

2012 MSU STUDENT RESEARCH CELEBRATION

April 19, 2012



MONTANA STATE UNIVERSITY

The 2012 Student Research Celebration is
Presented by the Undergraduate Scholars
Program and The Graduate School.

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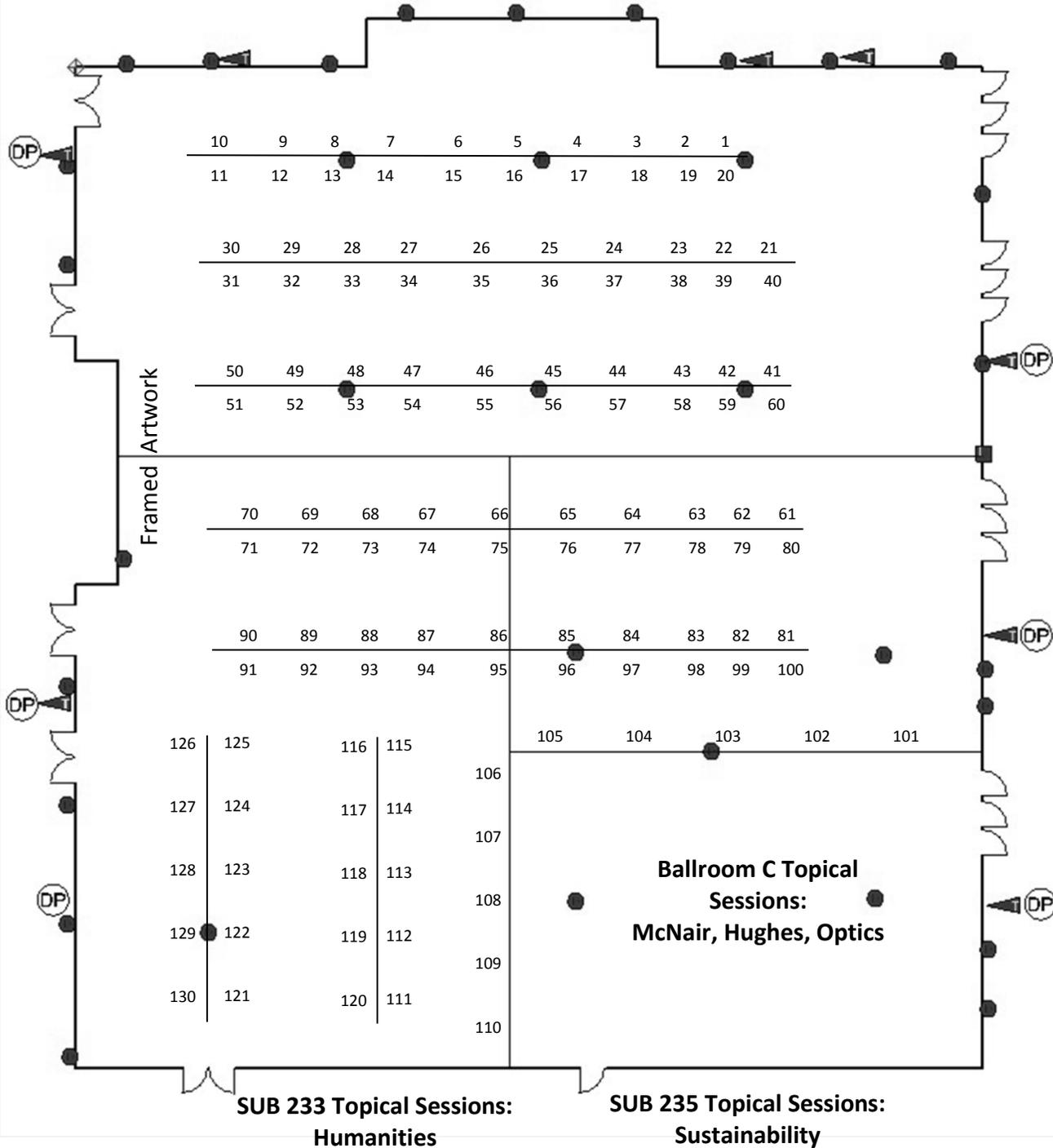
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Table of Contents

