engineering**

**Mentor: Paul Gannon-- Chemical Engineering**

***Interfacial Interactions Among Lanthanum Strontium Manganite (LSM) and Cobalt Manganese Applied to Hitachi ZMG232L***

Cobalt manganese thin film coatings that are used as diffusion barriers between high temperature solid oxide fuel cell cathodes and stainless steel interconnects is investigated. This study examines the interfacial interactions among lanthanum strontium manganite (LSM) and a protective layer of cobalt manganese applied to Hitachi ZMG232L interconnects. Metallic cobalt manganese was deposited via DC magnetron sputtering on Hitachi ZMG232L stainless steel interconnects that had been pre-oxidized for 0 and 10 hours in 800 C laboratory air. The samples were then coated with LSM and oxidized for 100 hours in 800 C laboratory air. Analysis using FE-SEM/EDX before and after oxidation revealed differences in diffusive behavior when comparing the 0 and 10 hour pre-oxidized interconnects. Samples pre-oxidized for 10 hours and then coated exhibited combined coating/oxide protection from LSM diffusion. This combined protection was greater than that of the 0 hour pre-oxidized coated interconnects or of 10 hour pre-oxidized uncoated interconnects.

**Loribeth Evertz: Mechanical Engineering**

**Mentor: Sarah Codd, Joe Seymour, Erik Rassi-- Mechanical and Industrial Engineering, Chemical and Biological Engineering**

***Oscillatory Flow Phenomena in Simple Fluids and Complex Fluids***

The human body depends on the heart to circulate blood via pulsatile flow. Under oscillatory flow, blood acts as a non-Newtonian fluid and diseased conditions can occur due to the fluid behavior. Gaining a better understanding of oscillatory flow in complex fluids similar to blood (i.e. colloidal suspensions) and the particle migration that can occur under such flow conditions could help in the prevention and diagnosis of disease and enhance drug delivery. Nuclear Magnetic Resonance, NMR, is a non-invasive

method for evaluating fluid mechanics and has been used to obtain spatially resolved velocity maps for water, xanthan-gum, polyacrylamide, and a colloidal suspension. A controllable oscillatory flow has been established and a colloidal suspension is used to model blood since measurements are obtained separately from the suspending fluid and the particles using NMR. The oscillatory flow is generated by a motor with an adapted arm driving a cylinder. It is sensed at a specific point in the cycle and the NMR spectrometer is triggered to measure the velocity distributions and transport phenomena of the fluid undergoing oscillatory flow at specific points in the oscillation cycle. Collectively, the system has been used to successfully compare the rheological properties of four separate fluids.

**Jude Eziashi: Chemical Engineering**

**Mentor: Paul Gannon-- Chemical and Biological Engineering**

***Protective Coating Research for Bipolar Plates in Proton Exchange Membrane Fuel Cells***

The objective of the USP project was to study the effects of protective coatings on bipolar-plates in Proton Exchange Membrane Fuel Cells (PEMFCs). Despite the fact that stainless steel has properties that are advantageous to PEMFC construction such as good electrical conductivity and machinability, its use as a material for bipolar-plates is still limited due to corrosion. During operation of the PEMFC, the steel corrodes forming an oxidized layer on the surface that increases the contact resistance and adversely affects the durability of the PEMFC. This project was aimed at designing and testing a simulated PEMFC environment based on journals published in the field. The aggressive PEMFC was made using 1M H<sub>2</sub>SO<sub>4</sub> + 2ppm F<sup>-</sup> solution at 70°C purged with either hydrogen or compressed air to simulate both the anode and cathode environments respectively. The methods employed include the electrochemical test to observe the rate of current dissipation and the interfacial contact resistance test to observe the rate at which the resistance increased depending on the materials tested. This project is the first step towards contributing to ongoing research aimed at increasing the efficiency and adoption of an efficient and environmentally friendly source of electric power generation.

**Hilary Fabich: Chemical Engineering**

**Mentor: Sarah Codd, Joe Seymour, Sarah Vogt, Einar Fridjonsson, Magnus Nyden (University of Technology, Göteborg, Sweden)-- Mechanical and Industrial Engineering, Chemical and Biological Engineering**

***Core Shell Particle Technology and Nuclear Magnetic Resonance Microrheology***

Using a novel technique to produce core-shell colloidal particles, two types of particles have been produced and used to elucidate an understanding of the complex microscale fluid dynamics in multiphase systems. Using Nuclear Magnetic Resonance (NMR), measurements of coherent and incoherent motion can be measured simultaneously in each of the multiple phases of a solution, colloid particles and suspending fluid. Two types of particles have been manufactured, one containing fluorinated oil and the other, hexadecane. The two separate particles are useful as both hydrogen and fluorine are NMR active nuclei and can allow for data to be obtained separately for the motion of the particles or the motion of the suspending fluid material within one experiment. The hexadecane oil core particles provide a proton <sup>1</sup>H NMR signal at a frequency different than the suspending water phase. The fluorinated oil core particles give a <sup>19</sup>F NMR signal which has a very different NMR frequency which is easily separated from the signal from any <sup>1</sup>H protons present in a sample. These particles will be used to begin implementing microrheology by NMR in the context of Mason and Weitz which is yet to be established.

**Pat Glatz: Mechanical Engineering**

**Mentor: Ed Adams-- Civil Engineering**

***Modeling Snow Temperature in Complex Topography***

The stability of snow on a mountain slope is largely dependent on particular states of snow layers. This includes the morphologic state of snow cover at the microstructure level, e.g. bonds and grains. This microstructure is largely dependent on the surface temperature and the temperature gradient of snow

after its initial formation as atmospheric precipitation. These thermal variations at and near the surface may lead to morphologies such as ice crusts, surface hoar, and near surface recrystallization. To look at this relationship, the first principles energy balance model RadThermRT , has been enhanced and implemented to account for the complex nature of the topography of a given slope. From the maps and weather input, one dimensional finite difference heat conduction equations are solved normal to the surface of interest, which allows the temperature profile of each facet to be determined. Currently, two slopes in the Yellowstone Club are being modeled with others in progress to see if these weak spots can be pre-casted. To date, surface crystallization can be modeled and seen for days that are known to have crystallization.

**Pat Glatz: Mechanical Engineering**

**Mentor: Ed Adams-- Civil Engineering**

***Growing Atmospheric Snow***

The field of snow science explores the intricate relationship between snow falling out of the sky and snow on the ground. Customarily, snow has been harvested towards the end of the year, but the snow changes shape as it sits. Now when new natural snow is not available, snow crystals can be grown in the lab that mimic the shapes seen falling from the sky. This is an important stepping stone in studying snow as a material even when it is not winter conditions. The snow maker is designed to make a sufficient quantity of snow to continue to study fresh snow throughout the year. The challenge is to make snow of different shapes, without rime, and in a relatively large quantity. With the experimentation done to date, snow can now be made in a large enough quantity to run other experiments. The process has also established the ability to make flakes that do not have rime, but variation in types of crystals is still in progress.

**Isaac Griffith: Computer Science and Philosophy**

**Mentor: Clemente Izuritea, John Paxton-- Computer Science**

***TrueRefactor: Towards a Completely Automated Refactoring***

Software engineering is a continually evolving discipline, wherein researchers and members of industry are working towards defining and refining what are known as best practices. Best practices are the set of known correct engineering techniques leading towards quality software. When a software artifact is produced it becomes locked into a single instantiation of these best practices, associated with the time in which the artifact was created. If such software is not maintained in such a way as to keep it current with the evolution of practice, then there is a good chance that later engineers may not understand the design choices made. There are techniques which exist, called refactorings, which allow the software to be modified to continue, without altering the outward appearance and behavior, maintaining the design. Unfortunately refactoring requires a person to both understand the techniques to be applied and the code to which they are applied to. We have developed a system using Artificial Intelligence techniques to employ these refactorings correctly, without requiring an underlying understanding of the software. This then allows the understandability, maintainability, and reusability (in other words the quality) of the software to be improved or maintained over time.

**Isaac Griffith: Computer Science and Philosophy**

**Mentor: Clemente Izuritea-- Computer Science**

***Concurrent Iteration Management in Ecological Systems Modeling***

Network Exchange Objects (NEO) is an object oriented modeling framework designed to facilitate ecosystems simulation modeling. Within the modeling context an ecosystem is represented as a "Scape", through which Currencies (e.g., water, heat, energy, and organisms) can be fluxed. These scapes are represented using graphs, which can potentially grow to include hundreds or even thousands of nodes and edges. Nodes represent locations where currencies are stored, and edges represent dividing lines between nodes as well as the fluxing of currencies. Simulating the fluxing of a currency through a graph involves repeated iterations over all nodes and edges. These iterations are used to effect changes in node-

stored resources based on the amount of flux occurring in attached edges. A single iteration comprises a single time-step where each node may be dependent upon the calculations in other nodes and edges, adding complexity to the issue of iteration management. We used sound software engineering techniques to enhance the performance of Iteration Management by developing a solution that utilizes multiple "threads" (bits of code executed in parallel). The solution then "weaves" these threads together into different patterns (as constrained by dependencies) to take advantage of multi-core processors, micro-computer clusters, and grid-based supercomputers.

**Stesha Gulick: Chemical and Biological Engineering**

**Mentor: Brent Peyton, Rob Gardner-- Chemical and Biological Engineering**

***Effects of Differing Light-Dark Cycles on the Growth of Microalgae to Optimize Biomass***

Due to the diminishing oil reserves, and increasing CO<sub>2</sub> emissions, the interest in microalgae as a form of alternative energy has sparked many interests. This past semester, I have been studying two particular types of algae, known as *Scenedesmus* (green algae) and RGd-1 (diatom), and their potential to produce hydrocarbon fuel. During this time, the growth rate and biomass accumulation were compared for differing light-dark cycles. In addition, I also tested further environmental parameters to fully understand the culture's growth and lipid production over the experiment time. These parameters include: population, pH measurement, Nile Red fluorescence, and media nitrate utilization. The starting point of the experiment was a 14-10 hour light-dark cycle, followed by a 12-12, 16-8, and 24 hour light. It was shown that the growth rate decreased when the light hours decreased, whereas the growth rate increased significantly when the light hours were increased. Preliminary hypotheses indicated that this would be the case; however, the optimal light-dark cycle for each organism is still to be determined. In future data analysis, I will determine the lipid accumulation of each of these cycles and see if there is any correlation to the faster versus slower growth rates.

**Lindsey Hanna, Brandon Norick: Computer Science**

**Mentor: Clemente Izuritea, John Paxton-- Computer Science**

***Using Dashboard Indicators to Quantify College Effectiveness***

There is a vast amount of data generated each semester by the College of Business (CoB) representing the accomplishments of the faculty, the students, and the College as a whole. Without a time effective means of condensing this data, it is unrealistic to expect the College to be able to form a complete understanding of their accumulated information. We have assisted the College in solving this problem by developing a configurable dashboard system. The dashboard is populated by indicators which were clearly defined by a committee within the College itself. The visualization graphs chosen were influenced by a survey to CoB faculty who were asked to rank them according to usefulness. The indicators, which show the most recent year, also include a drilldown showing historic data. These indicators can assist in top-level decision making, as well as provide the College with benchmarks which may be required for their accreditation process.

**Eric Hansen: Civil Engineering**

**Mentor: Pat McGowen-- Civil Engineering**

***Analysis of Non-Motorized use in Grand Teton National Park***

Bicycling in Grand Teton National Park has been growing in popularity for many years. In 1999, 13 year old Gabriella Axelrad was struck by a car and killed on Teton Park Road near Jenny Lake while riding with her family on a guided bicycle tour. This tragedy spurred the local community and the Park Service to action and efforts were initiated to improve safety for non-motorized users. In 2008, a separate shared use pathway was constructed that parallels Teton Park Road from the southern entrance at Dornan's to the Visitor Center at Jenny Lake. This 8 mile long paved path is the first phase of a proposed 41 miles of shared use pathway that would extend to Colter Bay Village. This evaluation shows the results of a non-

motorized user count and non-motorized user survey conducted by WTI personnel at various locations along the shared use pathway during the summer of 2010.

**Travis Harrer: Chemical and Biological Engineering**

**Mentor: Robin Gerlach, Al Cunningham, Adrienne Phillips-- Chemical and Biological Engineering, Center for Biofilm Engineering,**

***Microbially Induced Calcium Carbonate Precipitation Under Radial Flow Conditions***

Biologically induced carbonate mineralization is a process by which microorganisms reduce the solubility of carbonates, causing them to precipitate. The goal of this project is to apply pulse flow strategies to deposit calcium carbonate in a radial flow system in order to better understand how biomineralization could be controlled around injection wells at geologic carbon sequestration sites. The rock immediately around an injection well may be compromised due to drilling resulting in an increased risk of injected carbon dioxide potentially leaking back to the surface. By promoting the localized deposition of calcium carbonate around injection wells, leaks can potentially be sealed and carbon dioxide leakage can be reduced. The laboratory-based study showed significant calcium deposition within the radial reactor along with complete effluent plugging in some of the effluent ports. Destructive sampling further revealed the degree of calcium precipitation throughout the reactor.

**Saiichi Hashimoto: Computer Science**

**Mentor: Brendan Mumey-- Computer Science**

***Routing and Adaptive Power Control for Green Networking***

Network power consumption can be reduced considerably by adapting link data rates to their offered traffic loads, turning off unused nodes (routers) and routing traffic flows. We examine how to perform routing and adapt network power control in order to reduce the energy use in wired networks: Given a set of end-to-end communication sessions, determine how to route the flow (data traffic) through the network such that power consumption is minimized, subject to the constraint that the traffic demand of each session is satisfied. We adopt a power usage model: each network link contains bundle links that can be turned on or off selectively. Nodes can also be turned on or off; the power usage of an on node is a fixed constant. In order for a network link to be operational, both of its endpoint nodes must be turned on. We formulate the problem as an optimization problem, the Multi-session Flow Allocation with Power Adaption Problem. We first present a Mixed Integer Linear Programming formulation for the MF-PAP to provide optimal solutions. Then we present a shortest path based algorithm and a more sophisticated tree routing algorithm that has improved and near-optimal performance in our simulation results.

**Luke Humphrey: Mechanical Engineering**

**Mentor: Ahsan Mian-- Mechanical Engineering**

***Investigation of the Sensor Properties of Two-Dimensional Graphene Sheets***

Over the last five years, graphene has enjoyed wide and growing interest. The molecular structure of graphene is similar to materials such as carbon nanotubes and fullerenes. However, unlike the tube and spherical shape of nanotubes and fullerenes, respectively, graphene is a monolayer sheet of carbon atoms arranged in a honey-comb shaped lattice. Graphene is one of the first two-dimensional structures to be closely examined. Despite the interest in graphene, research addressing its strain-related sensor properties is relatively sparse. This research seeks to characterize the strain-related electronic properties of graphene sheets. In particular, resistive and piezoresistive effects will be investigated. In order to determine strain-related sensor properties, a sample of graphene, mounted on a silicone substrate, will be subjected to uniaxial strain in a four-point bending apparatus and large uniaxial strain in a tensile test. Resistivity measurements will be made using the Van der Pauw method. If any sensor properties are discovered, future research will investigate the effect of biaxial and dynamic strains.

**Jordan Kennedy: Mechanical Engineering**

**Mentor: Jennifer Brown-- Chemical and Biological Engineering**

***Rheological Characterization of Thermally Reversible Gels***

Xanthan gum and locust bean gum when mixed interact to form a firm thermally reversible gel. Flow and oscillatory testing was performed on xanthan gum, locust bean gum and a 1:1 ratio of xanthan gum/locust bean gum gelling system. Under constant shear xanthan and the gelling system display shear thinning behavior. Locust bean gum displays shear thinning behavior at higher shears with a Newtonian region at lower shear rates. Oscillatory measurements at a constant strain over a range of frequencies result in a dominantly elastic response for the xanthan and xanthan/locust bean gum gelling network while a greater viscous response is observed of the locust bean gum system. Xanthan gum acts as a weak gel. The measured response of the LBG is characteristic of hyper-entangled polymeric solutions. The xanthan/locust bean gum gelling network has a greater elastic response, a synergistic gelation, than the xanthan gum or locust bean gum systems separately. When subject to a range of temperatures, xanthan and xanthan/locust bean gum gelling network undergo changes in their viscoelastic response. Xanthan gum displays a one-step gel to solution transition point while the xanthan/locust bean gum gelling network displays a two-step gel to solution transition point.

**Justin Krohn: Computer Science**

**Mentor: Hunter Lloyd, John Paxton, Brock Lameres-- Computer Science, Electrical and Computer Engineering**

***Design & Implementation of Communication, Control & Monitoring Systems & Software for MSU's 2011 NASA Lunabotics Competition Robot***

The NASA Lunabotics tournament is an international university-level competition to build a remotely controlled robot capable of digging in a simulated lunar environment. As part of MSU-COE's 2011 entry, the Computer Science team designed, prototyped and built a command, control and communications system for both a prototype robot and the final design. Working closely with Mechanical and Electrical Engineers, the CS team designed and implemented an innovative combination of hardware and software to meet and exceed the project requirements. Control and monitoring of the EE-team designed motor system is handled by custom software running on an Arduino Mega 2560 microcontroller, with all communication occurring using IP across a wireless network. A netbook running custom software handles two video sensors and provides a live three dimensional depth map using a repurposed Microsoft Kinect sensor. Client software to control the robot can be run on both Android-based smartphones and laptop computers. The Android software features an innovative multi-touch based control system and can view live video and depth feeds from the robot. The desktop software features control of the system using a Xbox 360 controller and provides a live 3D movable view of the environment in front of the robot.

**Trevor Lane: Chemical Engineering**

**Mentor: Hugo Schmidt-- Physics**

***Transition Element Doping of Proton Conducting SOFCs***

Solid Oxide Fuel Cells (SOFCs) demonstrate a promising future for alternative energy production. Most often, fuel cells use oxygen as a reducing agent and hydrogen as an oxidizing agent due to their abundance and relatively low costs to produce water, a nontoxic, life-sustaining product. In a cell, a membrane separates the two half-cell reactions so that the electrons exchanged may be passed through an external circuit to generate electricity. Proton conducting SOFCs elicit an oxide membrane that allows the transport of protons while excluding all other particles. While the operation of SOFCs is well understood, the chemical composition of their membranes still requires investigation. Membranes suffer from degradation over time. In an effort to curb the degradation, membranes are produced by doping membrane recipes with transition elements. Calcining of the appropriate powders at high temperatures (about 1300°C) followed by extensive grinding achieves a homogeneous mixture suitable for the membranes. The powder mixture then gets pressed into the membrane pellets and sintered to eventually

produce a usable SOFC proton conducting membrane. Using an impedance spectrometer, the cells undergo testing to determine their electric outputs. This data provides a clear comparison for the effectiveness of doping SOFC proton conducting membranes.

**Brady Lassila, Tyler Hessler: Civil Engineering**  
**Mentor: Michael Berry, Jerry Stephens-- Civil Engineering**  
***Biodegradable Pykrete Beams***

Pykrete is a structural material composed of a mixture of water and wood chips frozen into a stiff material. With more understanding of the material properties of pykrete, the material could potentially be used in ice bridges, runways, roads, and temporary structures in cold regions. The use of steel reinforcement in pykrete beams has been investigated, but the use of wood dowel reinforcement is attractive because of the biodegradable nature of wood. Wood reinforcement would allow for ice bridges to melt away in the spring and leave behind only wood dowels and wood chips. The objective of this research was to determine effective wooden longitudinal and shear reinforcement configurations in pykrete beams, and to determine the effect of temperature on beam strength. Beams were formed, frozen, and tested in flexure at subzero temperatures in the Subzero Science and Engineering lab in Cobligh Hall. Multiple reinforcement configurations were tested to determine maximum capacity of the pykrete beams, and this configuration was used in beams tested at various temperatures.

**Chandra Macauley: Chemical Engineering**  
**Mentor: Paul Gannon-- Chemical and Biological Engineering**  
***The Influence of  $Cr_xO_y$  Microstructure on the Oxidation Behavior of CoMn Coatings on SOFC/SOEC Interconnects***

Cobalt manganese (CoMn) coatings are promising candidates to inhibit high-temperature surface oxidation of stainless steel (SS) interconnects in solid oxide fuel cells (SOFCs) and solid oxide electrolyte cells (SOECs). This study investigates the influence of the pre-oxidation layer microstructure on the oxidation behavior of CoMn interconnect coatings. SS441 samples were either pre-oxidized for 3 hours in 800°C laboratory air to develop a thermally grown chromium oxide layer or were coated with  $Cr_xO_y$  via radio frequency (RF) magnetron sputtering. Using these methods, chromium oxide layers with differing microstructures were produced. The samples were then coated with metallic CoMn via direct current (DC) magnetron sputtering. Field emission scanning electron microscopy (FE-SEM), energy dispersive x-ray spectroscopy (EDX) profilometry and x-ray photoelectron spectroscopy (XPS) were used to analyze the samples before and after 10 and 100 hours of oxidation in 800°C laboratory air. Significant differences in oxidation behavior were observed. Possible mechanisms for the observed oxidation behavior are presented and discussed.

**Zachary Morris: Civil Engineering**  
**Mentor: Robert Mokwa-- Civil Engineering**  
***Nondestructive Measurements of Geomaterials Using X-ray Computed Tomography: Some Practical Applications***

The mechanical behavior of geomaterials is highly dependent on the particle microstructure. Because of the inherent difficulties in measuring soil and rock properties on a microscale, geo-professionals use macro properties to estimate or predict the response of geomaterials to changes of state. These macro properties are used to represent gross or average measures of microstructure in terms of engineering behavior. Geo-professionals generally recognize the important influence of microstructure on the behavior of geomaterials; however, until recently, observation and quantification of particulate microstructure has been a tedious, time consuming process. Additionally, common geological and geotechnical tests are destructive in nature, and many test methods introduce bias by destroying or altering properties during the test. Non-destructive systematic test methods are described for quantifying microscale measurements using two-dimensional x-ray computer-aided tomography (x-ray CT) scanning

techniques. Practical applications are described in which x-ray CT technology is used to measure the void ratio distribution in soil samples, the pore size distribution in soil and rock cores, the grain size distribution of soil samples, and the influence of vesicles on the compressive strength of basalt. These studies indicate that x-ray CT technology represents a viable and useful approach for quantifying the internal structure of geomaterials.

**Kathryn Morrissey: Chemical Engineering**

**Mentor: Valerie Copie, Laura Jennings, Pat Secor-- Chemistry and Biochemistry**

***NMR Metabolite Profiling of Bacterial Biofilms in Chronic Pressure Ulcers***

Chronic wounds constitute a complex host/pathogen environment where the colonization by bacterial biofilms contributes to the persistence of infection. While all chronic wounds harbor a diverse population of bacteria, pressure ulcers have been shown to contain a large number of strict anaerobes. The main objective of this study is to determine the metabolite profiles of pressure ulcer biopsies at different depths using NMR-based quantitative metabolomics. To the best of our knowledge, metabolite profiling has not been conducted on chronic wounds. We hypothesize that anaerobic bacterial metabolism occurs deep within the wound bed where oxygen concentrations are low and that metabolites of anaerobic organisms can be detected using nuclear magnetic resonance (NMR) metabolite profiling. Metabolite profiles at different depths in pressure ulcers may provide information on the spatial variation of anaerobic metabolites within the wound bed allowing the treatment strategies such as hyperbaric oxygen to be tailored to the patient. Grant Acknowledgment: NIH NCRR Translational Supplement to grant P20-RR024237.

**Kathryn Morrissey: Chemical Engineering**

**Mentor: Otto Stein-- Civil Engineering**

***Orange Water and Water Quality Testing in Khwisero, Kenya***

Engineers Without Borders (EWB) at MSU works to bring clean water and sanitation to the community of Khwisero, Kenya. An issue of high levels of iron in two of the deep water wells installed by EWB has come to the organization's attention. The communities using these wells have stopped consuming the water from them due to the taste and color. After researching options of how to reduce the iron, a sand filter proved to be practical considering cost, labor, acceptance by the community, the use of local materials and sustainability. A biosand filter prototype was constructed using materials from the area and tested. The surrounding community has not been using the wells with high iron content, thus, research into how and where they are presently gaining their water was preformed. Water testing was completed on multiple water sources and springs in the area. Purification methods and beliefs from the community were tested to gain a better understanding of how clean the water is that the people consume. The majority of water sources tested positive for total coliforms and/or *E. coli*. This emphasizes the importance of using filtration and purification methods when consuming water from unknown sources.

**Elle Pankratz: Biological Engineering**

**Mentor: Brent Peyton, Natasha Mallette-- Chemical and Biological Engineering**

***Ascocoryne sarcoides: Exploration of Hydrocarbon Production Potential***

There is no denying that there is a high demand for alternative fuel production. For the past year, I have been studying the endophytic fungus, *Ascocoryne sarcoides* and its potential to biologically convert cellulosic substrates into non-petroleum hydrocarbon fuel. Two substrates are primarily used: glucose and cellulose. Optimal temperatures ranged from 13°C -20°C, optimal pH ranged from 5.0-6.5, and media concentrations ranged from 1x-3x. Hydrocarbon and glucose yield production were measured by HPLC, GC/MS, and NMR analysis. HPLC analysis shows overall biomass per glucose yield to be highest at sealed batch conditions at 20°C with a peak yield at 0.143 (g/g). Hydrocarbon production through the analysis of GC/MS and NMR is still being investigated, but preliminary results indicate production of ethanol,

acetaldehyde, nonanal, and 1-Octen-3-ol. As of today, the full scope of *Ascocoryne sarcoides* hydrocarbon production is unknown. However, future research will focus on product chemistry with emphasis on cellulose as a substrate.