MAP	4
TOPICAL PRESENTATIONS	
HUMANITIES.....	5
SUSTAINABILITY	5
MCNAIR SCHOLARS PROGRAM.....	6
HUGHES UNDERGRADUATE BIOLOGY PROGRAM	6
OPTICAL SCIENCE AND ENGINEERING	6
STUDENT EXHIBITS.....	7
MORNING POSTER PRESENTATIONS	8
AFTERNOON POSTER PRESENTATIONS	15
GRADUATE ABSTRACTS	
COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT	22
COLLEGE OF ENGINEERING	24
COLLEGE OF LETTERS AND SCIENCE.....	24
INTERDISCIPLINARY PROGRAMS, THE GRADUATE SCHOOL	28
UNDERGRADUATE ABSTRACTS	
COLLEGE OF AGRICULTURE	29
COLLEGE OF ARTS AND ARCHITECTURE.....	33
COLLEGE OF BUSINESS.....	40
COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT	41
COLLEGE OF ENGINEERING	44
COLLEGE OF LETTERS AND SCIENCE.....	62
COLLEGE OF NURSING	97
UNIVERSITY COLLEGE	99
ALPHABETICAL LISTING OF STUDENTS	100

Conference Map



Topical Sessions—SUB Room 233

Thursday, April 19, 10:00am-12:00pm

HUMANITIES—10:00AM-12:00PM

Storytelling, human relations, and literacy education are driving themes in this session, as researchers in Religious Studies and English present on projects ranging from study of religious tolerance, to literacy criticism and a fantasy novel, to the creation of youth writing camps and cultural criticism of school yearbooks.

10:10 – Chait Johar, Mechanical and Industrial Engineering (Barton Scott)

Study of Indonesia as a Paragon of Tolerance in Religion using ISKCON as a Test Case

10:30 – Nathan Phillips, English (Gretchen Minton)

Not True to Troilus, Nor False to Cressid: An Introduction to Shakespearean Textual Editing in Troilus and Cressida

10:50 – Erick Lake, Mathematical Sciences (Kris Ellingsen)

Rebirth

11:10 – Angie Ford, English (Doug Downs)

College Retention Initiatives at a High School Level: When Undergraduate Students Lead Summer Writing Camps

11:30 – Amber Kleven, English (Lisa Eckert)

Yearbooks as a Force in Representing and Developing Adolescence

Topical Sessions—SUB Room 235

Thursday, April 19, 10:00am-12:00pm

SUSTAINABILITY—10:00AM-12:00PM

Join us for a special selection of presentations with a focus on sustainability and the environment.

10:00 – Welcome

10:10 – Poster Viewing *

10:30 – Colin Reutter, Physics (Hugo Schmidt)

Analysis and mitigation of oxygen electrode delamination in solid electrolyzer cells

10:45 – Amber Schmit, Chemical and Biological Engineering (Christine Foreman)

Microbial isolates from Antarctica

11:00 – Erik Anderson, Electrical and Computer Engineering (Joseph Shaw)

Winterization and Upgrade of Remote Weather Station

11:15 – Poster Viewing*

11:30 – Bozeman Eats Screening—Samuel Atkins & Dylan Strike, Cell Biology & Neuroscience, Sustainable Foods & Bioenergy, (Jaime Jelenchich Jacobsen)

Bozeman Eats: A Documentary Film Surveying Food in the Gallatin Valley

***Cassidy Fisher, Mechanical and Industrial Engineering (Douglas Cairns)**

The Effects of Defects in Wind Turbine Blade Manufacturing

Sarah Johnson, Civil Engineering (Otto Stein)

Soil Redox Potential in Constructed Wetlands for Wastewater Treatment

Dayla Morris, Chemical and Biological Engineering (Robin Gerlach)

*Optimization and Kinetics of Ureolysis by *Sporosarcina pasteurii**

Dustin Talbert, Architecture (Ralph Johnson)

Reevaluating the Efficiency and Function of Regional Storage Units, a New Approach to Storage

Topical Sessions—SUB Ballroom C

Thursday, April 19, 9:00-11:00am & 2:00-6:00pm

MCNAIR SCHOLARS PROGRAM—9:00-11:00AM

RESEARCH SYMPOSIUM

This session will showcase the research of McNair Scholars from Liberal Studies, Religious Studies, Community Health, Cell Biology & Neuroscience, and Engineering.