**Steven Paulson: Chemical Engineering**

**Mentor: Ross Carlson-- Chemical and Biological Engineering**

***Construction and Characterization of Metabolically Engineered Escherichia coli Biofilm Communities***

Every year, biofilms cause thousands of infections by contaminating medical devices such as implants, prosthetics, and catheters and often become a problem in the treatment of chronic wounds. In addition, damage to industrial equipment and massive power plant energy losses can be attributed to biofilm growth. In order to find new and innovative solutions to these problems, the morphological and physiological characteristics of biofilms must be thoroughly understood. This study examined and compared engineered *Escherichia coli* biofilms through enumeration, microscopy, and oxygen microsensor analysis to gain more knowledge on the mutualistic relationships found in biofilms. The results showed that community biofilm cultures, engineered to mimic the common fermenter-oxidizer ecological theme, generally exhibited higher growth and substrate productivity than their respective mono-cultures. Heterogeneous spatial partitioning effects have been observed and are reproducible. Nutrient availability of oxygen and glucose, coupled with mass transfer limitations, were found to induce strain specific laminations in community biofilm structure. This work increases our understanding of syntrophic biofilm characteristics, which are a common occurrence in biofilms. Future studies will focus on characterizing new strains that are currently being constructed, including an oxygen-negative strain that uses alternative terminal electron acceptors.

**Kalen Ramey: Civil Engineering**

**Mentor: Otto Stein-- Civil Engineering**

***Water Projects in Khwisero Kenya***

Khwisero is a District in Western Kenya where the Montana State University Chapter of Engineers Without Borders is actively working to bring clean water and improved sanitation to 58 primary schools. There is a long history of aid work in Khwisero, including many different water projects. However, there is no documentation regarding even the basics about these projects, such as date of construction, source of funding, or current condition. In order to implement effective projects, it is important that EWB continues to expand its organizational knowledge base, and learn from work done by other aid groups. The objective of this research was to compile information on the different aid groups that have worked in Khwisero, as well as information regarding specific water projects. Interviews were conducted with individuals involved in different aspects of water projects in Khwisero. From this information, conclusions were drawn regarding the main challenges faced by aid groups, as well as the advantages and disadvantages of different types of water projects. This information will serve as a resource for EWB when approaching future projects, as well as a basis for continued research.

**Evan Rashid: Mechanical Engineering**

**Mentor: Ahsan Mian-- Mechanical Engineering**

***Development of Laser Microjoining Process***

While conventional joining processes are already well established and industrially feasible, laser joining process is a rather new process and requires more study to make it industrially feasible. Previous research showed that laser joining, to be precise, laser microjoining in submillimeter scale, is a useful technique for joining dissimilar materials for implantation in animal body. For example, Bio implantable devices required hermetic sealing with a high range of accuracy and in addition, bio compatibility. Laser microjoining offers both of those properties. Additionally, bio sensors, which are yet to be a commercial product, require the same kind of bonding in dissimilar materials which can be done precisely by laser microjoining. In field of Micro Electro Mechanical Systems, it is proven that laser microjoining is a feasible

way to join materials. As laser microjoining has a vast application, it is not yet industrially feasible. Our prime focus for this research will be to establish industrially suitable criteria for laser microjoining for a batch production. As previous researches on this field provide us with a wide range of data, our objective would be to choose a critical range for different parameters of the laser microjoining process to suit for a batch production.

**Brian Redman: Electrical Engineering**

**Mentor: Joseph Shaw, Paul Nugent-- Electrical and Computer Engineering**  
***Feasibility Study and Initial Design of a Low-cost All-Sky Infrared Cloud Imager***

Information about cloud patterns is useful for climate science studies and Earth-space optical communications research. Thermal infrared sky imaging is a technique that records cloud patterns by measuring the heat radiation emitted by the clouds. This method is particularly well suited for continuous ground-based measurements of cloud cover statistics because it functions equally well during day and night. Sophisticated infrared cloud imagers have been developed previously at Montana State University, but there is an interest in exploring the capabilities of lower-cost systems. Particularly, a low-cost infrared cloud imager capable of imaging the entire sky dome would make gathering wide-spread cloud statistics easier. This is an initial feasibility study of a low-cost cloud imager using an infrared camera viewing a metal dome mirror to achieve full-sky coverage. Problems associated with an off-axis camera will be addressed. In particular, the problems of mapping the position of an image on the dome to a position in the sky and compensating for distortion will be explored.

**Erin Ryan: Bio-Resources**

**Mentor: Joel Cahoon-- Civil Engineering**  
***Experimental Assessment of Westslope Cutthroat Trout Swimming Capabilities for Hydraulic Barrier Design and Retrofit***

Hydraulic structures, such as culverts or irrigation diversions, often result in the creation of a barrier for fish moving through an ecosystem. The unintentional presence of a barrier can have negative consequences on a fish population, but a strategic implementation of a barrier could also provide a positive effect. In order to manage these hydraulic structures it is important to be able to assess whether or not a fish of a certain species can pass through them. This study focuses on obtaining valid, volitional swimming ability data for Westslope cutthroat trout in an open-channel flume experimental setting. Sixty wild Westslope cutthroat trout were monitored individually by a series of three cameras as they swam through two different velocity challenges. Video of each trial was analyzed to determine the fish's velocity relative to the ground. Hydraulic data that was taken each day that trials were conducted is then paired with the groundspeed velocity to find the fish's velocity relative to the water. This information will be used to construct a speed-fatigue time curve to be used for the design and retrofit of hydraulic structures, especially in the Northern Rockies ecosystem.

**Nichole Schonenbach: Chemical Engineering**

**Mentor: Brent Peyton-- Chemical and Biological Engineering**  
***Effects of Temperature on Two Algal Strains***

Biofuels are an emerging alternative source of energy that can help reduce U.S. petroleum dependence while using existing infrastructure, including supply routes and refineries. In comparison with other biofuels, algal biodiesel is advantageous, because of its potential for higher oil to land use, as compared to other animal or plant biodiesel sources. My project is a continuation from last year, and is a part of a larger project to identify algal strains which could be used for pilot plant scale biodiesel production. My current project is to study how two algal strains *Chlorophyte Scenedesmus* WC-1 and pennate diatom RGD-1 behave at various temperatures ranging from 20°C to 40°C. Both algae were isolated from Yellowstone National Park and have been shown to produce significant amounts of lipid under 'stressful' conditions. Some of these stressful conditions include 24 hours of light, nitrate limitation, and in the case

of RGD-1, silica limitation. Each of these strains was isolated from a temperature greater than 30°C, however experiments thus far have been performed at 27°C for a better comparison of previously studies strains such as *Coelastrella* sp. PC-3. Through varying the reaction temperature, an optimum growth temperature can be determined for this green and diatom to produce maximal amounts of both biomass and lipid.

**Matthew Sherick: Chemical Engineering**

**Mentor: Joseph Seymour, Sarah Codd, Betsey Pitts, Michael Franklin-- Chemical and Biological Engineering, Mechanical and Industrial Engineering, Center for Biofilm Engineering**  
***Isolation of Bacterial Alginate from *Pseudomonas aeruginosa* Biofilms***

Certain strains of *Pseudomonas aeruginosa* bacteria produce the extracellular polysaccharide alginate, which forms a biopolymer gel in the presence of a divalent cation. Using isolation processes outlined in publications, bacterial alginate can be isolated from *P. aeruginosa* biofilms and made to form a gel by introduction of a divalent cation. Gelation of algal alginate has been thoroughly examined using Nuclear Magnetic Resonance (NMR), and a point of interest is to compare the properties of bacterial alginate with those of the previously characterized algal alginate. The formation of the gel under diffusion reaction conditions produces a capillary system within the structure. By examining gels from both acetylated and non-acetylated bacterial alginate, the process by which alginate binds water can be analyzed using NMR. The capillary system is of particular interest in the field of biotechnology, where these gels can potentially be formed to provide the structure for artificial tissue development. This system is also of interest as cystic fibrosis (CF) patients are also vulnerable to chronic *P. aeruginosa* infections. Studying bacterial alginate formation and gelation will provide a greater insight into the molecular dynamics of these infections.

**Casey Spaulding - MSU Northern: Diesel Technology**

**Mentor: Nestor Soriano - MSU Northern-- MSU-Northern Bio-Energy Center**  
***Performance and Emissions of Heavy Duty Diesel Engine***

Biodiesel is defined as monoalkyl esters of long chain fatty acids derived from plant oil or animal fat used as an alternative fuel in diesel engines. This study was performed to demonstrate the differences in performance and emissions of a heavy duty diesel engine fueled with various blends of canola biodiesel as compared to regular diesel fuel. Fuel consumption had increased with increasing biodiesel blends only at lower engine load. Exhaust temperatures remained almost unchanged up to B50. However, the use of B100 resulted in lower exhaust temperatures especially at higher engine load. Compared to regular diesel, NO<sub>x</sub> emissions had increased by 40% in B<sub>20</sub> and B<sub>50</sub> levels and only by 20% using B100 regardless of engine load. Total hydrocarbons, carbon monoxide, and soot emissions had decreased significantly reaching up to 34%, 60%, and 90% reduction, respectively with the use of B100. Formaldehyde had increased in all three steps with the use of B20 and B50 and decreased with the use of B100.

**Kelly Spendlove: Computer Science and Mathematics**

**Mentor: Brendan Mumey-- Computer Science**  
***Algorithm Formulation For Genome Sequence Assembly***

As DNA sequencing technology cannot read entire genomes at once, the genome is broken into smaller variable length pieces to be sequenced independently, which are then reassembled to produce the overall sequence. A current method for accomplishing this is called paired-end sequencing, which breaks the DNA up randomly into many small fragments, which are then sequenced on both ends, in order to obtain paired-end reads. These reads are paired together with a distance constraint. As the number of fragments increases, more of them will originate from neighboring locations on the genome, and the fragments will begin to overlap. Most current algorithms only employ this overlap information during assembly, and fail to take advantage of this distance until post-processing validation. However, by constructing an algorithm which effectively utilizes this distance during assembly, these algorithms should be improved upon. The

paired-end sequencing formulation is an open problem in complexity and parameterized complexity theory. This research then entails a proof of the complexity by means of a reduction from a problem with known complexity. Depending the tractability of the problem, either a fixed parameter tractable algorithm, or a heuristic approach can be developed in order to effectively utilize the distance information during assembly.

**David Stevens: Computer Science**

**Mentor: Brendan Mumey-- Computer Science**

***On Routing and Channel Selection in Cognitive Radio Mesh Networks***

Nodes in a cognitive radio mesh network of secondary users have the ability to choose which channels to broadcast on from a set of available channels, so long as they avoid channels that interfere with primary users. This ability can be used to improve overall network performance but also adds a layer of complexity by introducing the question of how best to use the channels. In this project, we examine the following problem: given a network of cognitive radio nodes and existing primary users, find the optimal routing path as well as the optimal selection of channels to be used along that path so as to maximize the total end-to-end data flow rate (throughput). We first show that obtaining a  $2/3 + \epsilon$  approximation to this problem is NP-hard. We then describe a heuristic algorithm for the problem and present simulation results to demonstrate its effectiveness against alternative routing approaches.

**Aaron Street: Chemical and Biological Engineering**

**Mentor: Robert Cramer-- Immunology and Infectious Diseases**

***Metabolism Modeling of Aspergillus fumigatus***

*Aspergillus fumigatus* is an opportunistic fungal pathogen that has recently become a major problem, affecting thousands of patients undergoing immunosuppression therapy each year. The main route of infection is the lung, where it encounters many difficult growing conditions such as high temperature, low oxygen and low nutrient levels. The objective of this research is to model the metabolism of *A. fumigatus* to predict what nutrients the fungus may use under specific conditions. By creating an input file of possible metabolic reactions, an output file can be created which predicts possible metabolic pathways. By analyzing this data it is possible to predict nutrient requirements and products of the fungus under certain conditions. The three pathways modeled will be glycolysis, ergosterol biosynthesis and oxidative phosphorylation. Results similar to metabolic data already obtained by the lab for *A. fumigatus* are expected, although this model should allow for a more complete analysis and better understanding of key pathways. After completion, experiments based on the model will be developed and the model may be expanded to include more metabolic pathways of *A. fumigatus*.

**Joshua Stringam: Chemical and Biological Engineering**

**Mentor: Adrienne Phillips, Robin Gerlach-- Chemical and Biological Engineering**

***Development of an injection strategy for homogenous calcium carbonate plugging by Sporosarcina pasteurii***

With CO<sub>2</sub> emissions on the rise, several means of reducing or mitigating the effects of emissions have been introduced. One proposed method is the capture and injection of CO<sub>2</sub> into underground formations such as non-potable saline aquifers. One concern with underground storage is potential leakage of CO<sub>2</sub> into the atmosphere. Drilling through cap rock may produce cracks or other high permeability zones sufficiently large to leak CO<sub>2</sub>. A novel method to plug these smaller cracks and potentially reduce the permeability of the cap rock is the use of the ureolytic bacterium *Sporosarcina pasteurii* to promote calcium carbonate formation. This plugging technique is promising because in contrast to cement injection, a low viscosity medium can be used to penetrate fine cracks more effectively than cement. The goal of the current study was to develop injection strategies enabling uniform calcium carbonate formation in porous media. To achieve this goal, a two foot long column was inoculated with *S. pasteurii* and supplied with calcium-free and calcium-containing brine solutions to promote calcium carbonate

mineralization. Strategies to minimize calcium carbonate precipitation around the injection point were employed. At the end of each experiment, the columns were destructively sampled to determine calcium carbonate distribution.

**Jacob Trudnowski: Chemical Engineering**

**Mentor: Zeb Barber-- Spectrum Lab**

***Pressure Induced Wavelength Shift Calibrations***

This project's goal is to test and, if necessary, improve on linear calibration equations created by the National Institute of Standards and Technology for acetylene spectroscopy. These equations help adjust equipment for absorption spectrum shifts in wavelength, caused by changes in gas pressure. NIST's initial development of these equations, for acetylene gas, utilized the tracking of 15 distinctive points in the gas distinct spectrum. By using a new laser source developed by Spectrum Lab and Bridger Photonics, which allows frequency to be well known at all times, these equations can be tested against many more points simultaneously, allowing for much more data to be taken at each pressure. The gas spectrum data is collected at a specific pressure, and then plotted with wavelength vs. absorption. The pressure is then changed, and the data is collected and plotted again. This is done for pressures 0-1 atmospheres (0-760 torr), and the data is analyzed to see how the spectrum shifts up or down in wavelength, due to pressure changes. By analyzing all this data, one can see how accurate and how applicable NIST's calibration equations are.

**Bryan Vadheim: Chemical Engineering**

**Mentor: Jeffrey Heys-- Chemical and Biological Engineering**

***Impact of Biofilm Structure on Biofilm-Fluid Interactions***

More than eighty percent of human infections involve biofilms, aggregates of microorganisms that form a structure in a moist environment by adhering to both a surface and each other. As a result, biofilms impact on the health and well being of humanity is enormous. The computational algorithm employed here is based on the C++ programming language, and it examines how changing select biofilm properties affect the overall structure and detachment of the microbe colony. In the model, colonies of organisms are attached to one another by springs. Varying the spring constant (biofilm stiffness), biofilm geometry, and extracellular matrix density all affect the response of the biofilm subjected to a moving fluid. These variables were chosen because they can be difficult to vary in experiments, but they are easy to vary in a numerical model. The model is used to predict the impact of the variables on the magnitude of biofilm displacement (maximum strain) and detachment of the biofilm from the surface. The overall objective of this research is to improve understanding of fluid-biofilm interactions.

**Jylissa Whisenhunt, Shawn Wright: Computer Engineering, Mechanical Engineering**

**Mentor: Brock Lameres, Ross Snider, Ashan Mian-- Electrical and Computer Engineering, Mechanical and Industrial Engineering**

***Exploiting Reconfigurable Computing for Increased Radiation Tolerance in Aerospace Flight Systems***

This research project involved development of a tile-based, many-core computer architecture that uses partial reconfiguration of a Field Programmable Gate Array (FPGA) to provide increased fault tolerance in the presence of radiation. By using a position sensitive radiation sensor in conjunction with a FPGA, specific regions of the FPGA that have been struck by radiation can be isolated and repaired in a very efficient fashion. By giving the recovery/repair circuitry the specific location where a fault may have occurred, the repair time can be significantly reduced, thus allowing for the damaged section to be repaired and used again. In order to adequately test such a sensor and repair protocol, an efficient test apparatus was designed and fabricated. The test apparatus needed to allow for repeated accurate testing at a low cost. In addition, a graphical user interface (GUI) was needed in order to track radiation strikes and analyze efficiency of circuitry reparation. Using the completed test apparatus, preliminary tests

involving manual radiation strikes showed the system to be in working condition and were verified by the customized GUI.

**Nathan Williamson: Chemical Engineering**

**Mentor: Jeffrey Heys-- Chemical and Biological Engineering**

***Simulation and Optimization of Inhaled Drug Delivery for Asthma***

The treatment of asthma attacks by aerosol inhalers is often ineffective; 4,000 Americans die due to asthma every year. It is hypothesized that the aerosol drug particles deposit before the problem (peripheral) bronchioles and airways; not equally dosing all areas of the lungs. The purpose of this research is to use computer modeling to judge the effectiveness of aerosol inhalers and the methods of their administration at equally dosing all lung bronchioles and airways. The computer model, developed in house, uses the Finite Element Method to approximate the solution to the Navier-Stokes equation governing fluid flow, and uses a force balance to track the particles individually. Currently, airway meshes of varying diameter ratios are being used to determine if particle deposition is a function of airway constriction. In addition, parameters are being set and refined in order to create model simulations that depict the desired conditions. These results will be compared to other research in order to test for validity. This research may prove useful for developing effective inhaler dosage methods and for designing asthma drug administering methods.

**Kaysha Young: Mechanical Engineering and Mechanical Engineering Technology**

**Mentor: Laura Stanley-- Mechanical and Industrial Engineering**

***Hands Free Texting While Driving - Is it Safer than Conventional Texting While Driving?***

Motivation: The research aim of this project is to observe any safety benefits that hands free (voice activated) texting may have over manual texting during simulated driving. Hands free texting software developers are claiming this software may reduce driver distraction. Background: Many states are grappling with whether to ban the use of cell phones while driving by increasing the penalties associated with such activities. This study will increase our understanding of driver distraction and may have potential implications for legislature and device development. Methods: Sixty participants (30 dyad pairs) between the ages of 18 and 25 will drive in a high fidelity simulator where they will engage in a single task (driving only) and two dual tasks (hands free and manual texting coupled with driving), while driving three roadway environments (rural, urban and freeway). The driver will follow a pace car which will brake randomly to determine the driver's reaction time to unpredictable conditions. Participants will be equipped with an eye tracker in order to measure eye glances to the device and the amount of time when eyes are off the road. Other dependent variables collected include: braking onset time, headway distance, lane position and mental workload.

## COLLEGE OF LETTERS AND SCIENCE

**Dema Alniemi: Cell Biology and Neuroscience**

**Mentor: Edward Dratz-- Chemistry and Biochemistry**

***Development of a Method for Isolation of Phosphoproteins Using Alkaline Phosphatase Mutants***

Proteomics, the study of proteins and their post-translational modifications (PTMs), is an increasingly important field of study. The most common PTM identified in cells is phosphorylation, which has been found to play a central role in a wide range of normal cellular regulation as well as in diseases such as diabetes and cancer. A new method for enrichment and isolation of phosphorylated proteins is being pursued using the *E. coli* alkaline phosphatase (ALP) enzyme to seek a novel and simple method for the global analysis of phosphoproteins. Wild-type ALP is a highly non-specific phosphatase that hydrolyzes the

bond between a phosphate group and its attached protein. A mutation in the active site of wild-type ALP, S102L, has been made that allows the enzyme to bind the phosphate group on proteins, but prevents hydrolysis of the bond, therefore keeping the protein attached. We plan to use the bead-bound ALP S102L mutant to bind phosphorylated proteins in complex biological extracts, and to separate them from unphosphorylated proteins. After elution, the enriched phosphoproteins can be analyzed by a variety of techniques. We also plan to make a streptag mutant of S102L ALP to increase the efficiency of binding to beads.

**Lydia Anderson: Organismal Biology**

**Mentor: David Sands, Alice Pilgeram—Plant Sciences and Plant Pathology**

***Enhancing the virulence of a biocontrol agent***

A fundamental problem with weed biocontrol agents is their lack of sufficient virulence. Biocontrol agents must be able to kill a weed in its seedling stage, they must be host specific, and they must be efficient enough to be used at low cost. Starting with a fungus that is host specific it is necessary to select for high virulence in order to have high mortality at reasonable cost. I chose the *Fusarium oxysporum* f.sp. strigae (FoxyS) because it only attacks the parasitic plant, *Striga hermontheca*. Striga can reduce farmer's yields of maize by 50% or more. Tests have shown that the amino acid tyrosine inhibits the striga without inhibiting maize, the principal food crop in Kenya. I used serial exposure to raise the levels of the tyrosine analog 3-fluorotyrosine to obtain tyrosine-excreting mutants of FoxyS. Tyrosine excretion was verified using a bacterial bioassay. These strains can be easily grown by farmers in Kenya to protect their fields of maize. They can initiate a village based industry of biocontrol agent production using these enhanced strains. My collaborators who will test the new agent in Kenya are Florence Oyosi and Sila Nzioki.

**Gillean Arnoux: Geology**

**Mentor: Todd Feeley-- Earth Sciences**

***Analysis of mafic enclaves in lavas from Uturuncu Volcano, SW Bolivia to determine system heterogeneity***

Magma mixing is an essential concept in volcanology used to classify volcanic systems. Evidence of magma mixing includes magmatic enclaves, which are inclusions emplaced within a host rock of related but distinct composition and of separated genesis. Enclaves are pertinent to our understanding of volcanic systems, as they provide information about the internal processes involved within the magma chamber. The origin of these phenomena is uncertain and a variety of hypotheses exist, including: incorporation of solid wall rock, xenoliths, restite retained from deep crustal melting zones, and cumulate fragments derived from the partially crystalline rinds of upper crustal magma reservoirs. We characterized mafic enclaves within lava flows from Uturuncu Volcano in Southwest Bolivia to determine heterogeneity of the system and also the origin of the enclaves. Evolution of the system was also examined. Methods used were X-ray fluorescence (XRF) and petrographic analyses of thin sections. These analyses were conducted on fifteen samples collected from a variety of flows. We present here petrographic heterogeneity within mafic enclaves from a single flow and across the lifespan of Uturuncu Volcano. We also propose the enclaves originated as undercooled blobs from a deeper crustal reservoir that were not completely mixed with the host melt.

**Edward Barge: Biological Sciences**

**Mentor: Cathy Cripps-- Plant Science and Plant Pathology**

***The ectomycorrhizal genus *Lactarius* in the Rocky Mountain alpine zone***

*Lactarius* is an important ectomycorrhizal genus in the Arctic-Alpine Biome where it associates primarily with *Salix* and *Betula* species. The Arctic-Alpine Biome covers roughly 8% of the earth's land and in the Rocky Mountains of North America is comprised of scattered islands above timber line in mountainous areas. Between 1999 and 2008, the first extensive study of arctic-alpine Rocky Mountain fungi was conducted in Montana, Wyoming and Colorado. Studies of the ectomycorrhizal fungi present in the arctic-

alpine areas are of importance as climate change is having many impacts on this biome, including range expansion of *Salix* species, a key alpine ectomycorrhizal phytobiont. This study focused on systematics of alpine *Lactarius* species of the Rocky Mountains collected in the Cripps & Horak study. The study resulted in identification of six different alpine *Lactarius* species: *L. glyciosmus*, *L. cf. lanceolatus*, *L. nanus*, *L. pseudouvidus*, *L. repraesentaneus* and *L. salicis-reticulatae*. These species are known to occur in many arctic-alpine habitats throughout the world in places such as Greenland, Iceland, the Alps, Svalbard and Scandinavia and are now documented for the Rocky Mountains of Montana, Wyoming and Colorado.

**Daniel Barta, Krista Brundridge, Ashley Poust: Paleontology, Earth Sciences**

**Mentor: David Varricchio-- Earth Sciences**

***Spheroolithid Eggs from the Cretaceous Tiantai Basin, Zhejiang Province, China***

Spheroolithid eggs attributable to the oogenera *Paraspheroolithus* and *Spheroolithus* are abundant in the mid-Cretaceous Liangtoutang and Chichengshan formations of Tiantai basin in Zhejiang Province, China. We examined approximately 232 previously undescribed spheroolithid eggs and took eggshell samples from four partial eggs in order to explore the parataxonomic affinities of our sample. Radial thin sections of the eggshell were examined and imaged with a petrographic microscope and scanning electron microscope. The eggs are tentatively assigned to *Spheroolithus* sp. on the basis of external morphological characteristics (shape and surface ornamentation) and eggshell microstructure. The 1.16-1.36 mm-thick eggshell consists of a single structural layer. The inner eggshell surface is deeply eroded and the outer eggshell surface lacks ornamentation; pores are difficult to observe in radial section. The shell units are narrow and display straight accretion lines that extend across shell units. The shell units exhibit a sweeping extinction pattern under cross polars. Shell thicknesses for the Zhejiang eggshell plot within the known thickness range for *Spheroolithus*. Differences in shell thickness among specimens may result from intraspecific or interspecific variation, taphonomic alteration, or measurement technique. This study provides a basis for future assessments of the diversity of ootaxa found in Tiantai basin.

**Taylor Bezek: Political Science**

**Mentor: Linda Young-- Political Science**

***Ethnic Diversity, Oil, and Party Politics: The Evolution of three Post-Soviet States***

In the nearly two decades since the official fall of the USSR the fifteen states produced from the collapse have evolved politically in a myriad of ways. Where some have flourished as functioning democracies, characterized by healthy political competition, others have been hindered by rampant autocracy. The Presidential Republic of Azerbaijan exemplifies the autocratic end of this spectrum, while the Parliamentary Republic of Latvia characterizes the other end, displaying a multitude of successful parties and democratic elections. The Semi-Presidential Republic of Georgia falls somewhere in the middle; void of certain elements akin to fostering competitive party politics. I investigate the determinants of party vigor using these three countries as case studies. I assess the role of ethnic diversity, natural resources, and the relationship between the two and how they influence party vigor for each respective state, with the goal of deducing the combination best suited to produce healthy political rivalries. The purpose of this project is to assess, through qualitative research, the role of ethnic cleavages coupled with natural resource endowment as an explanation for the success or stagnation of vigorous party politics in adolescent Post-Soviet states.

**Deborah Blanchard: English Literature , Spanish**

**Mentor: Bridget Kevane-- Modern Languages and Literatures**

***Unmasking the Superhero: Analyzing Junot D'az s The Brief Wondrous Life of Oscar Wao as Multicultural Hybridity Literature***

The term American Literature alludes to a hybridity of text and meaning that combines the different languages and cultures that make up America's writing landscape. When literary students begin to learn about American Literature, they are first exposed to a predominantly Euro-American canon and then

possibly to a multicultural grouping of American authors set up to represent the rest of America ethnic writing. Exposure to these other literatures raises the following questions: How does multicultural American literature fit into the larger Euro-American canon? Should the two groups remain separate or should they be woven together? How does the mainstream reader engage with the multicultural text in a meaningful manner without stereotyping groups of fellow Americans based on one or two works? Utilizing familiar themes that are a part American popular culture and literature, while engaging with the text, allows for meaningful analysis without losing the important messages the text may be trying to relay.

**Quinn Bloom: Sociology**

**Mentor: Tamela Eitle-- Sociology and Anthropology**

***Gender, water collection, and other household chores in Western Kenya***

Currently, an estimated 884 million people (37% living in Sub-Saharan Africa) do not use improved sources of drinking water. For these people, naturally occurring water sources can sometimes be very far from a homestead, resulting in many hours per week spent fetching water by hand. Many water infrastructure projects seek to reduce the amount of time that women, especially school age girls, spend collecting water. But if women are spending less time collecting water, does this necessarily imply that they will be spending more time in school? Household surveys (n=750) were conducted as part of an Engineers Without Borders at Montana State University project in the Khwisero District of Western Province, Kenya. The data collected could provide valuable insight into the effect of international aid projects on opportunities for women. Preliminary results indicate that there are significant correlations between gender, time spent collecting water, and time spent on other household chores.

**Caitlyn Brendal: Cell Biology Neuroscience**

**Mentor: Jackson Gross-- Land Resources and Environmental Science**

***Evaluating the Effects of Cadmium on Liver Volumes of *Rana pipiens* using Magnetic Resonance Imaging***

Cadmium is a heavy metal toxicant found in aquatic environments known to cause adverse effects on organisms. In previous studies, cadmium was found to effect growth and development of multiple species of frogs. Cadmium's effects on different stages of development, Gosner stage (GS) 25 to metamorphic climax, were investigated in *Rana pipiens*, at concentrations of 0 (control), 1.0, and 10.0 ug/L. Effects were quantified for amphibian length and survival throughout development. At the completion of metamorphic development, frogs were analyzed using magnetic resonance imaging. Liver mass was determined by selecting the area of the liver on individual sections of the MRI using ImageJ (version 1.43u). Metamorphic frog's liver volumes were then determined by measuring the pixel number of the highlighted areas with the ImageJ program. Total pixel numbers for each of the sections were then compiled for an estimated total volume. Metamorphic frogs exposed to 10 ug/L had significantly larger livers than other treat groups.

**Tyler Bridges: Paleontology**

**Mentor: David Varricchio-- Earth Sciences**

***Soft tissue or Biofilm?***

The controversy engendered by the discovery of soft tissue in a sixty five million year old fossil has become a topic of debate among many paleontologists. If the results are soft tissue, then the entire perspective the scientific community has on fossilization and molecular degradation must be shifted. If the soft tissue is really biofilm, which has become the leading hypothesis contrary to actual soft tissue, then there is a wealth of knowledge to be gained from bacteria living in fossils. This project has two main foci: To work together with a multi-team group to establish a final conclusion on the debate between soft tissue and biofilm and to work independently to establish a similar research with a different perspective that will either support or contradict the group data. The team based data will be a study of how taphonomic processes affect modern animal bones and relate the gathered data to the soft tissue. The

individual work will focus on using dyes and anti-bacterial agents to attempt to falsify both the soft tissue and biofilm hypotheses.

**Dewey Brooke: Chemistry and Biochemistry**

**Mentor: Brian Bothner, Brad Poore, Navid Movahed, Mavis Agbandje-McKenna (University of Florida)-- Chemistry and Biochemistry**

***Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry***

Adeno-associated virus (AAV) belongs to the Parvoviridae, a family of small, non-enveloped icosahedral viruses. The viral capsid has T=1 symmetry and is composed of 60 subunits, made up from three proteins (VP1, VP2, VP3) in a ratio of 1:1:10. The minor proteins are the same as VP3 in their C-termini region, but they have additional domains on their N-termini that play essential roles in cellular entry and trafficking. AAV entry is by receptor-mediated endocytosis, eventually depositing its genetic material in the nucleus of the cell. Structural studies of AAV have shown that the N-termini of VP1 and VP2 are initially internalized in the capsid and become externalized, most likely during endocytosis. Based on sequence and structural similarity, VP1 contains a phospholipase A2 domain (PLA2) which, when mutated, dramatically reduces infectivity. Currently, little is known about the mechanism of VP1 externalization or the role of the lipase in escape of the virus particle from the endosome. To characterize this PLA2 domain, we have developed a liquid-chromatography mass-spectrometry based assay for lipase activity. To date, we have tested factors such as receptor binding, heat, and pH on the externalization of the PLA2 and are addressing the mechanism for AAV's infection.

**Timothy Brox: Physics**

**Mentor: Jennifer Brown, Joseph Seymour, Mark Skidmore-- Chemical and Biological Engineering, Earth Sciences**

***Magnetic Resonance Studies of Polycrystalline Ice Structure***

Recent work has demonstrated that microorganisms can occupy the liquid filled inter-crystalline veins in ice and maintain their metabolic activity under these conditions. While these discoveries have increased the extent of the biosphere to include the large continental ice sheets of Antarctica and Greenland as biomes, the habitat of the microorganisms within the inter-crystalline liquid veins is poorly understood. Additionally, certain cold tolerant organisms produce extra cellular proteins (i.e., ice-binding proteins) that have the ability to bind to the prism face of an ice crystal and inhibit ice recrystallization. This phenotype affects the physical ice structure and the liquid vein network, potentially providing ice-inhabiting species a protective mechanism with which to control their habitat. One such microorganism is *Chryseobacterium* sp. V3519-10, a bacterium isolated from a depth of 3519 m in the Vostok Ice Core. This investigation examines 1) the inter-crystalline liquid filled vein network using Nuclear Magnetic Resonance (NMR) spectroscopy and Magnetic Resonance Imaging (MRI) and 2) the impact of extra cellular proteins from ice-adapted bacterium on ice structure.

**Krista Brundridge, Daniel Barta: Paleontology**

**Mentor: Frankie Jackson, David Varricchio, Xingsheng Jin-- Earth Sciences**

***Fossil Eggs from Zhejiang Province, China: evidence of a reducing environment facilitated by organic decomposition***

A majority of fossil eggs from the Upper Cretaceous, Tiantai basin in Zhejiang Province, China occur within predominantly red sandstone. A white halo occurs in the sediment immediately surrounding almost every egg examined in the collections of the Zhejiang Natural History Museum. Petrographic and X-ray diffraction examination of the white halo and the red sediment matrix shows no differences in the overall sedimentology and clay mineralogy. In contrast, iron staining of a thin section showed Fe<sup>2+</sup> and Fe<sup>3+</sup> in the white halo and red sediment, respectively. The white halo, therefore, indicates a reduced state immediately adjacent to the egg. The iron reduction was likely caused by the decay of organics that

decreased the amount of oxygen in the sediments surrounding the egg. In addition, six thin sections of eggshell reveal round spherical structures (160  $\mu\text{m}$  in diameter) with a dark rim. These structures, interpreted as pedotubules, exhibit multiple generations of sparry calcite. This provides potential evidence for interactions between organisms and eggs during early diagenesis.

**Abraham Burnett: Economics**

**Mentor: Joseph Atwood-- Agricultural Economics and Economics**

***Traders in the Sugarscape: The Efficacy and Efficiency of Using R and Fortran for Agent-based Modeling***

This project studies the efficacy and efficiency of using two programming languages (R and Fortran) for conducting agent-based modeling and simulation (ABMS). ABMS is a relatively new scientific method which allows researchers to study problems which would be impractical, too expensive, or unethical to study using traditional methods. Existing platforms fail to meet practitioners' needs because they are often either powerful but difficult to effectively utilize (Repast), or easy to use but inflexible and slow (Netlogo). As a third way of conducting social science, ABMS is at a crucial juncture because these existing platforms insufficiently meet social scientists' needs. This project seeks to determine if R and Fortran are viable alternatives for creating and running agent-based simulations. Projects like this assist practitioners in selecting the best platform or programming language for their needs by providing subjective and quantitative measures of the difficulty and complexity of using various alternatives. In order to ascertain the effectiveness of utilizing R and Fortran, we recreate the classic Sugarscape model by Epstein and Axtell and introduce a Trader class. We anticipate that the introduction of a Trader agent type into the Sugarscape will resolve the out-of-equilibrium market behavior observed in runs of the original model.

**Carson Butler: Fish and Wildlife Management**

**Mentor: Jim Berardinelli-- Animal and Range Sciences**

***Effect of Exposing Twenty-month-old Virgin Ewes to Mature Rams on Kisspeptin in Arcuate nucleus and Preoptic Area During the Early Breeding Season***

The question to be answered in this experiment is whether sudden introduction to rams alters the number of kisspeptin immunoreactive (IR) cells in the hypothalamus of 20-month-old virgin ewes during the breeding season. Brains from ewes exposed to a ram and from ewes not exposed to a ram were perfused with paraformaldehyde and the hypothalami dissected out. Immunohistochemistry (IHC) will be performed on 50  $\mu\text{m}$  sections from the PoA and ARC nuclei of the hypothalami using fluorescent microscopy to count kisspeptin IR cells in each section. An ANOVA test will be used to determine if the number of kisspeptin IR cells differs between treatment (ewes exposed to a ram and ewes not exposed to a ram). Results of this experiment will advance our knowledge of the physiological mechanism(s) involved in the biostimulatory effect of males on females of domestic animal species and may lead to a generalization regarding how male mammals affect reproductive behavior and function of female conspecifics.

**Nathan Carroll: Paleontology**

**Mentor: David Varricchio-- Earth Science**

***Description Of An Azhdarchid From The Two Medicine Formation Of Montana***

Azhdarchids are a unique clade of pterosaurs that appear to have been well adapted to terrestrial environments and rose to dominance in the late Cretaceous. The fossil record of pterosaurs in Montana, though sparse, seems to affirm this. Of the three fragmentary remains of pterosaurs described from Montana, all have been ascribed to the Azhdarchidae. This research will add another occurrence to that list. The pterosaur assemblage described is from the Jack's Birthday Site in the Two Medicine Formation and is comprised of several three-dimensionally preserved elements. Pterosaur specimens were comparatively examined in collections at the Museum of the Rockies, Bozeman, Montana, the Zhejiang Natural History Museum, Hangzhou China, and the University of Kansas Museum of Natural History, Lawrence, Kansas. Collections were also visited at the Texas Natural Science Center at the University of

Texas Austin. This institution was selected for its large collection of azhdarchid and other pterosaur material. The material examined at these institutions allowed for the elements of the Montana specimen to be identified and described. The elements were photographed, illustrated, molded, casted, and used to create a reconstruction. The new information from this specimen contributes greatly to our understanding of pterosaur paleoecology and biogeography.

**Cameron Clevidence: Organismal Biology, Microbiology**

**Mentor: Li Huang-- Plant Sciences and Plant Pathology**

***Identification of Gene Homologs Required for Lr21-Mediated Resistance Using Virus Induced Gene Silencing***

Bread wheat (*Triticum aestivum L.*), is a cereal food that supplies approximately 40% of the food and 25% of calories consumed globally. The fungal wheat pathogen, leaf rust (*Puccinia triticina*), damages wheat production by \$2 billion annually (National Agriculture Statistics Service, <http://usda.gov/nass>). Due to the complexity of the wheat genome ( $2n = 6x = 42$ , genome formula AABBDD) molecular mechanisms involved in leaf rust defense are relatively unknown. The objective of this research is to use Virus Induced Gene Silencing (VIGS) to determine homologs from gene families known to be active in the Lr21-mediated rust resistance pathway. VIGS utilizes the natural cellular process RNA interference to silence genes at the post-transcription level. By inserting a conserved fragment of a target gene into a viral vector we can effectively silence that gene in vivo, which allows us to observe the gene function. We have designed targets specific to individuals of the gene families Ror1, Rpg1, TGA, and SIPK. The active homologs determined in this experiment will allow us to gain a better understanding of gene-mediated rust resistance, and promote a better strategy to protect the production wheat from rust diseases.

**David Coles: Sociology**

**Mentor: Tamela Eitle-- Sociology**

***Understanding Intimate Partner Violence***

How important is alcohol use relative to Intimate Partner Violence (IPV)? This study will explore the relationship between risky behavior and violent interaction with one's loved partner or spouse, while controlling for drinking in order to get drunk in public. Using a National Youth Survey from 1987 I will cross-tabulate several types of IPV with other risky behaviors while controlling for those who are also getting drunk in public. Previous findings support evidence that shows drinking intensifies the risk of IPV if violent/risky behavior exists. However, I wish to expand on the question of how alcohol abuse will impact IPV in those with risky tendencies. My evidence shows that for some types of partner violence, alcohol plays more of a factor than for other types. The more physical violent forms, such as hitting or weapon usage, are examples of forms that are less significantly predicted by alcohol abuse. (As my past NYS data shows).

**Jasmine Croghan, Daniel Barta, Krista Brundrige, Jordan Drost, Chantell Bury: Paleontology, Geology**

**Mentor: David Varricchio, Frankie Jackson-- Earth Sciences**

***Eggshell thickness variation in Chinese dinosaur eggs***

Observation of approximately 200 dinosaur egg samples from the Cretaceous Tiantai basin, Zhejiang Province, China, reveals substantial eggshell thickness variation within the presumed *Spheroolithus* sp. eggs. Examination and analysis of eggs in hand sample combined with radial thin sections of two eggshells with differing variation allowed investigation of two potential sources of variation in eggshell thickness across an egg: original egg morphology or postmortem taphonomic processes. Eggshell thickness changes laterally from 2.0 mm to 0.6 mm and back to 2.0 mm across one side of an egg, with upper and lower values of 2.6 mm and 0.3 mm, respectively, and a standard deviation of up to .51 mm in the data set. These areas likely represent the top or bottom of the egg and result from dissolution during early diagenesis. However, the consistency of this variation among different localities within the Tiantai basin remains unclear. Because eggshell thickness is commonly used to assign fossil eggs to an oospecies,

distinguishing biologic from taphonomic attributes is important for assessing the diversity of ootaxa in the Tiantai basin, and the study of the taphonomy of eggshell thickness variation provides a reference for explanation of sources of variation in the fossil record of eggs.

**Kerstin Cullen: Physics**

**Mentor: Galina Malovichko-- Physics**

***EPR Characterization of Lithium Niobate Doped With Non-Paramagnetic Modifiers***

The paramagnetic defects in congruent and nearly stoichiometric Lithium Niobate crystals that had been doped with non-paramagnetic modifiers such as hafnium were studied. The investigator used modern magnetic spectroscopic systems such as a multi-frequency Bruker ELEXSYS 560 spectrometer and in addition a laser flash Photolysis Spectrometer Edinburgh LP920. The laser flash spectrometer was used to measure absorption or wavelengths by elements in the crystal. Angular dependencies of the EPR Spectra on orientation of the sample with respect to external magnetic field at room and liquid helium temperatures were studied in order to determine the kind of non-controlled impurities by taking advantage of the Quantum Zeeman Effect. In addition the angular dependencies of the spectra with respect to the external magnetic field will be used to estimate the relative concentrations of the impurities and intrinsic defects in the sample. As the hafnium doped sample was previously unstudied but theorized to prevent optical damage, properties could potentially be applicable to both the telecommunications and photonics industry.

**Rosemary Cunningham: English**

**Mentor: Danell Jones, Kirk Branch-- English**

***The Literary Work and Legacy of Manazar Gamboa***

This project focuses on the literary work and legacy of Manuel “Manazar” Gamboa, specifically, his published and unpublished poems. Gamboa, a revered ex-convict writer/poet, became a leader in the Los Angeles Chicano literary scene in the late 80’s and early 90s. A literary figure and an activist supporting at-risk youth through creative engagement, Gamboa left an enduring legacy in the city. Simon Schorno, who produced a short documentary about Gamboa’s life, Poetic License, eloquently summed up his legacy:

“The arc of Manazar was exceptional by any standard but what I believe made it really exemplary was, beyond the power of his writings, the man’s unflinching honesty, pride, and generosity of spirit.....the values Manazar embodied [were]—respect for all, rebellion against injustice, [and] creativity with a conscience.”

Using Gamboa’s archived papers and material at the UCLA Chicano Research Center Library, I surveyed many hundreds of poems—some previously published, some prepared for publications, and others still in progress—and chose this collection of selected poems in order to make his work available to a wider audience. The collection will also include an introduction based on the poems as well as interviews with Gamboa’s friends and fellow writers.

**Greg Doctor: Cell Biology and Neuroscience**

**Mentor: Christa Merzdorf, Elena Kalinina-Turner-- Cell Biology and Neuroscience**

***Investigating the Role of aqp-3b in Xenopus laevis Neurulation***

This research project aims to investigate the role of aqp-3b expression in neural tube closure using *Xenopus laevis* as a model organism. Aqp-3b is an aquaglyceroporin expressed along each neural fold in *Xenopus laevis* embryos. Past research from The Merzdorf Lab has shown that embryos in which aqp-3b had been inhibited along one neural fold exhibited a delay in the formation of said fold, while the other neural fold (with normal aqp-3b expression) appeared to extend and close normally. My hypothesis is that aqp-3b plays a vital role in *Xenopus laevis* neural tube closure via its effect on cytoskeletal conditions

within cells along the neural folds. I will investigate this hypothesis by using an aqp-3b morpholino oligonucleotide to inhibit aqp-3b expression along one neural fold in *Xenopus laevis* embryos. Aqp-3b morpholino injected embryos will be allowed to develop to various neurula stages (15-21), fixed, stained using fluorescently labeled phalloidin and cryosectioned or halved and cleared. The phalloidin stained cytoskeletons of neural cells in embryos exhibiting a neural tube defect will then be observed via standard fluorescence microscopy or confocal fluorescence microscopy. The first leg of this research project consisted of gaining familiarity working with *Xenopus laevis* embryos and learning protocols essential to the project. Techniques that have been learned and practiced thus far include: microinjecting, fixing, staining (with phalloidin), cryoprotecting, embedding and cryosectioning embryos. I have also begun injecting embryos with Lac-Z mRNA and staining for the resulting beta-galactosidase enzyme produced. In addition to phalloidin staining, a GFP-moesin mRNA construct will also be used (in non phalloidin-stained embryos) as an alternate method of visualizing the actin cytoskeleton in aqp-3b morpholino injected embryos. Determining the effect of aqp-3b expression on neural tube closure by observing a cell's cytoskeleton may help define a mechanism by which aqp-3b participates in neural tube closure and may yield insights into the role of the embryonic neural cell cytoskeleton in neurulation.

**Casey Donovan: Mathematics**

**Mentor: Steven Holmgren, Tatiana Kuznetsova, Bjorn Kvamme (University of Bergen, Norway)--  
Chemistry and Biochemistry, Physics**

***Molecular Dynamical Studies of Water Deposition on Calcite***

In an effort to reduce carbon emissions, carbon sequestration is being researched as a possible solution to minimize CO<sub>2</sub> released directly into the atmosphere. Calcite, CaCO<sub>3</sub>, is a common mineral found in the reservoirs and pipes used in sequestration and affects the formation of hydrates. Hydrates can impede or aid carbon capture by blocking pipes or more securely trapping CO<sub>2</sub>. My research was on the formation of hydrates and entailed creating and running simulations of water, carbon dioxide, and calcite systems at various temperatures. I used several molecular dynamics software packages, including Visual Molecular Dynamics and MDynamics 4.3. My results clearly show that immediately along the calcite surface, the structure of water is unfavorable for hydrate formation, but after several layers of water, the intermixing of CO<sub>2</sub> and water demonstrate excellent conditions for CO<sub>2</sub> hydrates. These results will help to make better predictions on the favorability of hydrate formation and the detriments (or benefits) it may cause.

**Carey Downey: Microbiology**

**Mentor: Kristin Juliar-- Montana AHEC and Office of Rural Health  
*Establishing a Health Care Workforce Analysis Plan for Montana***

In 2002, the governor set the stage to remedy the health care workforce shortage in Montana. The Blue Ribbon Task Force was commissioned with the task of accurately assessing the workforce shortage and developing recommendations to effectively find a solution to the issue. Of the 56 counties in Montana, 50 of them were found to be areas experiencing health professional shortages. While the reasons for the shortage are as diverse as the professions experiencing it, the main causes are believed to be an increase in the demand for services and too few people entering the health care work force. Many potentially beneficial proposals have been put forth to remedy the problem (including better access to professional training for Montanans), but there still remains the problem of knowing which professions are most needed and the areas of Montana they are needed. This study explores what other states are doing to assess health care workforce shortages. It looks specifically at surveys used during the re-licensure process and assessing the feasibility of implementing such surveys in Montana under the Montana Affordable Care Act and Workforce Development Planning Grant.

**Jordan Drost, Chantell Bury, Ashley Poust: Paleontology, Earth Sciences**

**Mentor: David Varricchio, Frankie Jackson-- Earth Sciences**

***Morphology and diagenetic alteration of an unknown oogenus from the Tiantai basin, China***

The mid-Cretaceous sediments of the Tiantai Basin, Zhejiang Province, China yield abundant fossil egg material representing several ootaxa, including a previously undescribed oogenus. These unknown eggs are prolate in shape and usually preserved vertically compressed. The thick eggshells exhibit varying patterns of shell coloration banding when viewed along radial section. Using petrographic light microscopy, cathodoluminescence (CL) and scanning electron microscopy (SEM), two specimens were examined to determine the influence of diagenetic alteration on the range of shell colorations. These analyses revealed moderately well-preserved microstructures including pores, shell units, and accretion lines. Mammillary cones present in one specimen (M8102-2X) are stained red by iron oxide. The upper 1/3 of the eggshell shows evidence of alteration and fluoresces bright orange under CL, indicating the presence of manganese. Secondary calcite in-fills pores and fractures. Initial investigations suggest that banding is the result of alteration to the chemical and physical structure of the eggshell. Further research will help distinguish biological and diagenetic features within these eggs and aid in determining the diversity of ootaxa in the Tiantai basin.

**Stefan Eccles: Physics**

**Mentor: Charles Kankelborg, Christina Dunn-- Physics**

***Estimating Diffraction Effects through the Talbot Effect***

Diffraction effects can be both a boon and a hindrance to optical systems. The relevance and significance of these effects vary with the specific configuration of the system. The aim of this project has been to find a simple method to quantize the significance of diffraction effects as light is transmitted through or reflected from an optical surface. The task is approached using a characteristic distance known as the Talbot Length. This distance is a measure of the tendency of a wavefront of light to "wash out" phase information as it propagates between optics. The Talbot Length can be used to set an upper limit on the distance over which light can propagate between optics while maintaining a specified spatial resolution. Although most results are general and applications to various systems are explored, particular focus is given to surface mapping techniques and phase shifting interferometry. For generality, consideration is given to collimated, diverging, and converging wavefronts.