- 9:00 – Jennifer Thornburg, English & Liberal Studies (Jerome Coffey)**
The Dream of the Rood, Translation and Book Project
- 9:20 – Troy Duker, History and Philosophy (Lynda Sexson)**
Go Down Moses: The Myth and Politics of Black Leadership
- 9:40 – Yanet Eudave, Health and Human Development (Bethany Letiecq)**
Coping and Mental Health Among Mexican Migrants in a New Frontier Settlement
- 10:00 – Shane Close, Psychology (Ian Handley)**
Hydration on Psychological Processes
- 10:20 – Kaysha Young, Mechanical and Industrial Engineering (Laura Stanley)**
Voice Activated Texting – Is it safer than Conventional Texting While Driving?
- 10:40 – David Driscoll, Mechanical Engineering (Stephen Sofie)**
Mitigation of Nickel Coarsening in SOFC Applications Through Chemical Anchoring

HUGHES UNDERGRADUATE BIOLOGY PROGRAM—2:00-4:00PM

EXTENDING UNDERGRADUATE RESEARCH THROUGH EDUCATION AND OUTREACH

Hughes Scholars are students in bioscience-related fields who commit to performing both research and outreach over a 9 to 12 month period. Scholars are chosen for their academics, their previous experience doing undergraduate research, their capacity to discuss interesting topics in depth, and their outreach plan.

- 2:00 – Tiphani Lynn, Cell Biology and Neuroscience (Charles Grey)**
Let's Talk About... the Difficulties of Discussing Mental Health
- 2:20 – Kelly Spendlove, Mathematical Sciences (Tomas Gedeon)**
Decoding a Universal Language: Communicating Mathematics
- 2:40 – Laura Whitmore, Land Resources and Environmental Sciences (William Inskeep, Mark Kozubal)**
Keep on Keepin' On; the Challenges of Science Outreach in Local Schools
- 3:00 – Ares Geovanos, Chemical and Biological Engineering (Edward Dratz)**
Nerdpsyched! A Foray into Interviewing Scientists on KGLT
- 3:20 – Hadeel Alniemi, Cell Biology and Neuroscience (Martin Lawrence, Brian Eilers)**
Cool Chemistry with Acids and Bases

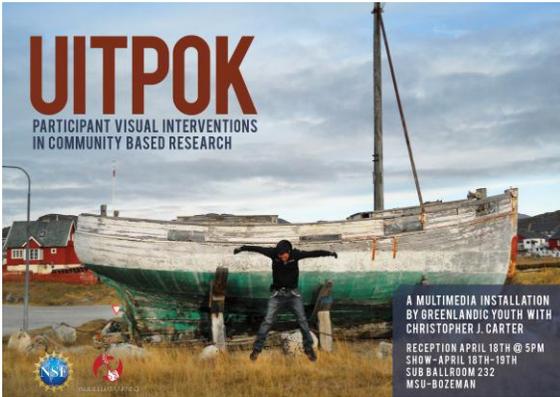
OPTICAL SCIENCE AND ENGINEERING—4:00-6:00PM

UNDERSTANDING AND USING LIGHT

Optics is the study and practical use of light. Topics discussed in this session will transition from the very small to large, as we explore the interaction of light with molecules, to fabrication of nano-scale optical structures, to the use of thermal infrared cameras to measure clouds in the atmosphere.