**Esteban Ferrero Botero: Anthropology**

**Mentor: Laurence Carucci-- Sociology and Anthropology**

***Misunderstandings and Deception: When Standardized Education Meets the Colombian Wayuu***

In the context of globalization, which involves a substantial and often disproportionate circulation or imposition of ideas, disempowered minority cultures have been assimilated into the larger society; catalysts for this circulation include businesses, aid agencies and governments. In Colombia, indigenous groups are going through this process, having significant effects on the lives of individuals, their desires, and how they perceive themselves. Tracking and analyzing this process becomes important to ensure effective and significant policy making for the locals and to understand cultural change. Through participant observation and in-depth interviewing among the Wayuu community of Siapana during the summer of 2010, complemented with archival research, this project aims to analyze a Colombian ethno-educational program in order to understand how it adapts to a local context, how foreign programs are perceived, what the outcomes are for individuals and the community, and what kind of conflicts are created. The historical victimization suffered by the Wayuu has placed them in a disempowered position vis-à-vis the *alijuna* (non-Wayuu); this disempowerment is ingrained in their sense of identity. Ethno-education programs have served as a way to empower this community by providing a sense of agency and control over their own lives, but, at the same time, reassuring their disempowered positionality within the larger society by inculcating inferiority and a desire of participation in the socioeconomic and political system. Thus, anxiety arises when individuals realize that their ideals of life are not being met, even when

education is present. Lastly, ethno-education facilitates the processes of objectification and externalization of Wayuu culture rendering it the main commodity of exchange.

**Angie Ford: English**

**Mentor: Doug Downs-- English**

***Dynamic Activity Requires Dynamic Study: In Activity Analysis of Firefighting, Status Quo Methods Can't Take the Heat***

How much can you observe about the activity of firefighting if you're standing still as the engine flies past? If, in your study, you cannot enter a burning building comprehending the voices squawking from your radio, fellow firefighters, and the training in your own head, chances are that you'll miss the activity's most vital parts. The same is true of researching the discourse of any activity. Activity Theory (Engestrom, 1999; Russell, 1997, 2002) allows us to study human interaction by tracing discourse as a tool for accomplishing a shared goal. Yet it is easy to forget that activities are inherently dynamic, so that attempts to study their discourse as a static tool, separate from the actual motion of the activity, will not suffice. Similarly, study of the activity demands insider knowledge. In studying firefighting, for instance, an outsider could ride along, interview, and partially understand what they're seeing, but without insider experience, the resulting representation may be significantly distorted. Unlike methods such as ethnography, which resolve these difficulties via participant observation and thick description, activity-theory analysis is still typically conducted statically, by outsiders, via scrutiny of documents and texts (such as incident reports and radio traffic). I use the example of firefighting discourse to study this methodological problem. My presentation uses insider activity analysis to walk through some of the intricate steps of what discourse looks like when being used as firefighting is happening and showing what would be missed by an outsider's static analysis.

**Rebecca Fox: Cell Biology and Neuroscience**

**Mentor: Laura Mentch-- Bridger Clinic**

***Sexual Health Needs Assessment of MSU College Students***

Bridger Clinic, Planned Parenthood, and MASH (Montana Advocates for Sexual Health) provide several sexual health programs and outreach opportunities for the MSU student population. In order to meet the needs for sexual health information on MSU campus, these organizations must stay up to date on student and professional perspectives on sexual health. The goal of this research was to conduct a needs assessment of MSU students in an effort to determine sexual health programming and outreach needs for this particular population. The research included recruitment for and administration of student surveys, recruitment of students for focus group discussions, and supplemental data from Student Health Services, Bridger Clinic, and the Gallatin County Health Department. These methods were put into place to establish what students need and what students think other students need from sexual health information. Results are indicating the overriding sexual health issues on campus, what resources pertaining to sexual health students are aware of, and what sexual health programs and activities on campus students would be interested in attending. Conclusions drawn from this research will enhance the future outreach efforts of Bridger Clinic, Planned Parenthood, and MASH.

**Andrew Freund: Cell Biology and Neuroscience**

**Mentor: Frances Lefcort-- Cell Biology and Neuroscience**

***Characterization of Vascular Endothelial Growth Factor in the Developing Nervous System***

Vascular endothelial growth factor (VEGF) is a signal protein produced by cells that stimulates the growth of new blood vessels. VEGF's normal function is to create new blood vessels during embryonic development and is an important signaling protein involved in both vasculogenesis and angiogenesis. When VEGF is over expressed, it can contribute to disease. Solid cancers cannot grow beyond a limited size without adequate blood supply; cancers that can express VEGF are able to grow and metastasize. In order to study VEGF's role in the developing nervous system, a bead soaked in a VEGF-blocking drug,

Su5416, was inserted into the neural tube of stage 12 quail. This method allowed for a consistent release of the drug into the proximal area directly surrounding the bead until stage 22 of development. Analysis of the resulting neural tissues using immunohistochemistry allows for the cross-talk of the developing nervous system and vasculature to be studied. Hence, the results presented here allow for not only VEGF to be studied, but any growth factor.

**Kate Fulbright: History**

**Mentor: Joshua Howe-- History**

***Where Are All the Women in Atmospheric Science?***

In the past few decades, women have made great strides in increasing their participation in scientific research. While women have gained influence in many areas of science, research in atmospheric science still remains largely in the hands of men. Why is it that men have dominated this important field, and how have the few women that have managed to make careers in atmospheric science contributed to research in the field? Moreover, what are the consequences of this lack of female representation for research on climate change, and how has this affected the nature of scientists' advocacy on global warming? I will research the historical origins of the problem of gender and climate science and the greater implications this has had for climate change advocacy. I plan to investigate how and why atmospheric science developed as a male dominated field that has yet to be breached by women from the discipline's early origins to its modern form as a major source of information on global warming. I will address how the limited female participants in climate science and climate change advocacy have influenced both scientists and politicians approaches to global warming, one of the most challenging issues facing society today.

**Rio Gonzalez: Literature**

**Mentor: Michael Sexson-- English**

***Pedagogical Technology***

My research is on Pedagogical Technology. Finding ways to enhance the classroom with the surplus of technology that has become so prevalent on campuses. I mean to do away with PowerPoint as bulleted, guided lectures have a tendency to put students to sleep and decrease, where I mean to increase, comprehension and retention in students via participation. PowerPoint makes tangential communication between student and teacher very difficult should media be helpful to answer a question.

**Riley Halligan: Philosophy**

**Mentor: Sara Waller-- Philosophy**

***Extended Minds, Extended Technologies, and Extended Persons***

Some transhumanist literature suggests that technologies that are directly connected to the human brain/body have different moral implications than the technologies that are not. For instance, Frabrice Jotterand discusses how some individuals consider technologies such as bionic arms and brain implants to contribute to the augmentation of human dignity. However, she argues that posthuman dignity is incompatible with human dignity. But, according to Clark and Chalmers, some forms of transhumanism are already pervasive in human culture, and have been for a long time. That is, when one uses any tool, even language, the mind is extended beyond the brain and even the skin. An extended mind implies an extended person. We can define a person loosely as an entity that possesses higher order conscious states, especially self-awareness and is entitled to certain rights. While questioning human use of technology is probably futile, we are faced with a pressing question; "What sort of technologies should we advocate for the human mind and person, and what sort of technologies should be avoided"? If we focus on this question, instead of opposing transhumanism at a general level, we confront the heart of the ethical issues at hand. While human beings have merged with technology for thousands of years, we still need to deal with the implications of technologies recently made available, and those that will likely exist

in the near future. This paper advocates a forward looking approach to transhumanism, and argues against positions that take transhumanism to be something that can be stopped.

**Jaron Hartman: Physics and Biology**

**Mentor: Charles Kankelborg-- Physics**

***Characterization of the MOSES Hollow Cathode Lamp Light Source***

The Multi-Order Solar Extreme Ultraviolet Spectrograph (MOSES) is a NASA sounding rocket payload that uses a narrowband, multi-order slitless spectrograph to image the sun in the extreme ultraviolet (EUV). This method, when compared to using a slit spectrograph, provides higher spatial and temporal resolution. Due to the specificity of MOSES in the EUV, the same emission lines MOSES will view when launched, must be recreated in the lab. A hollow cathode lamp (HCL) is used to complete this. Prior to testing of the MOSES optics and detection system, the HCL must be characterized. This involved determining the radiometric intensity, illumination pattern, and spectral content of the source. A photodiode was used to map out a 10 by 10 centimeter square of the illumination from the light source. The current output from the diode was then used to determine the radiometric intensity of the source. Characterization of the HCL has provided a reference when analyzing data from our detectors and allowed testing of MOSES to begin.

**Elsa Howard: Psychological Sciences**

**Mentor: Ian Handley-- Psychology**

***Placebo Effect, A Matter of Motivation?***

The phenomenon known as the placebo effect, which leads individuals to experience the outcome that they expect, has many implications in psychological sciences and healthcare. Some individuals realize and believe that their expectations bias their later experiences, which can cause them to correct against the bias, reducing placebo effects. In fact, these individuals may even overcorrect such that they come to experience the opposite of what they expected. Individuals who do not believe expectations bias experiences do not correct against this bias, and therefore, tend to experience placebo effects. However, correcting this bias comes at a cost of experiencing a more negative outcome. If one is about to experience a very unpleasant sensation, and expects a pill will make that situation less uncomfortable, people might be motivated to not correct and experience a placebo effect. This study presents individuals with different durations of noise blasts; we predicted that those who would normally correct their bias, when presented with a longer duration, would be motivated not to correct, resulting in experiencing placebo effects. The findings of this proposal may aide researchers and health practitioners to understand when individuals are likely, or less likely to experience placebo effects.

**Alta Howells: Chemistry**

**Mentor: John Peters-- Chemistry and Biochemistry**

***Structural and Functional Studies of Nuclear Associated Lamin 1 Protein, Nar1, a Homolog of Lower Eukaryotic, Algal and Bacterial [FeFe] Hydrogenase***

Nar1, a eukaryotic protein, is homologous to [FeFe] hydrogenase proteins and is present in lower eukaryotes, algae, and bacteria. However, unlike [FeFe] hydrogenases, Nar1 is not involved in the reversible oxidation of hydrogen. While the specific biochemical function of Nar1 is not known, it is clear that the primary difference between Nar1 and [FeFe]-hydrogenase lies in the C-terminal region of the protein sequences. [FeFe] hydrogenases contain the active site H-cluster consisting of [4Fe-4S] cluster and a 2Fe cluster in the C terminal domain. In contrast, Nar1 proteins contain a single [4Fe-4S] cluster in the C-terminal domain with a conserved tryptophan of unknown function. In order to better understand the evolution and structure of Nar1, the crystal structure will be determined. From there, using statistical analysis, the gene encoding the ancestor of HydA and Nar1 will be derived, synthesized, expressed and crystallized. Having the three crystal structures, HydA, Nar1 and the HydA/Nar1 ancestor, will provide great insight into the evolution of these enzymes, furthering an understanding of how Fe-S clusters gained

importance in their biological function. The crystal structure of Nar1 will also provide further insight into the exact biochemical function of Nar1.

**Forrest Hoyt: Biochemistry**

**Mentor: Benfang Lei-- Immunology and Infectious Diseases**

***Cloning of the IL-8 and C5a peptidase genes of Group A Streptococcus***

Group A Streptococcus (GAS) is an important human pathogen that is able to interfere with innate immune responses. We plan to examine the effect of overexpression of IL-8 peptidase SpyCEP and C5a peptidase ScpA on neutrophil recruitment. In preparation for the study, we planned to clone the spyCEP and scpA genes into the pDC123 vector. The large sizes of the genes made the PCR amplification very difficult. After trying with different primers and DNA polymerases, we eventually obtained the PCR product of the genes. Next, the low copy number of pDC123 and the large sizes of the PCR products made it very difficult to directly clone the PCR products of the spyCEP and ScpA genes into pDC123. We thus choose to first topo-clone the PCR products and then subclone the spyCEP and scpA genes into pDC123. We have successfully cloned the two genes into the topo-cloning vector. Subcloning of the genes into pDC123 is in progress.

**Cayman Irvine: Physics**

**Mentor: Petrus Martens, Rafal Angryk-- Physics, Computer Science**

***Assessing the Accuracy of Computer Feature Recognition Methods for Solar Imagery***

Development of feature recognition algorithms for Solar Dynamics Observatory images promises to allow more rapid and flexible analysis of this enormous data set. Our team has developed such an algorithm based on classification of texture parameters. We have performed preliminary testing of the algorithm on several solar datasets. This is accomplished by training the algorithm to recognize features present in a subset of a catalog then having it identify all features present in the remainder of the dataset. The phenomena identified by the algorithm are then compared to those present produced by other, feature-specific algorithms, and by human observers. A quantitative assessment can then be made of the algorithm's ability to reproduce the training catalog, and its agreement with other feature lists. Using these measures, we assess the accuracy of both modules, using the discrepancies between the different feature lists. We also discuss use of these agreement measures as a means of evaluating the consistency and accuracy of the other feature lists.

**Amanda Kelley: Biochemistry**

**Mentor: Martin Teintze-- Chemistry and Biochemistry**

***Guanides as Antibiotic Compounds***

*Pseudomonas aeruginosa* and *Acanthamoeba castellanii* are both opportunistic human pathogens and infect people who are immunocompromised. *P. aeruginosa* is a gram-negative bacterium that will also infect people who have open wounds, and it can cause airway infections in cystic fibrosis patients. *A. castellanii* is a eukaryotic pathogen that causes severe eye infections in contact lens wearers. Both of these pathogens are very difficult to treat due their resistance to many antibiotics. Chlorhexidine and alexidine are biguanide compounds with known antibiotic activity against both pathogens. The Teintze lab has synthesized guanide, biguanide, and phenylguanide compounds that have some similarity to chlorhexidine and alexidine. These compounds were originally synthesized to inhibit HIV infection, and have all been tested on both *P. aeruginosa* and *A. castellanii*. Some of the biguanide and phenylguanide compounds had activity against *P. aeruginosa* in the 2-10 $\mu$ M range, but the guanide compounds were less effective. After testing all the compounds on *A. castellanii*, a few showed some activity at high concentrations (200 $\mu$ M), but they were not nearly as active as chlorhexidine.

**Kyler Kingston: Biochemistry**

**Mentor: Christa Merzdorf-- Cell Biology and Neuroscience**

***Individual roles of Zic family proteins***

Closure of the neural tube is a landmark in early neural development. The neural tube is a vertebrate embryo's precursor to the nervous system. As neural tube defects are seen in 1 in 500 births, research of the genes that regulate neural tube closure is important in understanding early development of the fetus. This proposal's objective is to determine which transcription factor of the Zic family regulates a specific aquaporin during neural development. A screen for genes that are regulated by Zic transcription factors identified a gene that proved to be an aquaporin, aqp-3b. Inhibition of this aquaporin suggests that it is required for proper neural tube closure. During this screen zic1 was over-expressed; however, as all of the zic zinc-finger genes are very similar, it is possible that the targets of other Zic family members were also induced. Mutations in the zic2 and zic3 genes in humans and mice show neural tube defects. These defects have not been shown for zic1 mutations. Thus, our hypothesis states that either zic2 or zic3 regulates aqp-3b, the aquaporin that aids in closing the neural tube.

**Zachary Krehlik: Ecology and Evolution**

**Mentor: Robert Sharrock, Ted Clack-- Plant Sciences and Plant Pathology**

***Attempted Crystallization of the Histidine Kinase-Related Domain of Phytochrome B***

*Arabidopsis thaliana* is a model plant used in molecular genetic analyses. Phytochrome B (PhyB) is a red/far-red light receptor that controls plant responses to the light environment and has been the focus of many studies. It has two photoconvertible forms, one absorbs red photons and the other absorbs far-red photons. Red triggers developmental responses and far-red cancels these. Studies in other labs have been successful in analyzing the three dimensional structure of the amino-terminal end of a phy protein. The focus of this project was the *C terminus*, the histidine kinase-related (HisKA) domain. HisKA proteins are involved in two-component signal pathways present in multiple life forms, but principally in bacteria. Analysis of its crystal structure of this domain from the plant phyB protein would increase our understanding of how the many diverse forms of life perform cellular regulation. A section of the PhyB gene was cloned and inserted into the plasmid vector pET46, which is specialized for high-level expression of proteins in *E. coli*. This engineered plasmid was transformed into *E. coli* cells. An attempt to purify the protein domain by affinity chromatography showed that it was highly insoluble and resistant to purification by that method.

**Jamie Krushensky, Alice Hecht, Drew Dewolf, Camilla Armijo-Grover, Heather Smart: Sociology, Economics, Equine Science,**

**Mentor: Wendy Stock-- Agriculture Economics and Economics**

***Academic Student Success within an Introductory Economics Course: A Gender Based Study***

Since Fall 2009, an optional one-credit class (ECNS 105) taught by junior and senior level economics majors (i.e., peer leaders) has been offered to students concurrently enrolled in ECNS 101 at MSU. The ECNS 105 sections are taught under the leadership of a faculty member in the Department of Agricultural Economics and Economics (DAEE). This study looks at the effect of peer leaders' gender on student performance in ECNS 101. The research controls for differences in students' academic preparation and demographic characteristics, as well as ECNS 101 instructional variation. The existing literature on the effect of gender in mentoring relationships is inconclusive. Prior research, however, has tended to focus on one-to-one mentoring rather than on mentoring in a group setting. With potential implications of increases in retention rates within ECNS 101, as well as improvements in student academic achievement, we add to this literature by focusing on gender effects in an undergraduate classroom context.

**Jamie Krushensky: Sociology**

**Mentor: Tamela Eitle-- Sociology and Anthropology**

***Gendered Social Constraints on Leisure Participation***

Gender equality and perceived gender roles within a society play an enormous part in the construction of our everyday lives. Just as men are compelled to engage in certain behaviors in order to play the role of the male gender in a socially acceptable way (Kimmel & Messner, 1993), women are expected to fill other roles men may not be expected to. These differences in roles played by men and women create expectations on the daily lives of people. Through the use of responses acquired through the National Survey on Recreation and the Environment (2007-2009), this study will look at expectations placed upon gender roles and the relationships they may hold to level of leisure participation each gender takes part in. This study will draw a relationship between the suspected gender gap in leisure participation levels by placing focus on socioeconomic factors such as length of residence, number of persons within a household, and relative income. As preliminary data suggest, those with less socioeconomic stress are more capable of frequenting leisure activities such as hiking. As well, the more socioeconomic inequalities observed, the less leisure activity participation is likely.

**Eric Lake: Math**

**Mentor: Kris Ellingsen-- Honors**

***Rebirth***

Rebirth is an epic novel which tells the story of a country on the brink of war after the execution of its monarch, and it is up to a fallen princess to save the nation, despite her hatred of her father and the country he built. The book explores themes of justice, racism, and reincarnation. But readers only care about themes when there exists a compelling story driving them forward. As such, my goal was to discover the proper elements in creating a story. The easiest way to do this is to implement realistic characters that the readers can care about sufficiently to push them through the book. Fantastical settings are another way to generate reader interest, as well as confront complex themes. Rebirth fuses mythology--the idea of reincarnation--with science, to form a unique magic system. The setting allows me to explore how a society changes when reincarnation and souls are verifiably real, as well as other themes, in a more direct manner than other genres could accomplish. The results of the project thus far have been positive, justifying this approach to building the story, though future drafting and revision will be required to perfect these ideas.

**Kevin Lalli: Physics**

**Mentor: Kevin Repasky-- Physics**

***Iris Student Solar Spectrograph Competition - Pilot Run***

This year the Montana Space Grant Consortium, in collaboration with NASA's IRIS mission, began sponsoring a unique format for undergraduate research. The project brings together up to 25 interdisciplinary teams of undergraduates in order to design, construct, and implement a ground-based solar spectrograph. Besides collecting solar spectra to demonstrate their instruments, the students are encouraged to investigate scientific questions of their choosing using spectroscopy. The National Student Solar Spectrograph Competition will complete its pilot run this year with demonstration and judging being held April 22-23 at MSU. This year's pilot run features one team at MSU and one at Salish Kootenai College in Ronan, MT. Both teams are comprised of four members from engineering, computer science, and physics backgrounds. Registration is underway for the 2011-12 year. Teams from across the country will meet in Bozeman May 16-18 to showcase their work. This presentation will focus on the work of this year's MSU team, as well as the overall format of the competition.

**Sarah MacDonald: Sociology and Anthropology**  
**Mentor: Tamela Eitle-- Sociology and Anthropology**  
***Is it safe? Risk Perceptions of Drinking Water in Rural Kenya***

In rural Kenya, access to safe drinking water is a serious public health issue. However, even when safe water is available, perceptions about the water may affect its use. Different cultural backgrounds as well as gendered upbringings may influence perceptions of the water, which could result in health issues if the user's perception of safe water does not correspond with sanitation standards. In this paper I explore whether recent illness in the family is associated with residents' perceptions of water quality. I also explore whether gender affects both perceptions about water quality and the relationship between recent household illness and perceptions about water quality. A door-to-door survey, conducted by representatives from MSU's Engineers Without Borders (EWB), was conducted among households in an area where EWB is installing new wells. Preliminary analyses of these data suggest that people are more likely to perceive water quality as harmful to their health when they (or someone close to them) have experienced a recent illness, as well as that women are more likely than men to link illness in the household to water quality.

**Megan Malone: Sociology and Anthropology**  
**Mentor: Leah Schmalzbauer-- Sociology and Anthropology**  
***Water, the Essence of Survival and the Symbol of Oppression: Gender Inequalities Collide with Development***

Over the course of two summers I conducted research in Khwisero, Kenya while working with the Engineers Without Borders-Montana State University chapter. My ethnographic research looks at how collecting water affects the daily lives of women. My research analyzes collecting water as a symbol of women's oppression and that institutions like education, religion, and other cultural barriers are the means of gender inequalities. Furthermore, I look at how development ideologies often collide with cultural barriers. The data gathered through means of in-depth interviews, observations, focus groups and time journals. The focus groups were with the female teachers of three primary schools that EWB-MSU has worked with and the time journals were given to four women I knew from the different communities in Khwisero. My research and literature looks at development ideologies as struggling to maintain cultural continuity while trying to change the views on women and their work.

**Kyle Margolies: Physics**  
**Mentor: Randall Babbitt-- Physics**  
***Spatial-Spectral Hole Recovery***

Spectral hole burning uses narrow-band lasers to burn a hole in the characteristic absorbance pattern of a material at a specific frequency. If the modified absorption patterns could be accurately read, data could be stored as a series of holes. In order to read out the data, a laser is chirped across the frequency band of interest and the modified absorption characteristics of the material can be read. Readout laser signals distort upon encountering narrow band signal information in a material, making readout difficult to analyze. Spectrum Labs has developed an algorithm to model chirp behavior and recover information, but fast chirps still show significant distortion. Effective data storage would require reproduction of much more complicated signals than has been possible. Advances in the algorithm: using Maxwell's equation (Hilbert transforms) to predict the distortions, include phase noise, and running comparison of the effects of phase noise processed with different filtering settings. The goal is to derive an algorithm that will more accurately estimate the spectral structures in material from the experimental readout intensity.

**Justin Mauzey: Physics**

**Mentor: Kevin Repasky, John Carlsten-- Electrical and Computer Engineering, Physics**

***Using Honey Bees to Isolate Land Mines with a Lidar***

The research is to explore viable methods using bees to isolate landmines. Honey bees can be trained to be attracted to 2,4-Dinitrotoluene, a chemical in explosives. The maintenance of a bee hive and increasing the bee's attraction to explosives are handled by a separate team. Through control of the feeders, the bees are forced to traverse the field and will hover over buried explosives thinking it is a food source. Locating the bees is accomplished using a Lidar setup. A laser beam is projected onto a moving mirror that creates a raster scan that is superimposed over the mine field. Detecting an individual bee uses a technique where the laser light reflected from the wings is measured. The bee's wings beat at a known frequency, allowing us to isolate the bees from other insects and debris. Once the bees are isolated a 2D map is constructed using their population densities to then isolate the landmines. There have been multiple successful field demonstrations. A new laser has been ordered and will be deployed in the next phase of the project. The first planned location for using this de-mining process, is through the Department of Defense, and covers the Croatian border with Bosnia.

**James McKinney: Cell Biology and Neuroscience and Biochemistry**

**Mentor: Sheila Nielsen-Preiss-- Cell Biology and Neuroscience**

***Candida albicans and the Effects of Low-Shear Modeled Microgravity on Virulence and Pathogenesis***

*Candida albicans* has been shown to express genotypic and phenotypic changes when grown in microgravity/ zero gravity conditions. In these abnormal gravitational conditions, the yeast cells exhibit greater virulence and pathogenesis in addition to increased anti-fungal resistance. In order for further research to be done during space flight, mechanisms must be developed in order to prolong growth time and enable a more robust growth response while in space. It is hypothesized that if you minimized the initial inoculum, it would take longer for cells to reach the stationary growth phase. This can be accomplished through a serial dilution scheme resulting in the lowest practical inoculum. In addition, it is hypothesized that a greater physiological response to zero gravity culturing can be obtained by priming the cells in microgravity prior to inclusion aboard the shuttle. It is expected that the upcoming experiments will reveal a greater understanding of how *Candida albicans* cells react during storage and an overall look at their growth and change both in regular conditions and conditions exhibiting lower gravity.