- 4:00 – Tom Weas, Physics (Aleksander Rebane)**
Broad-band telescope for focussing femtosecond pulses in two photon absorption spectroscopy experiments
- 4:20 – Geoffrey Wicks, Physics (Aleksander Rebane)**
A New Femtosecond Nonlinear Transmission Experiment for Accurate Determination of Intrinsic Two Photon Absorption Spectra of Non-Fluorescent Chromophores
- 4:40 – Alexandr Mikhailov, Physics (Aleksander Rebane)**
Validity of Two-Level Approximation for Two-Photon Absorption in the Lowest Electronic Transition of Dipolar Molecules
- 5:00 – Skyler Rydberg, Electrical and Computer Engineering (Wataru Nakagawa)**
Fabrication of Optical Nanostructures Using HSQ Masks
- 5:20 – Ethan Keeler, Electrical and Computer Engineering (Wataru Nakagawa)**
Near-Infrared Polarization Optics using Nanostructured Silicon
- 5:40 – Brian Redman, Electrical and Computer Engineering (Joseph Shaw)**
Testing a Low-cost All-Sky Infrared Cloud Imager

Visit these STUDENT EXHIBITS!



Understanding Emerging Stressors and Adaptations in Generational Ranching Operations through Participant Visual Ethnography (Abst. Pg. 99)

Christopher Carter, Directed Interdisciplinary Studies
Mentor: Ann Bertagnolli, University Honor Program
SUB 232, April 18th-19th

Surfaces of Auschwitz (Abst. Pg.36)

Milenka Jirasko, Architecture
Mentor: Marie O'Neill, Architecture
Cheever Lower Gallery, April 1st-21st



Stav-Kirke [Norwegian Stave Churches] (Abst. Pg. 37)

Benjamin Larson, Architecture
Mentor: Bill Clinton, Architecture
Cheever Lower Gallery, April 1st-21st

My Skeletons Prefer the Kitchen (Abst. Pg. 40)

Jordan Thornton, Art
Mentor: Sara Mast, Art
Helen E. Copeland Gallery in Haynes Hall, April 16th-27th



MORNING POSTER PRESENTATIONS

SUB Ballrooms A, B, and D
 9:30am-12:30pm

Student, Mentor, Project	Poster #	Abstract Page #
Anna Bartkowiak: Health & Human Development Adina Smith -- Health & Human Development <i>Graduate Counseling Students' Growth</i>	1	23
Erika Lacy: Cell Biology & Neuroscience Mensur Dlakic -- Microbiology <i>Fluorescent Probes for Detecting Protein Interactions in Bacteria</i>	2	79
Kelly Spendlove: Mathematical Sciences Tomas Gedeon -- Mathematical Sciences <i>Predicting Critical Transitions in Complex Dynamical Systems</i>	3	91
Erin Smith: Chemistry & Biochemistry Michael Franklin -- Center for Biofilm Engineering <i>Alginate Epimerization by AlgG</i>	4	91
Amy Bloemendal: Health & Human Development John Seifert -- Health & Human Development <i>Blood glucose/lactate responses from ingesting high fructose corn syrup and sucrose beverages</i>	5	22
Meghan Huntoon: Psychology Jessi Smith -- Psychology <i>I'm Incredible!: Consequences of Violating the Modesty Norm</i>	6	25
Matthew Handley: Electrical & Computer Engineering Dave Klumpar, Ehson Mosleh -- Space Science & Engineering Laboratory <i>Using Solar Panel Data to Model In-Orbit Spacecraft Dynamics</i>	7	50
Ian Jefferies: Psychology Ian Handley -- Psychology <i>The Placebo Effect: The Result of Biased Information Acquisition?</i>	8	77
David Halat: Chemistry & Biochemistry Rob Walker -- Chemistry & Biochemistry <i>Studies of Solid Oxide Fuel Cells (SOFCs) and SOFC Materials with High-Temperature Raman Spectroscopy</i>	9	75
Justin Brewer: Cell Biology & Neuroscience Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience, Immunology & Infectious Diseases <i>Isolation and Cloning of zic Genes in Chick</i>	10	66
Natasha Cronsell: Health & Human Development Amy Cory -- Health & Human Development <i>Parent Perspectives on Opportunities for Healthy Physical Activity and Recreation for Young Children in Bozeman</i>	11	41
Rachel Ruggles: Cell Biology & Neuroscience Roger Bradley -- Cell Biology & Neuroscience <i>Rescuing NFPC defects in Xenopus Embryos</i>	12	89
Andrew Crawford: Mechanical & Industrial Engineering David Klumpar, Ehson Mosleh, David Racek -- Space Science and Engineering Laboratory <i>Multiple Spacecraft Adaptability for Small Satellite Ground Operations</i>	13	47
Edward Gall: Liberal Studies Leah Schmalzbauer -- Sociology & Anthropology <i>Studying Abroad In South America: Ethnographic Images and Short Films</i>	14	73
Virginia Schmidt: Sociology & Anthropology Tamela Eitle -- Sociology & Anthropology <i>Language & Inequality in Post-Colonial African Nations</i>	15	90