**Taisha McWilliams: Cell Biology and Neuroscience**

**Mentor: Kristin Juliar, Renee Harris-- Health Sciences**

***Montana Health: Growing in Your Backyard***

Rural Montana has a lack of supermarkets and grocery stores in many counties due to low, dispersed populations. This often equates to limited availability of fresh produce for numerous citizens. Thus, there is a large necessity for access to fresh food in this state. Community gardens are a growing answer to rural Montana's food insecurity needs. As need and interest have arisen, the Montana Rural Health Initiative (MT RHI) has been working on providing information to Montanans about community gardens by profiling existing community gardens, providing a series of three webinars on related gardening topics, and planning a community garden toolbox for the MT RHI website with information and resources. By making this material available to all Montanans through the MT RHI website, the RHI hopes to increase the number of community gardens in the state in order to help meet food accessibility needs and enhance the overall health and wellness of the populace.

**Elizabeth Miller: Cell Biology and Neuroscience**

**Mentor: Lynn Hellenga, Elizabeth Bird-- Nutrition and Physical Activity Program (NAPA)**

***Montana Breastfeeding Initiative: The Extent of Implementation of the 2011 Surgeon General's Call to Action***

The Nutrition and Physical Activity (NAPA) Program is a Centers for Disease Control and Prevention (CDC) grant-funded State Health Department Program established to work towards prevention of obesity and other chronic diseases via policy and environmental changes. Since 2004, Montana NAPA has worked both community-based and statewide to generate obesity prevention strategies and activities by connecting partners across the state, uniting them in the goal of improving the health of Montanans. NAPA concentrates on several settings, one of which is healthcare. A targeted behavior of this setting would enhance the health of mothers and children via increased breastfeeding initiation, duration, and exclusivity rates. To improve such rates, the Surgeon General has constructed a manual of initiatives that hospitals and other community programs are encouraged to implement. Constructing my project from The Surgeon General's 2011 Call to Action to Support Breastfeeding, I surveyed five NAPA-funded counties to determine the current status of breastfeeding support programs and initiatives in Montana communities. By researching the extent of the existing programs, I was able to compare a selection of Montana's resources to the Surgeon General's present expectations, and discover where progress could potentially be made to continue towards a healthier Montana.

**Kevin Murray: Biochemistry**

**Mentor: Robert Szilagyi-- Chemistry and Biochemistry**

***PHYSICAL CHEMICAL STUDY OF Ni-S SYSTEM WITH PREBIOTIC RELEVANCE***

The reversible oxidation and reduction of CO is catalyzed by the enzyme CO dehydrogenase. The active catalytic site of this enzyme consists of a Ni atom surrounded by sulfur ligands, encased in an Fe-S cluster. The chemical reactivity of CO/CO<sub>2</sub> has implications to the activity of prebiotic molecules, including H<sub>2</sub>O, CH<sub>4</sub>, and CO<sub>2</sub>. To better understand this catalytic process, and the electronic structure of the active site, we analyze a novel series of [Ni(SR)<sub>4</sub>]<sub>x</sub> complexes. In order to better model this series, we present an evaluation of the performance of simulated solvation environments in our computational simulations. Reference data from this series were collected using X-ray Absorption Spectroscopy (XAS) at the sulfur K-edge energy range. These spectra were simulated using both ground state Density Functional Theory (DFT) and excited state Time Dependent Density Functional Theory (TDDFT). We show systematic variation of the solvation environment. We use a gas phase, Polarized Continuum Model (PCM), and a Conductor-like Screening Model (CPCM) environment, as well as a full cell crystal structure encircled by a CPCM. We report spin densities and MO energies from these ground state DFT calculations. These are compared to the experimental XAS data, assessing the accuracy of each simulated environment.

**Kyle Murray: Geology**

**Mentor: Colin Shaw-- Earth Science**

***Study of the Savage Peak Shear Zone***

This is the first complete characterization of the recently discovered Savage Peak Shear Zone (SPSZ) located in the Colorado mineral belt. This area represents a weakness in the lithosphere that has undergone repeated faulting since the early Proterozoic. Both the SPSZ and the neighboring Homestake Shear Zone (HSZ) feature a complex system of pseudotachylite-bearing faults and mylonite zones trending northeast-southwest and dipping steeply to the northwest. The goal of this study is to determine whether the geometry and kinematics of the SPSZ are consistent with those of the HSZ and whether the two segments may be part of the same lithosphere-scale shear system. Local country rocks are semipelitic schists, gneisses, and granitic plutons with related dikes and veins of two ages: the 1.7 Ga Cross Creek batholith and the 1.4 Ga St. Kevin batholiths with deformation broadly coeval with plutonism. Petrographic analysis of the country rocks will provide temperature and pressure conditions during ~1.7 Ga deformation and examining deformation mechanisms and quartz creep regimes will provide estimates

of conditions of the pseudotachlyte/mylonite formation. Analysis of offset markers and branching geometries in the pseudotachlyte as well as asymmetric fabrics in the mylonite provide kinematic information for the shear zone.

**Fallon Niedrist: Sociology**

**Mentor: Tamela Eitle-- Sociology**

***Power-Control Theory and Social Bonds: Explaining Differences in Girls' Delinquency***

Previous theories of crime have developed to explain the deviance of boys and men, but much is left to be desired for theories to explain the processes of female delinquency. This study focuses on two theoretical underpinnings: Hagan and colleagues' power-control theory and Hirschi's social control theory, to explain differences in girls' delinquency when compared to boys. Power-control theory explains differences in girls' delinquency by looking at workplace power of the mother and father, finding that girls whose mothers hold powerful occupations (less patriarchal families) are more likely to commit deviant acts. Social control theory assumes that those who have strong ties to society are less likely to commit deviant acts. By combining these two theories, two hypotheses regarding the outcome of the research are as follows: (1) Girls from less patriarchal families will exhibit patterns of social bonds more similar to those of boys, and (2) Social bonds will mediate the relationship between level of patriarchy and delinquency for girls. Using the National Longitudinal Study of Adolescent Health (Add Health), preliminary analysis has found support for these hypotheses.

**Patric O'Hara: Physics**

**Mentor: Charles Kankelborg-- Physics**

***Updating Software for the Multi-Order Extreme Ultraviolet Spectrograph***

The MOSES (Multi-Order Solar Extreme Ultraviolet Spectrograph) underwent a hardware upgrade with respect to the ground station computers, and the flight computer software was found to be severely defective and in need of a rewrite. The ground station software was rewritten to make use of new software and hardware on the Ubuntu Linux platform. The flight software was audited in order to locate and alleviate any data-path constrictions, so as to increase the number of extreme-ultraviolet exposures that could be taken during one flight. Issues encountered include a lack of documentation, time constraints, and lack of support for what has become legacy hardware. Additionally, certain hardware components were found to have been damaged during flight and had to be replaced or repaired. Goals included minimizing the number of potential software errors, increasing the data acquisition rate for the MOSES instrument and adding means of ensuring scientific integrity of the data.

**Kristen Orelup: Biomedical Science**

**Mentor: Mensur Dlakic-- Microbiology**

***Detecting protein interactions in Bacteria using Gateway vectors and fluorescence complementation***

Large and small subunits of ribosomes are each composed of proteins and rRNA fragments. Eukaryotic ribosomes need ~150 trans-acting proteins that play key roles in the ribosome synthesis and assembly. These trans-acting factors play a role in ribosomal production in nucleoli, nucleus, and cytoplasm, or in a combination of these areas and are critical for the development of ribosomes. There are extensive interactions between trans-acting proteins in different cellular compartments along the process of the ribosome development similar to an assembly belt that would move from one end of a factory to the other while different people adjusted a product until it was complete. Two main techniques will be used in this project to study protein interactions. In Bimolecular Fluorescence Complementation (BiFC) assays, two non-fluorescent pieces of a fluorescent protein are fused to two different proteins and when the two proteins interact, they fluoresce. The second is Gateway cloning which is a technique that allows for quick and efficient way to transfer DNA sequences into multiple types of vectors. In this work we will use Gateway constructs and transfer them into bacterial vectors so that they can be used as controls in prokaryotic cells.

**Mellie Park: Biochemistry****Mentor: Hien Nguyen, Matt Mckay (University of Iowa)-- Chemistry*****Urea-Linked Cyclodextrin Analogues***

For over a century cyclodextrins have been used to study biochemical mechanisms. Consisting of oligomers composed of 6 to 8  $\alpha$ -(1-4)-linked D glucopyranose units, cyclodextrin's intermolecular forces between the inward facing hydroxyl groups provide stability. This structure provides a lipophilic interior that could play host to a range of hydrophobic molecules; yet, due to the reversibility nature of the cyclodextrin's interior it is difficult to store the guest molecule indefinitely. In this study, our group proposed a strategy to synthesize  $\alpha$ -(1,4)-urea-linked cyclodextrins connected by amine groups. Incorporating an amide-hydrogen bond into a cyclodextrin structure could provide not only better bonding to guest molecules, but also create more room. Using chemistry already established by this lab, this project aims to first synthesize cyclodextrin intermediates by investigating the coupling of trichloroacetimidates with polypeptide chains, and testing the ability of the nickel catalyst to promote the rearrangement of oligosaccharide trichloroacetimidates. This knowledge allows for creation of urea-linked cyclodextrins analogues. While alpha glycosyl ureas are found naturally in aminoglycoside antibiotics, very little is known about their possibilities and character. This project intends to gain insight in the chemical properties of these analogues while seeking development of efficient synthesis methods.

**Vladimir Perga: Psychology****Mentor: Michelle Meade-- Psychology*****Correct Contagion of Memory in Young and Older Adults***

The social contagion paradigm, whereby one individual's recall of events affects the memories of another, has examined the detriments of reliance on others for recall in both young and older adults. However, little attention has been paid to the possible benefits received from this effect. The current study adapted the social contagion paradigm to examine if young and older adults' memory can benefit from the correct suggestions of others. Participants viewed common household scenes, and then took turns recalling items from the scenes and reading previous subjects responses on note-cards. Subjects then individually recalled as many items as they could from the original scenes. Any benefit of correct items was determined by comparing how likely subjects were to recall the correct contagion items when they were presented in the note-cards relative to how likely they were to recall the items when they were not presented on the note-cards. Results showed that both young and older adults were more likely to recall the correct contagion items when the item had been presented in the note cards. This finding suggests that young and older adults may rely on others for cues to improve memory performance.

**Russell Ricker: Physics and Applied Mathematics****Mentor: Rufus Cone, Charles Thiel-- Physics, Spectrum Lab*****Growth and Characterization of Rare-Earth Activated Calcium Sulfate Crystals***

Resonant optical materials are of interest for many applications such as high-bandwidth optical signal processing and quantum information applications. Rare-earth doped anhydrous calcium sulfate has been identified as a prime candidate for these applications due to its low concentrations of nuclear spin in calcium, sulfur, and oxygen. For use in optical applications, large (>2x2x2mm), transparent, and high-purity crystals must be grown. With this motivation, we report on our investigation into effective growth techniques to obtain optical-quality crystals. In this project we investigated techniques to grow large single crystals of calcium sulfate for optical applications in the 1.5 micron telecom band. We adopted the method of dissolving calcium nitrate tetrahydrate crystals into 98% sulfuric acid at high temperatures until the solution is saturated. The solution is then evaporated over a long period to induce nucleation of calcium sulfate. Results of growth apparatus and solutions will be discussed on the poster, as well as implications for optical applications.

**Johnathan Rios: Sociology and Liberal Studies**

**Mentor: Tamela Eitle, Leah Schmalzbauer, Scott Myers-- Sociology and Anthropology**

***Water Source Distance and Sustainability In Relation to the Effectiveness of Projects Conducted By the MSU Chapter of Engineers Without Borders***

The intention of this research is to address the effectiveness of the projects conducted by MSU chapter of EWB by examining two major topics, distance to water sources and sustainability, by analyzing data from surveys conducted in Khwisero, Kenya in 2008 and 2009 by community members. The surveys, numbering over 1500, ask a variety of questions regarding water collection statistics and habits, sanitation, and economic issues. Unfortunately, past research on the topic has shown a high level of project failure with varying affects on the communities in which they take place, many of these a result of unsustainable practices such as lack of hand pump maintenance. The World Health Organization (WHO) has set standards for water access, however it is unclear whether these standards are being met by current EWB projects. Preliminary findings indicate that wells constructed at schools may not meet WHO standards for distance but are more sustainable in the long run due to the fact that they work through current functioning structures rather than creating new ones.

**Shelby Rogala: History**

**Mentor: Kristen Intermann-- History and Philosophy**

***Establishing an International Volunteering Ethic***

The purpose of this paper is to discuss the ethical obligations of international volunteers and volunteer agencies. One might think that volunteers and volunteer agencies have minimal obligations to the communities they serve precisely because it is voluntary and non-profit. That is, we tend to think of volunteering as a supererogatory act, an act that goes above and beyond the call of duty. However, new ethical problems have emerged, particularly in the area of short-stay volunteering, or voluntouring. I will argue that volunteer practices are often carried out in ways that deny the autonomy of local populations. However, this does not translate into international volunteering as an inherently unethical practice that ought to be condemned. Rather, I will argue both organizations and volunteers have moral duties to the populations they serve. This argument will be developed through an analysis of current structural programs as well as research on improved methods for transparency within organizations. I will draw out the implications that my analysis has for developing an international volunteering ethic.

**Kaitlyn Roth: Biochemistry**

**Mentor: Brian Bothner-- Chemistry**

***Investigation of Adeno-Associated Virus Capsid Structure Dynamics with QCM-D***

The Adeno-Associated Virus (AAV) is a small icosahedral virus that has a 4.7 kb single stranded DNA genome and is a member of the parvoviridae family. AAV has proved to mediate gene transfer for long term genome correction and is non pathogenic to humans, making it ideal for gene therapy. It has also been shown that it can insert its genome into dividing as well as non-dividing cells. This makes it possible for AAV to infect neurons and other quiescent cells. Before gene therapy can be used appropriately; a better understanding of the functional gene transporter is needed. The physical structures of twelve of the serotypes have been determined, although the dynamics of these capsids are not as well understood. By using a technique called Quartz Crystal Microbalance with Dissipation monitoring (QCM-D), the frequency and dissipation of four different serotypes, AAV1, AAV2, AAV5 and AAV8, were taken at different pH levels to emulate the intracellular environment of a target cell.

**Luke Rothschild: Philosophy**

**Mentor: Prasanta Bandyopadhyay-- Philosophy**

***Investigating a Pragmatic Account of Simpson's Paradox***

Simpson's Paradox (SP) is the reversal or cessation of a trend shown by two individual data sets when the sets are combined. We have proposed an approach which concerns 'what to do' (i.e., which statistics to choose) when confronted with the two conflicting statistics? To address this point, we investigate a way of choosing between the subpopulation data and the overall data using pragmatic considerations. In this way it can be said to be a pragmatic account of the 'what to do' question in SP. After concluding our research in light of the relevant literature, we find a pragmatic account cannot provide a resolution to the 'what to do' question in the broad way we initially proposed. We concede that the causal model of SP, advanced by Pearl (*Causality*, 2000) remains the best way to address the 'what to do' question. We do however, identify a type of 'what to do' question that is not liable to explanation by the causal model, i.e., one that pertains to a situation in which there are no causal considerations on which to condition a decision. This suggests that a more comprehensive account is necessary for 'what to do' questions with regard to SP.

**Katherine Ruff, Dillon Maslach: Literature, Philosophy**

**Mentor: Sara Waller-- Philosophy**

***How Enmeshed are Moral Judgments with Sociality? An Empirical Investigation***

Does the number of friends and associates one has impact the moral judgments one makes (or vice versa)? How are moral judgments related to academic interests and gender? Several researchers in a variety of fields have made initial claims regarding the relationship between moral judgments and social networks. (See Brass et al (1998); Moll et al. (2002); Latour (2005); Cikara et al (2010), Cima et al, (2010)). We propose to continue this research by analyzing survey results of moral responses by approximately 90 Montana State University students towards (and compare the studies to?) the actions of fictional characters in a series of vignettes. Moral responses will be based upon and compared to declared majors, gender, and number of *best friends*, *friends*, *online friends*, *close associates*, and *close family members* in an effort to explore the relationship between morality and one's social network. The research is currently in progress. We will report our results and discussions of the relationships between moral judgment types, academic interests, gender, and social network size. If moral judgment types are directly or inversely related to these aspects of student life, we will discuss possible implications for sociopathic problems and Antisocial Personality Disorder.

**Lauren Sharp: Sociology**

**Mentor: Tamela Eitle-- Sociology**

***Depression and Suicide Ideation Among Latino Youth in the United States***

Hispanic-Americans are the largest minority group in the United States, currently comprising around 15% of the population. The negative mental consequences of immigration on children's well being has been greatly documented, however, there is now a large population of United States born Latinos, or Chicanos, and the high rates of mental disorders still prevail. Chicano youth have the highest rate of depression and suicide among any racial group in the United States. Why is this group more susceptible to mental disorders when compared to black and whites? Former research suggest that the quality of family relations is a strong predictor for depression and suicide risk for Latino youth. Preliminary findings, based on data from the National Longitudinal Study of Adolescent Health (Add Health) indicate that those children with poor relationships with their parents have a greater risk for depression and suicide ideation. By examining my results on this sensitive relationship we can reshape our prevention and treatment programs so that they specifically cater to this at-risk group.

**Barinderjit Singh: Biomedical Science**

**Mentor: Jamie Sherman-- Plant Sciences and Plant Pathology**

***Genetic Validation of Quantitative Trait Loci for Wheat Stem Sawfly Attraction in Montana Spring Wheat***

Wheat stem sawfly is a significant pest for Montana growers. Wheat stem sawfly are attracted to plants in early summer and deposit eggs inside the stem. Eggs hatch and larvae crawl up and down the stem eating the plant from the inside out. In fall, larvae crawl to base of stem, cut the stem and pupate. Significant losses are accrued primarily due to lodging of cut stems. A potential way of reducing infestation is to create lines less attractive to the sawfly. Quantitative Trait Loci have been previously identified for attractiveness to the wheat stem sawfly (Sherman et al., 2010). In order to test the QTLs in different backgrounds, we will use marker assisted selection to create a new population. Last summer, a F4 population of recombinant inbred lines was grown in a sawfly infested field. I phenotyped these lines for sawfly cutting and I am in the process of genotyping these lines with the molecular markers for sawfly attraction. Over the spring, I will complete genotyping and statistically analyze the data to confirm the markers. I will also grow up the heterozygous progeny and using markers assisted selection derive homozygous sib lines that will be useful for further analysis.

**Erin Smith: Biochemistry**

**Mentor: Jean Starkey-- Microbiology**

***The Role of Mesenchymal Stem Cells in a Rabbit Transplantable Carcinoma***

Cells from the rabbit VX2 tumor have shown the ability to differentiate into multiple mesenchymal cell lineages. This finding leads to the belief that mesenchymal stem cells are either the primary tumor stem cell population in this tumor or play a role in tumor formation and survival. Through obtaining the RNA from these tumor cells along with cells differentiated in tissue culture from the in vivo VX2 tumor cells, it can be found which genes in these cells are upregulated and downregulated in parallel with differentiation in culture. To determine the genes present in the cancer cells, rabbit microarrays were obtained from Nimblegen/Roche. Each tissue type will be run on the arrays and analyzed to determine the genes that may play a role in VX2 tumorigenesis and tumor maintenance. From this data we hope to obtain a better understanding of how VX2 tumor cells arise, proliferate, and inhibit normal cell apoptotic processes.

**Hillary Stacey: Chemistry and Broadfield Science Teaching**

**Mentor: Mary Cloninger-- Chemistry and Biochemistry**

***Altering Homotypic Cancer Cell Aggregation With a Lactose-Functionalized Dendrimer***

Recent discoveries have shown that homotypic cellular aggregation in cancer cells can be mediated through protein carbohydrate interactions. Galectin-3 in particular is constantly involved in cancer cell aggregation. This protein interacts with glycoproteins on the cell surface to cause the cells to aggregate, and this aggregation helps the cancer proliferate and metastasize. We try to mimic the protein carbohydrate interactions between the cells and galectin-3 with a carbohydrate complex that is not attached to the cell to disrupt the interactions with the cells and galectin-3. We will use a multivalent dendrimer complex for our carbohydrate because the dendrimer may be heterogeneously functionalized in the future to administer drugs or for imaging in vivo. In this experiment, a lactose functionalized dendrimer is shown to affect cellular aggregation because of its interactions with galectin-3. The generation-2 lactose functionalized dendrimer is shown to inhibit cellular aggregation when applied to cancer cells that have been incubated with galectin-3.

**Joseph Steffens: Chemistry, Cell Biology and Neuroscience**

**Mentor: Brian Bothner-- Chemistry and Biochemistry**

***Activity Based Protein Profiling with Sulfolobus solfataricus***

*Sulfolobus solfataricus* is an archaeal extremophile found in volcanic springs at temperatures ranging from 72-85° C in acidic conditions ranging from a pH of 2.5-3.5. This research investigated the response of *S. solfataricus* to environmentally relevant levels of stress. Activity Based Protein Profiling (ABPP) with fluorescent probes was employed along with proteolysis and mass spectrometry-based protein identification, to elucidate proteins that were differentially regulated. ABPP uses small molecules that target active forms of specific enzyme classes. An advantage of ABPP is that the enzyme activity can be measured for an entire enzyme class on a proteomic scale. ABPP with *S. solfataricus* is of biomedical significance because archaea have similarities to eukaryotic cells and understanding how *S. solfataricus* responds to stress could shed light on how human cells respond to stress and potentially elucidate new methods of combating stress and the associated diseases. Soluble proteins from stressed and control cells were reacted with various dyes and resolved by 2D-DIGE. Differential protein labeling was analyzed. Spots of interest were excised and underwent tryptic digestion and protein identification using the SP2 in-house Mascot database. Causes of specific protein expression in response to certain forms of stress were hypothesized.

**Caleb Stoltzfus: Physics**

**Mentor: Randall Babbitt-- Physics**

***Mid-IR DIAL***

A laser system is being developed for remote sensing of chemicals in the mid-IR (3-4 microns range). For mid-IR light generation, a nonlinear crystal of periodically poled nearly stoichiometric lithium tantalite (PPSLT) is used to convert a compact 1064 nm diode pumped Nd:YAG laser into 1550 nm and 3400 nm (signal and idler, respectively) outputs via optical parametric generation (OPG). To narrow the output spectra at wavelengths specific to the chemicals of interest, a process called optical parametric amplification (OPA) is used, where a narrow linewidth distributed feedback (DFB) seed laser is spatially overlapped with the 1064 nm pump laser inside the PPSLT crystal. Tuning the wavelength of the seed laser at 1550 nm also tunes the idler output in the mid-IR, enabling the laser to be tuned on and off the absorption peak of a chemical of interest. This laser system will use differential absorption LIDAR (DIAL) to detect methamphetamine effluents. This system would give law enforcement an incredibly powerful tool, and would allow law enforcement to test a suspected methamphetamine production facility from up to 100 meters away. It could also be used for on site testing of air quality in suspected production facilities before sending in personnel.

**Kamlynn Thomas: Physics and Mathematics**

**Mentor: Aleks Rebane-- Physics**

***Relationship Between Two-Photon Absorption and Dipolar Properties in a Series of Fluorenyl-Based Chromophores***

In this project we investigated a series of fluorenyl-based chromophores in an attempt to establish a correlation between the two-photon absorption (2PA) cross section and the wavelength shift (Stokes shift) between the absorption and emission maxima. Such correlation may arise from comparing the permanent electric dipole moment difference between the ground state and the excited electronic state because both quantities depend on this molecular parameter. This particular series of chromophores consists of the same fluorenyl core end-capped with systematically varying electron donating (ED) or electron withdrawing (EW) groups. Each chromophore was mixed with solvents of varying dielectric constants and the Stokes shifts were calculated. The data was plotted as Stokes shift versus a polarity function of the solvent, and a linear fit was taken to approximate the slope. 2PA measurements were taken of each chromophore in the lowest dipole-allowed transition. These measurements indicated that stronger ED or EW end groups increased the peak 2PA cross section whereas weaker or neutral ends

resulted in smaller 2PA cross sections. By comparing the results from these two methods we were able to tentatively quantify of the permanent electric dipole moment of the compounds.

**Jon Todorovich: Physics**

**Mentor: Kevin Repasky-- Physics**

***Two-Colored Lidar Inversion Algorithm Development for the Study of Atmospheric Aerosols***

The Earth's climate system is an extremely complicated system that is not yet fully understood. One aspect of this system that is particularly unclear is the role of atmospheric aerosols. To study the effects of these atmospheric aerosols, a two color lidar instrument has been built based on the fundamental wavelength and second harmonic, 1064 nm and 532 nm respectively, from a Nd:YAG laser. Scattered light is collected using a Schmidt Cassegrain telescope. The 532 nm channel is monitored using a gated photomultiplier tube and the 1064 nm channel is monitored using an avalanche photodiode. Inversion algorithms have been developed to invert the data received from the telescope. These inversion algorithms are based on the constant lidar ratio assumption at both the 1064 and 532 nm wavelengths, while the constrained ratio aerosol model provided the initial lidar ratios. This inversion technique is based on the method first described by Fernald.

**Lotus Torre: Sociology**

**Mentor: Graham C. Austin-- Marketing**

***Brand Awareness and Hedonic Consumption***

Secondhand consumers or “thrifters” are adopting the consumer practices of firsthand consumption: consuming or avoiding recognizable brands. Firsthand marketing efforts spill into secondhand consumption; whereby “thriftling” is the intersection of hedonic consumption and acute brand awareness.

**Elizabeth Van De Grift: Cell Biology and Neuroscience**

**Mentor: Laura Mentch-- Bridger Clinic**

***Clinic Efficiency***

Bridger Clinic is a Bozeman, MT Title X clinic specializing in reproductive health, providing medical services and contraceptives at free or reduced costs. In response to decreasing patient numbers, including new patients, the clinic initiated a clinic visit redesign. This included the implementation of next day scheduling to reduce both no shows and cancellations. The redesign also included an examination of clinic efficiency at the patient level. The purpose was to increase the number of patients seen per day and per hour, as well as streamline the patient visits by lowering wait times and eliminating room transfers. The goals of the redesign were to increase the number of new patients of both sexes, as well as the total number of patient visits. The findings of this study are based off of the comparison of statistics calculated in January and February of 2010 to the same statistics in 2011.

**Juliana Velasco: Cell Biology and Neuroscience**

**Mentor: Shelly Hogan, Mary Miles-- McNair Scholars Program, Health and Human Development**

***Correlation Between C-reactive Protein and the Prevention of Diabetes***

The focus of this study was to help develop a better understanding about inflammatory markers, such as C-reactive protein (CRP), which is an inflammatory marker associated with early signs of diabetes and other diseases. More specifically, this study was designed to help determine if CRP could be used as a predictive biomarker of insulin resistance in an overweight population (BMI>25), at least 25 to 45 years-old, both male and females. For the purpose of this study subjects could not have been diagnosed as suffering from hypertension, diabetes, heart disease, not pregnant or be using contraceptive methods (birth control), or any other severe health condition. Preliminary findings, without adjustment for covariate variables, revealed that CRP is not correlated to a Homeostatic Model Assessment estimate of insulin resistance (HOMA). Additional data from our ongoing study may clarify the role of CRP in the

progression primarily of diabetes, and to help determine if in the future CRP could be a specific biomarker used for early detection and prevention of type 2 diabetes.

**Francisco Velasco: Psychology**

**Mentor: Michelle Meade-- Psychology**

***Asymmetrical Conflict: Sleep Deprivation as a Precursor to PTSD Among Veterans***

Conflicts ranging from a global scale to smaller indigenous battles have been prevalent throughout human history. Each contains unique cultural and environmental differences, but also a shared commonality-combat. Combat and its association to Post Traumatic Stress Disorder (PTSD) is well documented, yet the preceding moments leading into combat are not understood. Are there other variables that act as a primer in an individuals' vulnerability to PTSD? Literature has shown that in civilian populations sleep deprivation induces cognitive abnormalities (Heon-Jeong & Kwang-Yoon, 2003). Today, combat troops engage in asymmetric warfare that sometimes requires sleep deprivation to complete a mission. The purpose of this research was to evaluate the relationship between sleep deprivation during combat and a later diagnosis of PTSD. Additionally, is there a threshold at which troops can sustain themselves in combat without sleep and not succumb to either PTSD or any type of sleeping disorder? Veterans with and without a PTSD diagnosis completed a survey about sleep rotations during missions and firefights, number of missions and diagnosis of sleeping disorders. Results indicated that there was a significant relationship between sleep deprivation and a later diagnosis of PTSD. In addition, preliminary results indicated a maximum operational threshold for troops.

**Laura Villegas: Economics and Political Science**

**Mentor: Linda Young-- Political Science**

***Developing under the curse of Coltan***

Colombia is a nascent mineral economy with the potential to become an exporter of strategic minerals. As such, the country faces the opportunities and also the problems associated with mineral resource-driven economies. The discovery of strategic minerals like colombo-tantalite (coltan) constitutes a major challenge for policymakers. The inability of the government to protect the nation's natural resource threatens the sustainability of future economic and social development. Assertive natural resource policy is clearly a priority of the State. The purpose of this research is to provide specific policy guidance on how to use potential wealth from coltan as a means for sustaining economic and social development. I will part from the premises that institutional strength is a critical element connecting resource-abundance and economic growth, and that the nature of the legal structure defining who has rights over the country's natural wealth appears to determine institutional quality. In the analytical part of this project I will attempt to answer the following two questions: (1) What model of ownership structure can the government of Colombia adopt in order to maximize and retain coltan-generated revenues? And (2) how should the country manage these rents in order to further social and economic development?

**Nickolas Wagner: Physics**

**Mentor: Galina Malovichko-- Physics**

***Characteristics of Lithium Niobate Crystal Doped 6% with Gallium***

This presentation will discuss the affects that the introduction of Gallium, during production, has on a Lithium Niobate crystal. The crystal being studied is six percent Gallium. The structure of a crystal with paramagnetic defects has been mapped using electron paramagnetic resonance spectroscopy (EPR). This research was done using a Bruker E-560 in the lab of Dr. Galina Malovichko. By determining the angular dependance of the resonances using EPR in coordination with the theoretical structure of stoichiometric Lithium Niobate a model of the structure of the doped sample can be attained. This Model will included an effective g-tensor, as well as describe the internal field of the crystal. This can be used to predict or confirm the properties of doped Lithium Niobate. This will lead to further study of this and other types of

defects for use in practical applications such as optical modulators, surface acoustic wave devices, mobile phones, LASER frequency doubling, among others.

**Sarah Walton: Biochemistry**

**Mentor: Martin Teintze-- Chemistry and Biochemistry**

***Antimicrobial Properties of Guanide, Biguanide, and Phenylguanide Compounds***

Bacteria are the cause for many infections in humans, and there is a constant need for new antibacterial drugs due to bacteria's ability to develop drug resistance. The objective of the research I have conducted is to test guanide, biguanide, and phenylguanide compounds synthesized in our lab for antimicrobial properties against *Burkholderia cepacia* and *Candida albicans*. *B. cepacia* are gram negative rod shaped bacteria that primarily cause pneumonia in Cystic Fibrosis patients. *C. albicans* are a fungus responsible for causing different kinds of yeast infections. The guanide, biguanide, and phenylguanide compounds were tested in three different experiments. First, more than 30 compounds were tested at two different concentrations to determine if any inhibition of growth occurred. The active compounds from that experiment were then tested at multiple concentrations to determine the concentration at which 50% inhibition occurs (the IC50). Then, these compounds were tested to find the minimum concentration where total inhibition of growth occurs (the MIC). Calculating the IC50 and MIC values for the active compounds will enable us to determine if the compounds are possible antibacterial drug candidates.

**Sarah Watt: Cell Biology and Neuroscience**

**Mentor: Steve Stowers-- Cell Biology and Neuroscience**

***Genetic screen for enhanced control of gene expression in *Drosophila melanogaster* larval neurons***

We are investigating how sensory information is transformed into behavioral responses using the fruit fly *Drosophila melanogaster*. We used the formidable genetics of *Drosophila* to map and understand mechano and thermosensory circuits in the relatively simple nervous system (10,000 neurons) of *Drosophila* larva. In the fly model system, both sensory and motor neurons have been defined, but the circuitry between them (interneurons) remains in question. Interneurons are the connectors, which reside between sensory and motor neurons. Once mapped, it will be possible to visualize and study the information processing functions occurring in these interneurons. The genetic screen is designed to increase the precision of manipulation of neural circuits which will lead to an increase in the depth of understanding of these circuits functions. The combinational genetic screen performed transposes FLP recombinase randomly throughout the genome. A subset of these genomic insertions will cause FLP recombinase to be expressed in neuronal subsets that are part of the mechano and thermo circuits. Using this enhancer trap genetic screen we identified fly strains that enhance our ability to map and understand the functional properties of these circuits. These strains will be combined with optogenetics to investigate circuit structure and function with high resolution.

**Christina Watts: Mathematics**

**Mentor: Elizabeth Burroughs-- Mathematical Sciences**

***Modeling the Effects of Predator Exlosures on the Western Snowy Plover***

In Humboldt County, California, nest exlosures were used between 2001 and 2006 as a management tool in the recovery of the threatened local population of western snowy plovers. Due to a sudden increase in adult mortality in 2006, field biologists monitoring the species abandoned the use of nest exlosures. This poster will describe a project designed to assess the efficacy of nest exlosures by constructing a mathematical model using a discrete time stochastic model to predict the change in the plover population. The model uses beta distributions to model demographic parameters. Whenever possible, these distributions were fit to survey data on these populations. The model showed nest exlosures to be effective in increasing egg survival. However, the model also showed that an increase in adult mortality potentially caused by the nest exlosures would counteract this increase in egg survival. The model

predicts that if exclosures decrease adult survival to seventy percent of its natural state, the population is negatively impacted and the nest exclosures are no longer beneficial.

**Hannah Willis: Biology**

**Mentor: David McWethy-- Earth Sciences**

***Fire and climate history of central Mozambique during the past 100-200 years***

Central Mozambique has a tropical climate, frequently experiencing droughts in the dry season and consequently recurring wild fires. This project aims to reconstruct Mozambique's fire and climate history for the past 100-200 years and relate this to ENSO variability. In this project we studied the relationship between tree ring growth and precipitation and ENSO variability for 19 *Burkia Africana* tree discs, a common species of the area. Samples were taken from the Miombo woodland of Matondo, located 100km south of the Zambezi River and 200km inland from the Indian Ocean, part of a latitudinal range in which ENSO effects have been found to be strongest. Tree ring widths were measured along three transects of each disk marked by terminal parenchyma bands, with the intention of presenting a negative correlation of rainy season tree ring growth with warm-phase ENSO events. Fire scars were also identified with the expected fire outbreak at every 5-10 years, and knowledge of this trend will be very useful in fire management efforts of the future. The results collected from this project will help us to better understand fire regimes and ENSO variability of the region, allowing better preparation for the effects of climate change.

**Alexandre Wing: Biological Science**

**Mentor: Lisa Rew-- Land Resources and Environmental Science**

***Vehicles as a vector of plant seed dispersal: Quantifying seed loss over distance***

Movement of plant propagules by vehicles is an important but relatively unmeasured component of plant invasions, and few data exist quantifying how far propagules are dispersed once present on a vehicle. A controlled experiment measured seed loss on a passenger vehicle. Known amounts of a soil and seed slurry were applied to plates, dried, then attached to the chassis of a vehicle. Seven distances were driven (0 - 256 km) on paved and unpaved roads under wet and dry conditions. Loss of seed on paved roads was minimal under dry conditions, with more than 95% of seeds still retained after 256 km. However, under wet conditions, as much as 100% of propagules were lost, depending on position under the vehicle. Losses on unpaved roads under dry conditions were similar to those on paved roads, with minimal seed loss over all distances. But, on wet paved roads the rate of seed loss was much higher, with 83% of seed lost by 256km compared to dry conditions where 99% of seed was retained by 256km. These data suggest that seeds adhered to a vehicle may travel indefinitely until acted upon by wet driving conditions, where propagule dispersal increases quickly and significantly.

**Carin Wolfe: History and American Studies**

**Mentor: Michael Reidy, Pat Roath-- History and Philosophy, Museum of the Rockies**

***Applying Museum Collections Policy and Procedure to Fly Fishing Objects***

This project researches and applies the proper techniques and tools used by museums across the United States to accession, catalog, clean, and preserve objects for long-term storage. A collection of fly fishing objects were donated to the Office of the President at Montana State University by the Federation of Fly Fishers in the summer of 2010. Factors to consider when working with collections include: pest management, environmental hazards, object decay and fragility, data collection and storage, and future displays. To address these concerns, part of my research is developing, designing, and producing a Policy and Procedures Manual for the collection, which includes a conservation program, loan system, and cataloging processes, as well as an Integrated Pest Management monitoring program. At the end of the project, all objects will be recorded in an electronic database, properly stored with easy to identify tags, and a plan in place for future accessions and displays.

**Rachelle Wood: Mathematics Education**  
**Mentor: Elizabeth Burroughs-- Mathematical Sciences**  
***MCTM Lesson Plan Analysis***

Education in the United States is starting to undergo a transformation. Teaching not only includes giving information to students, but how, what and when to present concepts. This project looks at a variety of aspects of the mathematics lessons provided on the Montana Councils of Teachers of Mathematics (MCTM) website in order to determine what changes need to be made, but also to create a more useful and easily accessible resource. Each lesson is analyzed based on the Common Core State Standards and NCTM standards, for both mathematical content and pedagogy. A short abstract including the content, teaching strategies, age or ability level, and/or whether the lesson meets Indian Education for All requirements is included to classify the lessons. This information is used to analyze the data and to identify gaps in the standards or areas of mathematics represented by the website lessons. The gaps in information can be used to determine the types of lessons needed to be added in order to provide a well-rounded resource for pre-service and in-service teachers.

**D. Cary Woodruff: Earth Sciences**  
**Mentor: Jack Fisher-- Sociology and Anthropology**  
***Stone Cut Mark Identification On Animal Remains***

Tool marks on animal bones are useful characters that allow archaeologists to determine key information about the peoples who produced those marks. Many studies have been conducted to associate a tool to the mark created, such as the morphology left by a unifacial or bifacial implement. However in most cases the flesh is stripped and cut marks are created on the bone surface. If the objective is to compare ancient marks to modern marks, the results may seem similar; however they are inaccurate representations of the truth. For the purposes of our experiment we used ten bifacial tools and ten unifacial tools to butcher intact white-tailed deer limbs. Once the bones were void of flesh and cleaned, examinations were conducted to determine if more accurate mark morphologies could be determined or distinguished, and if patterns of present marks could be correlated to the soft tissue anatomy. In addition the utmost care was taken during butchering to avoid contact with the bone. Occasional contact did occur, and these are the marks that truly matter because they reflect the remnants of the process and activity, not the simple ability to leave a mark.

**Thomas Wright: Biochemistry**  
**Mentor: Martin Teintze-- Chemistry**  
***Antibacterial Activity of Guanides, Biguanides and Phenylguanides***

New methods of treating bacterial infection are constantly needed as bacteria develop resistance to the present treatment options. Methicillin-resistant *Staphylococcus aureus* (MRSA) is an example of one strain of Staph that is resistant to antibiotics such as penicillins, cephalosporins, and monolactams. The Teintze lab has synthesized many guanides, biguanides and phenylguanides with the intent of blocking the CXCR4 chemokine receptor necessary for HIV to bind to mammalian cells. These drugs are not limited to their activity against HIV, however, and many are active against various bacteria. Along with staph, the lab has tested the compounds against *Acinetobacter baumannii*, *Enterococcus faecalis*, *Escherichia coli* and *Pseudomonas aeruginosa*. The compounds are structurally similar to known bis-biguanides used as antibiotics (chlorhexidine and alexidine), but may inhibit bacterial growth in different ways. This project was focused on finding the IC 50 of the active compounds on Staph. This is an important measurement that allows reasonable comparison between the compounds and known antibacterial drugs.

**Mary Lynn Young: Biochemistry**

**Mentor: Dr. Matthew Fields-- Center for Biofilm Engineering**

***Stimulation of a non-targeted Sporotalea-like organism during bioremediation of a chromium-contaminated site at the Hanford, WA Nuclear Reservation***

An anaerobic Sporotalea-like organism was isolated from a chromium-contaminated site in the 100H area of the DOE s Hanford, Washington Nuclear Reservation. The site was stimulated for metal-reducing bacteria for the ability to reduce toxic soluble Cr(VI) to insoluble Cr(III). Lactate enrichments resulted in isolation of a Sporotalea-like organism which appeared to out-compete sulfate-reducing bacteria (SRB). Furthermore, preliminary small-subunit rDNA studies indicated an increase in Sporotalea populations upon in situ stimulation. To better understand the relationship between this Sporotalea organism and other lactate-consumers we examined the basic growth characteristics of the isolate. Results indicated no sulfate reduction and fermentation appeared to be the primary mode of metabolism. Growth studies with low nitrate levels showed a disappearance of nitrate over time, but nitrate appears to be inhibitory at high concentrations. Growth studies also demonstrate Cr(VI) disappearance with continued growth of the isolate. The closest relative of the isolate, *Sporotalea colonica* (98.5% similar), produces the antibiotic naphthalecin. It is possible that production of an antimicrobial could contribute to the inhibition of SRBs. This isolate is a prime candidate for examining the interactions and physiological roles of non-targeted organisms stimulated at bioremediation sites which may be advantageous or antagonistic to the bioremediation process.

## COLLEGE OF NURSING

**Amber Dubai: Nursing**

**Mentor: Kathleen Schachman-- Nursing**

***Development and Testing of a Survey to Measure the Stressors Experienced by the Spouses of Firefighters***

Background: Firefighters are faced with a variety of occupational stressors that have a profound impact on their spouses. However, few studies have examined the stressors experienced by firefighter spouses. This two year project began with a comprehensive literature review examining the stressors experienced by the spouses of career firefighters. Identified themes included: dealing with daily irritations of shift work, concerns about firefighter safety and emotional health, and the firefighter's tendency to withdraw after a traumatic event. Objective: The purpose of this project was to create a survey to accurately reflect these stressors, and to conduct a pilot test to determine content-validity. Based on the identified themes, a 29-item survey was developed. Methods: 34 surveys were distributed to the spouses of the career firefighters in Bozeman, Montana. Thirty surveys were returned for a response rate of 88%. Conclusions: Overall, this expert panel validated the authenticity of the 29-item survey. A few suggestions were offered for modifications. Additional questions were identified and adjustments to the survey were performed to more accurately capture the full range of stressors experienced by spouses. Distribution of the survey to a larger audience will be necessary to further refine the reliability and validity of this survey.

**Anne Hansen: Nursing**

**Mentor: Sandy Kuntz-- Nursing**

***Participant observation and field notes of focus group dynamics among tribal and local health care providers***

On January 29, 2010, tribal and county public health nurses and other local healthcare providers gathered at a conference on the Flathead reservation to increase their knowledge of environmental health toxins that could impact the health of the fetus, infant, or child and discuss local priority issues of concern. The

purpose of this study was to gather participant observation of the social interactions, contextual and relational aspects of the conference, and describe the interplay between diverse but common perspectives. Methods: Detailed field notes captured snippets of qualitative observations throughout the day based on an agenda of events and the scheduled focus group activities at the end of the day. Data collection included textual, maps, and diagrams of seating and interactions among participants. Results: Individuals and groups were observed as they engaged in activities. Voluntary seating and groupings at the beginning of the conference (self selection) was contrasted with prescribed seating (organizer pre-arranged) during the focus groups. Conclusions: Participant observation provides additional data points in the iterative, mixed methods process that leads to a better understanding of the community's perspective on a public health issue. Active engagement by local providers is an essential component.

**Heather Lytle: Nursing**

**Mentor: Elizabeth Rink-- Nursing**

***Creating Sustainable Palliative Care Programs for Critical Patients in Nkomazi South Africa***

The AIDS pandemic is potentially the greatest struggle humanity will ever face. In the northeast corner of South Africa, by the borders of Mozambique and Swaziland, resides the region of Nkomazi. In Nkomazi, the government estimates 36.8% of this region's population is infected with HIV. In 2009, a human subject approved needs assessment survey was conducted with fifty-two critical patients in Nkomazi, South Africa. This survey investigated availability of resources, most common symptoms, medical access, supervision of patients, and medication distribution. The results revealed many barriers to sustainable community and home based care programs. Thus, this year's research holistically explores ways to tackle these barriers through sponsorship, care giver training, improving overall morale, and treatment strategies with end of life care. With the overall goal to create vision for established grassroots programs and for those daily serving the critically ill; this program would make resources available to allow patients to die with comfort, dignity, and peace.

**Lauri McCarthy: Nursing**

**Mentor: Elizabeth Kinion-- Nursing**

***Parents' Knowledge of Healthy Dental Habits for Pre-schoolers***

Background: Early Childhood Caries (ECC) remains the most common, chronic, preventable disease of early childhood (Early Childhood Caries is the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child aged 71 months or younger). Left untreated childhood caries often lead to pain and infection which are highly indicative of future health risks including deficits in self-esteem, growth and cognition. Many factors contribute to the prevalence of ECC: dietary habits, dental hygiene, vertical and horizontal transmission of streptococcus mutans, the causative organism, and a paucity of knowledge in non-dental health care providers and parents. Objective: To identify parental understanding of dental hygiene. Methods: Background information was gathered via a search of CINAHL and MEDLINE electronic databases. The search was restricted to research-based, peer reviewed articles. Data were collected via a 20 question survey entitled, Smiling Future Parent Survey. The survey was distributed via one of two methods to parents of children who attend the Gallatin County Head Start Programs. The two methods of distribution were: 1) in person and 2) by teachers at two of the facilities. Data collection is continuing. Results: Pending data analysis completed by April 2011.

**Janice Ostermiller: Nursing**

**Mentor: Karen Zulkowski-- Nursing**

***The Effect of Fluoride Levels in Public Water Supplies on Dental Caries***

*Background:* Fluoride protects teeth from demineralization caused by acid and also plays a role in remineralization of already damaged tooth enamel. Past research has indicated that fluoridated water can play an important role in preserving dental health. The EPA has recently adjusted the recommended fluoridation level of public water supplies. *Purpose:* To determine if water is still a predominant source of

fluoride. *Methods:* This study utilized data collected pertaining to fluoride levels in public water supplies in the 56 Montana counties. Data was also collected from the Healthy Montana Kids insurance program indicating the number of dental caries per county in children under 20. The data was entered into a statistical software program (SPSS) and analyzed. *Results:* There is a moderate negative linear correlation between the amount of fluoride in public water supplies and the number of cavities reported by Healthy Montana Kids. *Conclusions:* The study results indicate water continues to be an important source of fluoride, however, due to the noted limitations of this study the results should be interpreted with caution. Further research is required in order to determine the total number of cavities per county over time and alternate sources of fluoride.

## UNIVERSITY COLLEGE

**Dustin Kuipers: Liberal Studies**

**Mentor: Walter Fleming-- Native American Studies**

***Cosmology of Incarceration***

My research included looking at the overrepresentation of American Indians inside institutions of coercion (prisons). This overrepresentation occurs when you compare their state population in Montana, (7%), to their incarcerated rates (16% for men and 31% for women) in the Department of Corrections. The historical analysis looks at the confusing nature of jurisdiction, while attempting to explain it and outlines other important cases in Federal Indian Law that demonstrate the unique relationship between the United States Government and American Indians. The research included numerous interviews with either previously incarcerated individuals and/or employees that worked in Montana State Prison in Deer Lodge. I wanted to know what kind of rehabilitative services the Department of Corrections offered and if they were cross-culturally aware or trained. I also looked at the major role that alcohol plays in crimes committed by American Indians and the implications of alcohol use and abuse in reservation life.

**Jennifer Thornburg: Liberal Studies**

**Mentor: Jerome Coffey-- English**

***The Dream of the Rood***

For nearly two centuries the massive stones lay like a broken giant in the yard of a Scottish church. Carved with winding vines, elaborate scenes, and strange, cryptic letters, this was the Ruthwell Cross, one of the oldest preaching crosses in Europe. The mysterious linear letters were Viking runes. Their meaning remained a mystery for centuries until the discovery of the Vercelli manuscript in Italy in 1822. It contained the same runic verses, which J.M. Kemble soon translated. The *Dream of the Rood* is one of the earliest and most beautiful pieces of English literature. Rood is the Viking word for cross. This poem details the crucifixion of Christ from the point of view of a dreamer who falls asleep and dreams of a cross. The cross personified tells of its service to mankind as the tree on which the Lord was crucified. I have researched the Old English text and am writing a manuscript for a children's book. I will use Celtic lettering to illuminate the pages and will collaborate in the illustration process. My vision is to create a beautiful, rhymed manuscript that will educate and entertain adults and children as they read this important, historical text.

2011 Student Research Celebration  
 April 14, 2011

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Student, Mentor, Project	Session	Poster #	Abstract Page #
<b>Kemal Akkoyun, Chris Allen:</b> Environmental Science and Environmental Engineering Catherine Zabinski, Otto Stein-- Land Resources and Environmental Studies, Civil Engineering <i>Determining the effect of carbon loading on denitrification rates in constructed wetlands</i>	am	1	41
<b>Dema Alniemi:</b> Cell Biology and Neuroscience Edward Dratz-- Chemistry and Biochemistry <i>Development of a Method for Isolation of Phosphoproteins Using Alkaline Phosphatase Mutants</i>	am	99	67
<b>Dema Alniemi:</b> Cell Biology and Neuroscience Edward Dratz-- Chemistry and Biochemistry <i>Working with elementary students to explore where germs grow and how they are shared</i>	Hughes Topical	2:00 pm SUB 233	67
<b>Lydia Anderson:</b> Organismal Biology David Sands, Alice Pilgeram-- Plant Sciences and Plant Pathology <i>Enhancing the virulence of a biocontrol agent</i>	pm	2	68
<b>Gillean Arnoux:</b> Geology Todd Feeley-- Earth Sciences <i>Analysis of mafic enclaves in lavas from Uturuncu Volcano, SW Bolivia to determine system heterogeneity</i>	am	2	68
<b>Kevin Bangen:</b> Mechanical Engineering Chris Jenkins-- Mechanical and Industrial Engineering <i>Mechanical Properties of Biological Tissue with Repair</i>	am	4	50
<b>Edward Barge:</b> Biological Sciences Cathy Cripps-- Plant Science and Plant Pathology <i>The ectomycorrhizal genus Lactarius in the Rocky Mountain alpine zone</i>	am	5	68
<b>Daniel Barta, Krista Brundridge, Ashley Poust:</b> Paleontology, Earth Sciences David Varricchio-- Earth Sciences <i>Spheroolithid Eggs from the Cretaceous Tiantai Basin, Zhejiang Province, China</i>	am	12	69
<b>Ana Baselga:</b> Aeronautical Engineering Chris Jenkins-- Mechanical and Industrial Engineering <i>Bio-Inspired Concept for Satellite Cluster Deployment</i>	am	93	50
<b>Anna Bergstrom:</b> Land Resources Analysis and Management Brian McGlynn-- Land Resources and Environmental Sciences <i>Watershed and stream network geometry: Implications for water and solute fluxes from watersheds</i>	pm	5	42

Student, Mentor, Project	Session	Poster #	Abstract Page #
<b>Taylor Bezek:</b> Political Science Linda Young-- Political Science <i>Ethnic Diversity, Oil, and Party Politics: The Evolution of three Post-Soviet States</i>	pm	3	69
<b>Alexandra Black:</b> Graphic Design Gesine Janzen-- Graphic Design <i>The American Influence</i>	am	6	35
<b>Deborah Blanchard:</b> English Literature , Spanish Bridget Kevane-- Modern Languages and Literatures <i>Unmasking the Superhero: Analyzing Junot Diaz's The Brief Wondrous Life of Oscar Wao as Multicultural Hybridity Literature</i>	am	8	69
<b>John Blaskovich:</b> Chemical Engineering Robin Gerlach, Erin Field-- Chemical and Biological Engineering <i>Biological Reduction of Hexavalent Chromium</i>	pm	92	50
<b>Quinn Bloom:</b> Sociology Tamela Eitle-- Sociology and Anthropology <i>Gender, water collection, and other household chores in Western Kenya</i>	pm	8	70
<b>Genna Boland:</b> Photography Michael Ivie-- Plant Sciences and Plant Pathology <i>Photo-Documentation of the Coleoptera of Saba</i>	pm	9	35
<b>Jared Bowden:</b> Biochemistry Edward Dratz-- Chemistry and Biochemistry <i>Investigating the mystery contained in the cargo of human serum albumin</i>	pm	12	26
<b>Caitlyn Brendal:</b> Cell Biology Neuroscience Jackson Gross-- Land Resources and Environmental Science <i>Evaluating the Effects of Cadmium on Liver Volumes of Rana pipiens using Magnetic Resonance Imaging</i>	am	9	70
<b>Tyler Bridges:</b> Paleontology David Varricchio-- Earth Sciences <i>Soft tissue or Biofilm?</i>	am	10	70
<b>Kristen Brileya:</b> Microbiology Matthew Fields-- Center for Biofilm Engineering <i>Colocalization of Syntrophs in a Methanogenic Biofilm</i>	am	11	26
<b>Dewey Brooke:</b> Chemistry, Biochemistry Brian Bothner, Brad Poore, Navid Movahed, Mavis Agbandje-McKenna-- Chemistry and Biochemistry <i>Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry</i>	am	62	71
<b>Dewey Brooke:</b> Chemistry, Biochemistry Brian Bothner, Brad Poore, Mavis Agbandje-McKenna-- Chemistry and Biochemistry <i>Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry</i>	McNair Topical	10:30 am SUB 233	71

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<b>Timothy Brox:</b> Physics Jennifer Brown, Joseph Seymour, Mark Skidmore-- Chemical and Biological Engineering, Earth Sciences <i>Magnetic Resonance Studies of Polycrystalline Ice Structure</i>	pm	25	71
<b>Krista Brundridge:</b> Paleontology Frankie Jackson, David Varricchio, Xingsheng Jin-- Earth Sciences <i>Fossil Eggs from Zhejiang Province, China: evidence of a reducing environment facilitated by organic decomposition</i>	pm	34	71
<b>Steve Bugni, Adie Phillips, James Connolly:</b> Environmental Engineering, Non Degree, Environmental Engineering Robin Gerlach, Al Cunningham-- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Controlling the Distribution of Microbially-Induced Calcium Carbonate Precipitation in 2-D Porous Media Reactors Under Pulse-Flow Conditions</i>	am	14	25
<b>Lisa Bullard:</b> English Lisa Eckert, Doug Downs, Robert Petrone-- English <i>Influencing Others to Care about Social Justice</i>	pm	11	27
<b>Katherine Burbank:</b> Chemistry Robert Szilagyi-- Chemistry and Biochemistry <i>Molecular Basis of U Toxicity</i>	pm	13	27
<b>Abraham Burnett:</b> Economics Joseph Atwood-- Agricultural Economics and Economics <i>Traders in the Sugarscape: The Efficacy and Efficiency of Using R and Fortran for Agent-based Modeling</i>	pm	14	72
<b>Carson Butler:</b> Fish and Wildlife Management Jim Berardinelli-- Animal and Range Sciences <i>Effect of Exposing Twenty-month-old Virgin Ewes to Mature Rams on Kisspeptin in Arcuate nucleus and Preoptic Area During the Early Breeding Season</i>	pm	16	72
<b>Noelle Carpenter:</b> Chemical Engineering Paul Gannon-- Chemical and Biological engineering <i>Solid Oxide Fuel Cells Thermal Barrier Coatings</i>	pm	17	51
<b>Nathan Carroll:</b> Paleontology David Varricchio-- Earth Sciences <i>Description Of An Azhdarchid From The Two Medicine Formation Of Montana</i>	pm	18	72
<b>David Carron:</b> Environmental Design Ralph Johnson-- Architecture <i>Sustainable Residential Design</i>	pm	19	35
<b>Christopher Carter:</b> Interdisciplinary Studies: Media and Geographic Identity Ann Bertagnolli-- Honors <i>Understanding Community Through Collaborative Visual Ethnography</i>	am	3	36

Student, Mentor, Project	Session	Poster #	Abstract Page #
<b>Sean Caskey:</b> Health Sciences Sheila Nielsen-Preiss-- Health Sciences <i>Osteogenic Sarcoma: A Comprehensive Review</i>	am	16	22
<b>Mark Chumrau, Scott Mooney:</b> Mechanical Engineering Vic Cundy-- Mechanical and Industrial Engineering <i>Sustainable Greenhouse Heating System</i>	am	119	51
<b>Bryce Clark:</b> Chemical Engineering Paul Gannon-- Chemical Engineering <i>Fundamental Thermodynamic Study of Nickel's Reaction with Silicon and Silicon Containing Gases at Relatively Low Temperatures</i>	pm	20	51
<b>Cameron Clevidence:</b> Organismal Biology, Microbiology Li Huang-- Plant Sciences and Plant Pathology <i>Identification of Gene Homologs Required for Lr21-Mediated Resistance Using Virus Induced Gene Silencing</i>	am	17	73
<b>David Coles:</b> Sociology Tamela Eitle-- Sociology <i>Understanding Intimate Partner Violence</i>	am	18	73
<b>James Connolly:</b> Environmental Engineering Robin Gerlach, All Cunningham-- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Imaging Biofilm and Microbially Induced Calcium Carbonate Precipitation in 2D Porous Media Reactors</i>	pm	23	25
<b>Travis Craft, Melissa Dale:</b> Computer Science, Japanese, Spanish John Paxton, Clem Izurieta, Michelle Meade-- Computer Science, Psychology <i>Learning a New Language: A Technological Approach</i>	pm	4	52
<b>Jasmine Croghan, Daniel Barta, Krista Brundrige, Jordan Drost, Chantell Bury:</b> Paleontology, Geology David Varricchio, Frankie Jackson-- Earth Sciences <i>Eggshell thickness variation in Chinese dinosaur eggs</i>	pm	33	73
<b>Kerstin Cullen:</b> Physics Galina Malovichko-- Physics <i>EPR Characterization of Lithium Niobate Doped With Non-Paramagnetic Modifiers</i>	pm	22	74
<b>Rosemary Cunningham:</b> English Danell Jones, Kirk Branch-- English <i>The Literary Work and Legacy of Manazar Gamboa</i>	pm	10	74
<b>Jake deNeui:</b> Architecture Ralph Johnson-- Architecture <i>Energy Conscious Commercial Design</i>	pm	24	36
<b>Eric Dietrich:</b> Civil Engineering Leah Schmalzbauer-- Sociology and Anthropology <i>Khwisero's Context: Local Perception of Development Efforts in Rural Western Kenya</i>	pm	26	52

Student, Mentor, Project	Session	Poster #	Abstract Page #
<b>Greg Doctor:</b> Cell Biology and Neuroscience Christa Merzdorf, Elena Kalinina-Turner-- Cell Biology and Neuroscience <i>Investigating the Role of aqp-3b in Xenopus laevis Neurulation</i>	am	19	74
<b>Casey Donovan:</b> Mathematics Steven Holmgren, Tatiana Kuznetsova, Bjorn Kvamme (University of Bergen, Norway)-- Chemistry and Biochemistry, Physics <i>Molecular Dynamical Studies of Water Deposition on Calcite</i>	pm	27	75
<b>Carey Downey:</b> Microbiology Kristin Juliar-- Montana AHEC and Office of Rural Health <i>Establishing a Health Care Workforce Analysis Plan for Montana</i>	pm	28	75
<b>David Driscoll:</b> Mechanical Engineering Stephen Sofie-- Mechanical Engineering <i>Investigation of Engineered Pore Structures in Powdered Metals by Means of Freeze Tape Casting</i>	pm	29	52
<b>Jordan Drost, Chantell Bury, Ashley Poust:</b> Paleontology, Earth Sciences David Varricchio, Frankie Jackson-- Earth Sciences <i>Morphology and diagenetic alteration of an unknown oogenus from the Tiantai basin, China</i>	am	13	76
<b>Krista Drummond:</b> Electrical Engineering Randall Babbitt-- Physics <i>Structured Light Imaging for Deep Sea Exploration</i>	am	20	53
<b>Amber Dubai:</b> Nursing Kathleen Schachman-- Nursing <i>Development and Testing of a Survey to Measure the Stressors Experienced by the Spouses of Firefighters</i>	pm	35	97
<b>Benjamin Duffus:</b> Chemistry Joan Broderick, John Peters-- Chemistry and Biochemistry <i>Carbon Monoxide and Cyanide Ligand Formation in [FeFe]-Hydrogenase Biosynthesis by the Radical AdoMet Enzyme HydG</i>	am	21	27
<b>Alisa Durkheimer:</b> Chemical Engineering Otto Stein-- Civil Engineering <i>Survival of Kenyans: Alternative Ways To Purify Water</i>	am	22	53
<b>Stefan Eccles:</b> Physics Charles Kankelborg, Christina Dunn-- Physics <i>Estimating Diffraction Effects through the Talbot Effect</i>	am	23	76
<b>Brian Ellingwood:</b> Chemical and Biological Engineering Paul Gannon-- Chemical and Biological Engineering <i>Oxidation Behavior of Ferritic Stainless Steels at 800° C in Single (Air/Air) and Dual Atmosphere (Air/Hydrogen) Exposures and the Effects of Utilizing Pre-Oxidation Treatments</i>	pm	30	53
<b>Brian Ellingwood:</b> Chemical and Biological Engineering Steve Holmgren-- Chemistry <i>Molecular Dynamics Study of Water-Hematite Interactions and the Effects of Dissolved Carbon Dioxide</i>	pm	31	54

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Dustin Elliott:</b> Chemical Engineering Paul Gannon-- Chemical Engineering <i>Interfacial Interactions among lanthanum strontium manganite (LSM) and cobalt manganese applied to Hitachi ZMG232L</i>	am	24	54
<b>Loribeth Evertz:</b> Mechanical Engineering Sarah Codd, Joe Seymour, Erik Rassi -- Mechanical and Industrial Engineering, Chemical and Biological Engineering <i>Oscillatory flow phenomena in simple fluids and complex fluids</i>	am	25	54
<b>Jude Eziashi:</b> Chemical Engineering Paul Gannon-- Chemical and Biological Engineering <i>Protective Coating Research for Bipolar Plates in Proton Exchange Membrane Fuel Cells</i>	pm	36	55
<b>Hilary Fabich:</b> Chemical Engineering Sarah Codd, Joe Seymour, Sarah Vogt, Einar Fridjonsson, Magnus Nyden (University of Technology, Göteborg, Sweden)-- Mechanical and Industrial Engineering, Chemical and Biological Engineering <i>Core Shell Particle Technology and Nuclear Magnetic Resonance Microrheology</i>	pm	37	55
<b>Esteban Ferrero Botero:</b> Anthropology Laurence Carucci-- Sociology and Anthropology <i>Misunderstandings and Deception: When Standardized Education Meets the Colombian Wayuu</i>	pm	38	76
<b>Caitlin Field:</b> Graphic Design and Honors Meta Newhouse-- Art <i>Gustav Klutsis: A Proper Gander at Propaganda</i>	pm	39	36
<b>Jake Flentie:</b> Environmental Horticulture Science Chaofu Lu-- Plant Sciences and Plant Pathology <i>Genetic screen of mutant fatty acid composition in seeds of Arabidopsis thaliana</i>	pm	40	42
<b>Angie Ford:</b> English Doug Downs-- English <i>Dynamic activity requires dynamic study: In activity analysis of firefighting, status quo methods can t take the heat</i>	Humanities Topical	8:30 am SUB 233	77
<b>Rebecca Fox:</b> Cell Biology and Neuroscience Laura Mentch-- Bridger Clinic <i>Sexual Health Needs Assessment of MSU College Students</i>	am	26	77
<b>Lauren Franco:</b> Microbiology Matthew Fields, Brent Peyton-- Center for Biofilm Engineering, Chemical & Biological Engineering <i>Molecular and Phenotypic Characterization of Three Scenedesmus Algal Isolates</i>	am	27	28
<b>Brandon French:</b> Health Sciences Sheila Nielsen-Preiss-- Health Sciences <i>Using Sociometer Theory to Understand Obesity: A Basis for Intervention Design</i>	pm	41	22

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Andrew Freund:</b> Cell Biology and Neuroscience Frances Lefcort-- Cell Biology and Neuroscience <i>Characterization of Vascular Endothelial Growth Factor in the developing nervous system</i>	am	100	77
<b>Andrew Freund:</b> Cell Biology and Neuroscience Frances Lefcort-- Cell Biology and Neuroscience <i>Analyzing chick embryos with elementary students to understand how organisms develop</i>	Hughes Topical	2:20 pm SUB 233	77
<b>Kate Fulbright:</b> History Joshua Howe-- History <i>Where Are All the Women in Atmospheric Science?</i>	pm	42	78
<b>Kathryn Gause:</b> Horticulture Mike Giroux-- Plant Science and Plant Pathology <i>Screening for Mutations in Starch Synthesis to Create High Amylose Durum</i>	am	28	43
<b>Pat Glatz:</b> Mechanical Engineering Ed Adams-- Civil Engineering <i>Modeling Snow Temperature in Complex Topography</i>	am	29	55
<b>Pat Glatz:</b> Mechanical Engineering Ed Adams-- Civil Engineering <i>Growing Atmospheric Snow</i>	am	30	56
<b>Rebecca Gleason:</b> Health Sciences Suzanne Christopher-- Health Sciences <i>Improving Participation in Safe Routes to Schools Programs for Montana Native American Communities</i>	pm	32	23
<b>Rio Gonzalez:</b> Literature Michael Sexson-- English <i>Pedagogical Technology</i>	am	34	78
<b>Isaac Griffith:</b> Computer Science and Philosophy Clemente Izuritea, John Paxton-- Computer Science <i>TrueRefactor: Towards a Completely Automated Refactoring</i>	am	31	56
<b>Isaac Griffith:</b> Computer Science and Philosophy Clemente Izuritea-- Computer Science <i>Concurrent Iteration Management in Ecological Systems Modeling</i>	am	32	56
<b>Kelsey Guffey:</b> Animal Science Clayton Marlow-- Animal and Range Sciences <i>Foraging Ecology of Bison in a Foothills Grassland-Steppe Ecosystem</i>	McNair Topical	10:15 am SUB 233	43
<b>Stesha Gulick:</b> Chemical and Biological Engineering Brent Peyton, Rob Gardner-- Chemical and Biological Engineering <i>Effects of Differing Light-Dark Cycles on the Growth of Microalgae to Optimize Biomass</i>	pm	83	57
<b>Riley Haligan:</b> Philosophy Sara Waller-- Philosophy <i>Extended Minds, Extended Technologies, and Extended Persons</i>	am	36	78

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Lindsey Hanna, Brandon Norick:</b> Computer Science Clemente Izuritea, John Paxton-- Computer Science <i>Using Dashboard Indicators to Quantify College Effectiveness</i>	am	7	57
<b>Ryan Hannahoe:</b> Elementary Education Mary Leonard-- Education <i>Turning Eyes to the Big Sky Project</i>	am	37	48
<b>Anne Hansen:</b> Nursing Sandy Kuntz-- Nursing <i>Participant observation and field notes of focus group dynamics among tribal and local health care providers</i>	pm	43	97
<b>Eric Hansen:</b> Civil Engineering Pat McGowen-- Civil Engineering <i>Analysis of Non-Motorized use in Grand Teton National Park</i>	pm	45	57
<b>Travis Harrer:</b> Chemical and Biological Engineering Robin Gerlach, Al Cunningham, Adrienne Phillips-- Chemical and Biological Engineering, Center for Biofilm Engineering, <i>Microbially Induced Calcium Carbonate Precipitation Under Radial Flow Conditions</i>	pm	46	58
<b>Jaron Hartman:</b> Physics and Biology Charles Kankelborg-- Physics <i>Characterization of the MOSES Hollow Cathode Lamp Light Source</i>	am	38	79
<b>Saiichi Hashimoto:</b> Computer Science Brendan Mumey-- Computer Science <i>Routing and Adaptive Power Control for Green Networking</i>	am	39	58
<b>Sonny Hawk:</b> Soil and Water Sciences Dr. Jackson Gross-- United States Geological Survey, Northern Rocky Mountain Science Center <i>Impacts of Sound Pressure Levels on Snake River Cutthroat Trout (<i>Oncorhynchus clarkii</i>) Life History Stages</i>	am	40	43
<b>Tammi Heneveld, Megan Sullivan:</b> Graphic Design, Liberal Studies Florence Dunkel-- Graphic Design <i>Mali Children's Book</i>	pm	52	37
<b>Josh Henning:</b> Film and Photography Theo Lipfert-- Film and Photography <i>Advanced Visual Effects</i>	pm	15	37
<b>Tyler Hinshaw:</b> Health Sciences Elizabeth Kinion, Sheila Nielsen-Preiss-- Nursing, Health Sciences <i>Diabetes and Periodontal Disease in Native American Communities</i>	am	41	23
<b>Jordan Holsinger:</b> Microbiology Matthew Fields-- Center for Biofilm Engineering <i>Rate comparisons for phototrophic and heterotrophic growth in algal strain CHLOR-1 isolates</i>	am	43	28

Student, Mentor, Project	Session	Poster #	Abstract Page #
<b>Jeffrey W. Hostetler:</b> American Studies Susan Kollin-- English <i>Why is Fly Fishing So White?</i>	pm	48	34
<b>Elsa Howard:</b> Psychological Sciences Ian Handley-- Psychology <i>Placebo effect, a matter of motivation?</i>	am	42	79
<b>Alta Howells:</b> Chemistry John Peters-- Chemistry and Biochemistry <i>Structural and Functional Studies of Nuclear Associated Lamin 1 Protein, Nar1, a Homolog of Lower Eukaryotic, Algal and Bacterial [FeFe] Hydrogenase</i>	am	101	79
<b>Alta Howells:</b> Chemistry John Peters-- Chemistry and Biochemistry <i>Introducing high school students to some of the college opportunities available to students pursuing bioscience and pre-health fields</i>	Hughes Topical	3:00 pm SUB 233	79
<b>Forrest Hoyt:</b> Biochemistry Benfang Lei-- Immunology and Infectious Diseases <i>Cloning of the IL-8 and C5a peptidase genes of Group A Streptococcus</i>	pm	49	80
<b>Luke Humphrey:</b> Mechanical Engineering Ahsan Mian-- Mechanical Engineering <i>Investigation of the Sensor Properties of Two-Dimensional Graphene Sheets</i>	am	45	58
<b>Jacob Hunter:</b> Architecture Chris Livingston-- Architecture <i>Memorial Garden</i>	pm	51	37
<b>Carla Hutson:</b> Pre-Veterinary Christa Merzdorf-- Cell Biology and Neuroscience <i>Are the "wings" of zic1 expression part of the premigratory neural crest?</i>	am	46	44
<b>Amanda Hyman:</b> Environmental Biology Geoffrey Poole-- Land Resources and Environmental Sciences <i>Stream Metabolism Following Restoration and Remediation of Silver Bow Creek, Montana, USA</i>	pm	65	44
<b>Cayman Irvine:</b> Physics Petrus Martens, Rafal Angryk-- Physics, Computer Science <i>Assessing the Accuracy of Computer Feature Recognition Methods for Solar Imagery</i>	am	48	80
<b>Milenka Jirasko:</b> Architecture Ralph Johnson-- Architecture <i>Sustainable Building Alternatives for Bozeman Rowhouses</i>	pm	54	38
<b>Stephanie Johnson:</b> Dietetics Brian Bothner-- Chemistry and Biochemistry <i>Using Graphic Designs to Communicate Scientific Research</i>	am	35	48

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Kendra Kaiser:</b> Soil and Water Sciences and Environmental Biology Brian McGlynn-- Land Resources and Environmental Sciences <i>Ecohydrology: Disturbance and the intersection of vegetation pattern and landscape structure</i>	pm	6	44
<b>Lauren Kay:</b> Earth Sciences David Lageson-- Earth Sciences <i>Tectonic deformation as a taphonomic process: using dinosaur bones as strain indicators</i>	pm	56	28
<b>Amanda Kelley:</b> Biochemistry Martin Teintze-- Chemistry and Biochemistry <i>Guanides as Antibiotic Compounds</i>	pm	57	80
<b>Jordan Kenedy:</b> Mechanical Engineering Jennifer Brown-- Chemical and Biological Engineering <i>Rheological Characterization of Thermally Reversible Gels</i>	McNair Topical	10:45 am SUB 233	59
<b>Gal Keren-Aviram:</b> Biochemistry Edward Dratz-- Chemistry and Biochemistry <i>The Proteomics of Human Epilepsy</i>	pm	61	29
<b>Kyler Kingston:</b> Biochemistry Christa Merzdorf-- Cell Biology and Neuroscience <i>Individual roles of Zic family proteins</i>	pm	60	81
<b>Zachary Krehilk:</b> Ecology and Evolution Robert Sharrock, Ted Clack-- Plant Sciences and Plant Pathology <i>Attempted Crystallization of the Histidine Kinase-Related Domain of Phytochrome B</i>	am	49	81
<b>Justin Krohn:</b> Computer Science Hunter Lloyd, John Paxton, Brock Lameres-- Computer Science, Electrical and Computer Engineering <i>Design &amp; Implementation of Communication, Control &amp; Monitoring Systems &amp; Software for MSU's 2011 NASA Lunabotics Competition Robot</i>	am	118	59
<b>Jamie Krushensky, Alice Hecht ,Drew Dewolf, Camilla Armijo-Grover, Heather Smart:</b> Sociology, Economics, Equine Science, Wendy Stock-- Agriculture Economics and Economics <i>Academic Student Success within an Introductory Economics Course: A Gender Based Study</i>	am	51	81
<b>Jamie Krushensky:</b> Sociology Tamela Eitle-- Sociology and Anthropology <i>Gendered Social Constraints on Leisure Participation</i>	am	52	82
<b>Priyanka Kudalkar:</b> Plant Biotechnology Gary Strobel-- Plant Biosciences <i>Muscodor sutura, a Novel Endophyte Making Bioactive Volatile Compounds</i>	pm	62	45
<b>Dustin Kuipers:</b> Liberal Studies Walter Fleming-- Native American Studies <i>Cosmology of Incarceration</i>	am	50	99

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<b>Eric Lake:</b> Math Kris Ellingsen-- Honors <i>Rebirth</i>	Humanities Topical	9:30 am SUB 233	82
<b>Kevin Lalli:</b> Physics Kevin Repasky-- Physics <i>Iris Student Solar Spectrograph Competition - Pilot Run</i>	am	33	82
<b>Trevor Lane:</b> Chemical Engineering Hugo Schmidt-- Physics <i>Transition Element Doping of Proton Conducting SOFCs</i>	am	53	59
<b>Cassandra Langr:</b> Molecular Biosciences Michael Babcock-- Psychology <i>Ischemic Gerbil Model: Object and Spatial Recognition</i>	am	54	29
<b>Mort Larsen:</b> Geology David Lageson-- Earth Sciences <i>Structural inversion of the southern Madison-Gravelly arch by the Hebgen-Red Canyon normal faults, SW Montana</i>	pm	63	29
<b>Brady Lassila, Tyler Hessler:</b> Civil Engineering Michael Berry, Jerry Stephens-- Civil Engineering <i>Biodegradable Pykrete Beams</i>	pm	120	60
<b>Aubrie Ler:</b> Cell Biology and Neuroscience, Health Science Sheila Nielsen-Preiss-- Health Sciences <i>Diabetic Retinopathy as an Ocular Manifestation of Diabetes Mellitus</i>	am	55	30
<b>Elyse Lovell:</b> Adult and Higher Education Marilyn Lockhart, Betsy Palmer, Carrie Myers-- Education <i>An Enhanced Understanding of Motivational Factors for Students Who Are Parents</i>	am	56	24
<b>Janice Lucon:</b> Chemistry Trevor Douglas-- Chemistry and Biochemistry <i>Polymers Inside the P22 Protein Cage Architecture</i>	pm	64	30
<b>Helen Lynn, Whitney Treadway:</b> Earth Sciences Dave Lageson-- Earth Sciences <i>Structural Controls on Fluid Migration Through Thrust Faults of the Stewart Peak Culmination</i>	pm	103	30
<b>Heather Lytle:</b> Nursing Elizabeth Rink-- Nursing <i>Creating Sustainable Palliative Care Programs for Critical Patients in Nkomazi South Africa</i>	pm	53	98
<b>Chandra Macauley:</b> Chemical Engineering Paul Gannon-- Chemical and Biological Engineering <i>The influence of CrxOy microstructure on the oxidation behavior of CoMn coatings on SOFC/SOEC interconnects</i>	pm	66	60
<b>Sarah MacDonald:</b> Sociology and Anthropology Tamela Eitle-- Sociology and Anthropology <i>Is it safe? Risk Perceptions of Drinking Water in Rural Kenya</i>	pm	67	83

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Megan Malone:</b> Sociology and Anthropology Leah Schmalzbauer-- Sociology and Anthropology <i>Water, the Essence of Survival and the Symbol of Oppression: Gender Inequalities Collide with Development</i>	pm	74	83
<b>Diveena Marcus:</b> Native American Studies Matt Herman, Geoff Gamble, Kristin Ruppel-- Native American Studies, Sociology & Anthropology, Native American Studies <i>She Loves Us</i>	Humanities Topical	8:50 am SUB 233	31
<b>Kyle Margolies:</b> Physics Randall Babbitt-- Physics <i>Spatial-Spectral Hole Recovery</i>	pm	76	83
<b>Justin Mauzey:</b> Physics Kevin Repasky, John Carlsten-- Electrical and Computer Engineering, Physics <i>Using Honey Bees to Isolate Land Mines with a Lidar</i>	pm	69	84
<b>Lauri McCarthy:</b> Nursing Elizabeth Kinion-- Nursing <i>Parents' Knowledge of Healthy Dental Habits for Pre-schoolers</i>	am	57	98
<b>Adam McClure, H. Li, P. Rugheimer, E. Arenholz:</b> Physics Yves Idzerda-- Physics <i>Magnetic Properties of Single Crystal Fe<sub>1-x</sub>Gax Thin Films</i>	am	64	31
<b>James McKinney:</b> Cell Biology and Neuroscience and Biochemistry Sheila Nielsen-Preiss-- Cell Biology and Neuroscience <i>Candida albicans and the Effects of Low-Shear Modeled Microgravity on Virulence and Pathogenesis</i>	am	59	84
<b>Taisha McWilliams:</b> Cell Biology and Neuroscience Kristin Juliar, Renee Harris-- Health Sciences <i>Montana Health: Growing in Your Backyard</i>	am	60	84
<b>Elizabeth Miller:</b> Cell Biology and Neuroscience Lynn Hellenga, Elizabeth Bird-- Nutrition and Physical Activity Program (NAPA) <i>Montana Breastfeeding Initiative: The Extent of Implementation of the 2011 Surgeon General's Call to Action</i>	am	61	85
<b>Anita Moore-Nall:</b> Geology David Lageson, David Mogk-- Earth Sciences <i>Mineralized Uranium Vanadium deposits in the Pryor Mountains, South central Montana and the Little Mountain Mining District, north central Wyoming may provide a link to the elevated lead and mercury in the Bighorn River</i>	pm	68	31
<b>Anuar Morales-Rodriguez, Aracely Ospina-Lopez:</b> Plant Science, Entomology Kevin Wanner-- Plant Science and Plant Pathology <i>Evaluation of four different bait traps to sample wireworms (Coleoptera: Elateridae) infesting wheat and barley crops in Montana</i>	pm	1	21

<b>Student, Mentor, Project</b>	<b>Session</b>	<b>Poster #</b>	<b>Abstract Page #</b>
<b>Kilani Morris:</b> Food and Nutrition Darcy Hunter-- WIC Office <i>Evaluation of WIC fruit and vegetable benefits on children consumption rates and benefit utilization</i>	pm	77	49
<b>Zachary Morris:</b> Civil Engineering Robert Mokwa-- Civil Engineering <i>Nondestructive measurements of geomaterials using x-ray computed tomography: Some practical applications</i>	McNair Topical	11:00 am SUB 233	60
<b>Kathryn Morrissey:</b> Chemical Engineering Otto Stein-- Civil Engineering <i>Orange Water and Water Quality Testing in Khwisero, Kenya</i>	am	104	61
<b>Kathryn Morrissey:</b> Chemical Engineering, Biological Sciences, Valerie Copie, Laura Jennings-- Chemistry and Biochemistry <i>NMR Metabolite Profiling of Bacterial Biofilms in Chronic Pressure Ulcers</i>	am	103	61
<b>Kathryn Morrissey:</b> Chemical Engineering, Biological Sciences, Valerie Copie, Laura Jennings-- Chemistry and Biochemistry <i>Connecting undergraduate students with graduate mentors in science and engineering fields</i>	Hughes Topical	2:40 pm SUB 233	61
<b>Kyle Murray:</b> Geology Colin Shaw-- Earth Science <i>Study of the Savage Peak Shear Zone</i>	am	58	85
<b>Kevin Murray:</b> Biochemistry Robert Szilagyi-- Chemistry and Biochemistry <i>Physical Chemical Study of Ni-S System with Prebiotic Relevance</i>	am	63	85
<b>Caroline Nelson:</b> Liberal Arts Nelleke Beltjens-- Liberal Arts <i>An Investigation In Repetition</i>	pm	21	38
<b>Fallon Niedrist:</b> Sociology Tamela Eitle-- Sociology <i>Power-Control Theory and Social Bonds: Explaining Differences in Girls' Delinquency</i>	pm	100	86
<b>Katya Numbers:</b> Psychology Michelle Meade-- Psychology <i>Social Contagion and Item Credibility: Is Memory Accuracy Determined by Item Accuracy?</i>	am	65	32
<b>Kristen O'Brien:</b> Environmental Horticulture William Hoch-- Plant Sciences and Plant Pathology <i>Production of Tetraploid Russianolive (<i>Elaeagnus angustifolia</i>) for Use in Development of Sterile Horticultural Varieties</i>	am	66	45
<b>Patric O'Hara:</b> Physics Charles Kankelborg-- Physics <i>Updating Software for the Multi-Order Extreme Ultraviolet Spectrograph</i>	am	67	86

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<b>Alison O'Neil:</b> Biochemistry Trevor Douglas-- Chemistry and Biochemistry <i>Genetically Programmed in vivo Packaging and Controlled Release of Protein Cargo from Bacteriophage P22</i>	am	68	32
<b>Kristen Orelup:</b> Biomedical Science Mensur Dlakic-- Microbiology <i>Detecting protein interactions in Bacteria using Gateway vectors and fluorescence complementation</i>	am	69	86
<b>Janice Ostermiller:</b> Nursing Karen Zulkowski-- Nursing <i>The effect of fluoride levels in public water supplies on dental caries</i>	am	70	98
<b>Elle Pankratz:</b> Biological Engineering Brent Peyton, Natasha Mallette-- Chemical and Biological Engineering <i>Ascocoryne sarcoides: Exploration of Hydrocarbon Production Potential</i>	am	71	61
<b>Mellie Park:</b> Biochemistry Hien Nguyen, Matt Mckay (University of Iowa)-- Chemistry <i>Urea-Linked Cyclodextrin Analogues</i>	am	72	87
<b>Nikitaben Patel:</b> Biotechnology, Veterinary Molecular Biology Dr. Katherine Gauss-- Immunology and Infectious Diseases <i>Develop PLAGL2 oncogenic myeloid cell line model</i>	am	73	45
<b>Steven Paulson:</b> Chemical Engineering Ross Carlson-- Chemical and Biological Engineering <i>Construction and Characterization of Metabolically Engineered Escherichia coli Biofilm Communities</i>	am	74	62
<b>Vladimir Perga:</b> Psychology Michelle Meade-- Psychology <i>Correct Contagion of Memory in Young and Older Adults</i>	am	75	87
<b>Steven Powell:</b> Fine Art Independent Project-- <i>Bio-ID Project</i>	pm	7	38
<b>Shefah Qazi:</b> Biochemistry Trevor Douglas-- Chemistry and Biochemistry <i>Enhanced Relaxivity and In Vivo Imaging of Macrophage-Rich Carotid Lesions with Protein Cage Based T1-Contrast Agents</i>	am	76	32
<b>Kalen Ramey:</b> Civil Engineering Otto Stein-- Civil Engineering <i>Water Projects in Khwisero Kenya</i>	am	77	62
<b>Evan Rashid:</b> Mechanical Engineering Ahsan Mian-- Mechanical Engineering <i>Development of Laser Microjoining Process</i>	pm	50	62

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<b>Brian Redman:</b> Electrical Engineering Joseph Shaw, Paul Nugent-- Electrical and Computer Engineering <i>Feasibility Study and Initial Design of a Low-cost All-Sky Infrared Cloud Imager</i>	pm	71	63
<b>Sydney Reichardt:</b> Food and Nutrition Christa Merzdorf-- Cell Biology and Neuroscience <i>Expression Patterns of tnrc4, XI.25952, and XI.8933 in Early Neural Development</i>	am	102	49
<b>Sydney Reichardt:</b> Food and Nutrition Christa Merzdorf-- Cell Biology and Neuroscience <i>Exploring genes and DNA with participants in the Big Brothers/Big Sisters program</i>	Hughes Topical	3:20 pm SUB 233	49
<b>Beth Renick:</b> Community Health Mary Miles-- Health and Human Development <i>Mindfulness-Based Stress Reduction (MBSR) as a Strategy for Lowering Perceived Psychosocial Stress and Disease Risk Variables</i>	pm	72	49
<b>Russell Ricker:</b> Physics and Applied Mathematics Rufus Cone, Charles Thiel-- Physics, Spectrum Lab <i>Growth and Characterization of Rare-Earth Activated Calcium Sulfate Crystals</i>	pm	70	87
<b>Johnathan Rios:</b> Sociology and Liberal Studies Tamela Eitle, Leah Schmalzbauer, Scott Myers-- Sociology and Anthropology <i>Water Source Distance and Sustainability In Relation to the Effectiveness of Projects Conducted By the MSU Chapter of Engineers Without Borders</i>	am	15	88
<b>Jordan Roberts:</b> Photography and Environmental Studies Kyle Bajakian-- Photography <i>Sustainable Food Systems: A photographic journal</i>	pm	73	39
<b>Melissa Robertson:</b> Molecular Biosciences Kevin Wanner-- Plant Sciences and Plant Pathology <i>Sequencing, Assembling and Annotating BAC Clones from a Genomic Library to Identify Sex Pheromone Receptor Genes.</i>	pm	75	33
<b>Shelby Rogala:</b> History Kristen Intermann-- History and Philosophy <i>Establishing an International Volunteering Ethic</i>	McNair Topical	11:15 am SUB 233	88
<b>Daniel Ross:</b> Earth Sciences David Lageson-- Earth Sciences <i>Structural Geology of the North-Half of the Swift Reservoir Culmination, Northern Sawtooth Range, Montana</i>	pm	114	33
<b>Kaitlyn Roth:</b> Biochemistry Brian Bothner-- Chemistry <i>Investigation of Adeno-Associated Virus Capsid Structure Dynamics with QCM-D</i>	pm	79	88

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<b>Luke Rothschild:</b> Philosophy Prasanta Bandyopadhyay-- Philosophy <i>Investigating a Pragmatic Account of Simpson's Paradox</i>	am	78	89
<b>Katherine Ruff, Dillon Maslach:</b> Literature, Philosophy Sara Waller-- Philosophy <i>How Enmeshed are Moral Judgments with Sociality? An Empirical Investigation</i>	pm	55	89
<b>Laurie Rugemer:</b> Science Education Irene Grimberg, Elisabeth Swanson, Peggy Taylor-- Education, Intercollege Program of Science Education (MSSE) <i>Online Learning: A Study of Beginning Science Teachers and How They Participate in a Content-Based Online Mentoring Program</i>	pm	80	25
<b>David Arnar Runolfsson:</b> Photography Kyle Bajakian-- Film and Photography <i>Whaling: The future of an endangered tradition</i>	am	47	39
<b>Erin Ryan:</b> Bio-Resources Joel Cahoon-- Civil Engineering <i>Experimental Assesment of Westslope Cutthroat Trout Swimming Capabilities for Hydraulic Barrier Design and Retrofit</i>	pm	81	63
<b>Brett Sather:</b> Land Rehabilitation Catherine Zabinski-- Land Resources and Environmental Sciences <i>N<sub>2</sub>O Greenhouse Gas Losses from Three Forms of Nitrogen Fertilizer</i>	am	79	46
<b>Jerome Schleier, Collin Preftakes:</b> Ecology, Environmental Sciences Robert Peterson-- Land Resources and Environmental Sciences <i>The joint toxicity of three pyrethroid types to Drosophila melanogaster</i>	pm	85	21
<b>Nicole Schonenbach:</b> Chemical Engineering Brent Peyton-- Chemical and Biological Engineering <i>Effects of Temperature on Two Algal Strains</i>	pm	82	63
<b>Rory Schulte, Jake Brown:</b> Motion Picture Video Theatre Tom Watson-- Film and Photography <i>Connect the Dots</i>	pm	119	39
<b>Amy Servid:</b> Biochemistry Trevor Douglas-- Chemistry and Biochemistry <i>Protein Cage Nanoparticles and Associated Protection against Respiratory Viruses</i>	am	80	33
<b>Lauren Sharp:</b> Sociology Tamela Eitle-- Sociology <i>Depression and Suicide Ideation Among Latino Youth in the United States</i>	pm	86	89
<b>Julia Sharrock, Colton Knudsen:</b> Film Dennis Aig-- Film & Photography <i>The Hollow</i>	pm	117-118	40

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<b>Matthew Sherick:</b> Chemical Engineering Joseph Seymour, Sarah Codd, Betsey Pitts, Michael Franklin-- Chemical and Biological Engineering, Mechanical and Industrial Engineering, Center for Biofilm Engineering <i>Isolation of Bacterial Alginate from Pseudomonas aeruginosa Biofilms</i>	pm	87	64
<b>Barinderjit Singh:</b> Biomedical Science Jamie Sherman-- Plant Sciences and Plant Pathology <i>Genetic Validation of Quantitative Trait Loci for Wheat Stem Sawfly Attraction in Montana Spring Wheat</i>	am	81	90
<b>Heather Smart:</b> Equine Science and Economics Myles Watts, Doug Young-- Agricultural Economics & Economics <i>The Impact of Sales Taxes on R.V. Sales</i>	pm	47	46
<b>Aaron Smith:</b> Health Sciences Sheila Nielsen-Preiss -- Health Science <i>Improving care and outcomes: A program to increase health care adherence among college students</i>	am	82	23
<b>Erin Smith:</b> Biochemistry Jean Starkey-- Microbiology <i>The Role of Mesenchymal Stem Cells in a Rabbit Transplantable Carcinoma</i>	am	83	90
<b>Max Smith:</b> Sustainable Foods and Bioenergy Systems Mary Stein-- Health & Human Development <i>Three Ways to Measure a Neighborhood Supported Model of Agriculture</i>	pm	58	46
<b>Max Smith:</b> Sustainable Crop Production Mary Stein-- Health and Human Development <i>The Organizer's Guide to Replicating Urban Agriculture Projects</i>	pm	59	47
<b>Anna Snapp:</b> Plant Science Chaofu Lu-- Plant Sciences and Plant Pathology <i>Camelina sativa as a platform for the production of oils with enhanced lubricant properties</i>	pm	88	21
<b>Blair Sorlie:</b> Environmental Design Ralph Johnson-- Architecture <i>Sustainable Housing</i>	pm	89	40
<b>Casey Spaulding - MSU Northern:</b> Diesel Technology Nestor Soriano - MSU Northern-- MSU-Northern Bio-Energy Center <i>Performance and Emissions of Heavy Duty Diesel Engine</i>	pm	90	64
<b>Kelly Spendlove:</b> Computer Science and Mathematics Brendan Mumey-- Computer Science <i>Algorithm Formulation For Genome Sequence Assembly</i>	pm	91	64
<b>Hillary Stacey:</b> Chemistry and Broadfield Science Teaching Mary Cloninger-- Chemistry and Biochemistry <i>Altering Homotypic Cancer Cell Aggregation With a Lactose-Functionalized Dendrimer</i>	pm	93	90

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<b>Joseph Steffens:</b> Chemistry, Cell Biology and Neuroscience Brian Bothner-- Chemisty and Biochemistry <i>Activity Based Protein Profiling with Sulfolobus solfataricus</i>	am	84	91
<b>Joshua Stenseth:</b> Health Sciences Sheila Nielsen-Preiss-- Health Science <i>Healthcare Reform in the West Bank</i>	pm	94	24
<b>David Stevens:</b> Computer Science Brendan Mumey-- Computer Science <i>On Routing and Channel Selection in Cognitive Radio Mesh Networks</i>	pm	95	65
<b>Caleb Stoltzfus:</b> Physics Randall Babbitt-- Physics <i>Mid-IR DIAL</i>	am	85	91
<b>Aaron Street:</b> Chemical and Biological Engineering Robert Cramer-- Immunology and Infectious Diseases <i>Metabolism Modeling of Aspergillus fumigatus</i>	am	86	65
<b>Joshua Stringam:</b> Chemical and Biological Engineering Adrienne Phillips, Robin Gerlach-- Chemical and Biological Engineering <i>Development of an injection strategy for homogenous calcium carbonate plugging by Sporsarcina pasteurii</i>	pm	96	65
<b>Michael Tarrant:</b> Music Technology Kristi McGarity-- Music <i>Recording Soundscapes: Butte</i>	am	87	40
<b>Kelsey Tessier:</b> Architecture Ralph Johnson-- Architecture <i>Rethinking Design</i>	pm	97	40
<b>Kamlynn Thomas:</b> Physics and Mathematics Aleks Rebane-- Physics <i>Relationship Between Two-Photon Absorption and Dipolar Properties in a Series of Fluorenyl-Based Chromophores</i>	am	88	91
<b>Jennifer Thornburg:</b> Liberal Studies Jerome Coffey-- English <i>The Dream of the Rood</i>	Humanities Topical	9:10 am SUB 233	99
<b>Atty Timothy:</b> Health Sciences Sheila Nielsen-Preiss, Jane Shelby-- Health Sciences <i>Efficacy of Holistic Approaches to Native American Health</i>	pm	78	24
<b>Jon Todorovich:</b> Physics Kevin Repasky-- Physics <i>Two-Colored Lidar Inversion Algorithm Development for the Study of Atmospheric Aerosols</i>	pm	98	92
<b>Lotus Torre:</b> Sociology Graham C. Austin-- Marketing <i>Brand Awareness and Hedonic Consumption</i>	McNair Topical	10:00 am SUB 233	92

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<b>Bradley Towey:</b> Chemistry Robert Szilagy-- Chemistry and Biochemistry <i>Probing the Mo site of FeMo-co by Synthesis, Spectroscopy, and Theory</i>	pm	115	34
<b>Whitney Treadway, Helen Lynn:</b> Earth Sciences Dave Lageson-- Earth Sciences <i>Fracture Assessment of a Laramide Uplift in the Rocky Mountain Foreland, Thermopolis Anticline, WY</i>	pm	102	34
<b>Logan Triplett:</b> Film James Joyce-- Film <i>Modern Exposure: The art of exposure for the digital sensor</i>	am	44	41
<b>Jacob Trudnowski:</b> Chemical Engineering Zeb Barber-- Spectrum Lab <i>Pressure Induced Wavelength Shift Calibrations</i>	am	89	66
<b>Bryan Vadheim:</b> Chemical Engineering Jeffrey Heys-- Chemical and Biological Engineering <i>Impact of Biofilm Structure on Biofilm-Fluid Interactions</i>	pm	107	66
<b>Elizabeth Van De Grift:</b> Cell Biology and Neuroscience Laura Mentch-- Bridger Clinic <i>Clinic Efficiency</i>	am	90	92
<b>Juliana Velasco:</b> Cell Biology and Neuroscience Shelly Hogan, Mary Miles-- McNair Scholars Program, Health and Human Development <i>Correlation Between C-reactive Protein and the Prevention of Diabetes</i>	pm	104	92
<b>Francisco Velasco:</b> Psychology Michelle Meade-- Psychology <i>Asymmetrical Conflict: Sleep Deprivation as a Precursor to PTSD Among Veterans</i>	pm	105	93
<b>Laura Villegas:</b> Economics and Political Science Linda Young-- Political Science <i>Developing under the curse of Coltan</i>	am	91	93
<b>Tristany Wagner:</b> Land Resources and Environmental Sciences Jackson Gross-- USGS <i>The Impacts of Seismic Technologies on Fisheries</i>	am	92	47
<b>Nickolas Wagner:</b> Physics Galina Malovichko-- Physics <i>Characteristics of Lithium Niobate Crystal Doped 6% with Gallium</i>	pm	106	93
<b>Sarah Walton:</b> Biochemistry Martin Teintze-- Chemistry and Biochemistry <i>Antimicrobial Properties of Guanide, Biguanide, and Phenylguanide Compounds</i>	pm	108	94

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<b>Sarah Watt:</b> Cell Biology and Neuroscience Steve Stowers-- Cell Biology and Neuroscience <i>Genetic screen for enhanced control of gene expression in Drosophila melanogaster larval neurons</i>	pm	99	94
<b>Christina Watts:</b> Mathematics Elizabeth Burroughs-- Mathematical Sciences <i>Modeling the Effects of Predator Exlosures on the Western Snowy Plover</i>	am	94	94
<b>Kluane Weibel:</b> Architecture Ralph Johnson-- Architecture <i>Re-developing the Single Family Residence</i>	pm	101	41
<b>Jylissa Whisenhunt, Shawn Wright:</b> Computer Engineering, Mechanical Engineering Brock Lameres, Ross Snider, Ashan Mian-- Electrical and Computer Engineering, Mechanical and Industrial Engineering <i>Exploiting Reconfigurable Computing for Increased Radiation Tolerance in Aerospace Flight Systems</i>	pm	84	66
<b>Nathan Williamson:</b> Chemical Engineering Jeffrey Heys-- Chemical and Biological Engineering <i>Simulation and Optimization of Inhaled Drug Delivery for Asthma</i>	pm	111	67
<b>Hannah Willis:</b> Biology David McWethy-- Earth Sciences <i>Fire and climate history of central Mozambique during the past 100-200 years</i>	am	95	95
<b>Alexandre Wing:</b> Biological Science Lisa Rew-- Land Resources and Environmental Science <i>Vehicles as a vector of plant seed dispersal: Quantifying seed loss over distance</i>	pm	110	95
<b>Carin Wolfe:</b> History and American Studies Michael Reidy, Pat Roath-- History and Philosophy, Museum <i>Applying Museum Collections Policy and Procedure to Fly Fishing Objects</i>	pm	44	95
<b>Rachelle Wood:</b> Mathematics Education Elizabeth Burroughs-- Mathematical Sciences <i>MCTM Lesson Plan Analysis</i>	pm	109	96
<b>D. Cary Woodruff:</b> Earth Sciences Jack Fisher-- Sociology and Anthropology <i>Stone Cut Mark Identification On Animal Remains</i>	pm	116	96
<b>Thomas Wright:</b> Biochemistry Martin Teintze-- Chemistry <i>Antibacterial Activity of Guanides, Biguanides and Phenylguanides</i>	am	96	96
<b>Kaysha Young:</b> Mechanical Engineering and Mechanical Engineering Technology Laura Stanley-- Mechanical and Industrial Engineering <i>Hands Free Texting While Driving - Is it Safer than Conventional Texting While Driving?</i>	am	97	67

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<b>Mary Lynn Young:</b> Biochemistry Dr. Matthew Fields-- Center for Biofilm Engineering <i>Stimulation of a non-targeted Sporotalea-like organism during bioremediation of a chromium-contaminated site at the Hanford, WA Nuclear Reservation</i>	pm	112	97
<b>Justin Zarecor:</b> Management Minette Jessup-- Business <i>The Influence of Perceived Risk on Capital Allocation</i>	pm	113	47
<b>Oliwia Zurek:</b> Immunology and Infectious Diseases Trevor Douglas, Allen Harmsen-- Chemistry and Biochemistry, Veterinary Molecular Biology <i>Letting Viruses Do the Work: In Vivo Selection for a P22 Capsid with Long Blood Half-life and Lung Residency</i>	am	98	22