Student, Mentor, Project	Poster #	Abstract Page #
Carla Hutson: English Christa Merzdorf -- Cell Biology & Neuroscience <i>Are the "wings" of zic1 expression a part of the pre-migratory neural crest?</i>	16	76
Melis Penic: Chemical & Biological Engineering Michael Franklin -- Microbiology <i>Visualization and Characterization of the Pseudomonas aeruginosa Biofilm Matrix with Fluorescent Staining</i>	17	55
Jankiben Patel: Plant Sciences & Plant Pathology Chaofu Lu -- Plant Sciences & Plant Pathology <i>Generation of a T-DNA Mutagenized Camelina Population</i>	18	31
Hazal Ural: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Copying Nature: Chemical Synthesis of a Possible Catalytic Compound for H2 Generation</i>	19	93
Hauwa Yusuf: Computer Science Clemente Izurieta -- Computer Science <i>EAS: Efficient and Accurate Statistics</i>	20	61
Kevin Bangen: Mechanical & Industrial Engineering Chris Jenkins -- Mechanical & Industrial Engineering <i>Membrane Tearing</i>	21	45
Erik Anderson: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Winterization and Upgrade of Remote Weather Station</i>	22	44
Matthew Sherick: Chemical & Biological Engineering Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Analysis of Homogeneous and Inhomogeneous Gelation of Alginate Derived from Pseudomonas aeruginosa</i>	23	57
Jean-Paul Toussaint: Chemical & Biological Engineering Ross Carlson, Florence Mus -- Chemical & Biological Engineering <i>Metabolic analysis of lipid accumulation in a microalga</i>	24	58
Bridget Bergin: Mechanical & Industrial Engineering Sarah Codd -- Mechanical & Industrial Engineering <i>NMR Technologies for Monitoring Biological and Geochemical Processes in the Subsurface</i>	25	45
Hannah Newhouse: Chemical & Biological Engineering Brent Peyton -- Chemical & Biological Engineering <i>Optimization of Lipid Accumulation in Green Algae Using a Photobioreactor and Connections between Algal DNA</i>	26	55
Kayla Babbitt: Mechanical & Industrial Engineering Stephen Sofie -- Mechanical & Industrial Engineering <i>Design and Development of a Seebeck Coefficient Measurement System</i>	27	45
Cheyenne Lesky: Chemistry & Biochemistry Ann Bertagnolli, Darcy Hunter -- Montana INBRE, Montana WIC <i>Improving Client Turnout at WIC through Text Communication</i>	28	80
Brett Green: Physics Hugo Schmidt -- Physics <i>Characterization of Strontium-doped Lanthanum Manganite Solid Oxide Fuel Cell Cathodes</i>	29	74
Brett Green: Physics John Neumeier -- Physics <i>Superconductivity in Alkali-doped Dibenzopentacene</i>	30	74
Ethan Berg, Sean Stettner: Cell Biology & Neuroscience, Bioengineering Steve Hamner -- Microbiology <i>Microbial Source Tracking of Escherichia coli in the Little Big Horn River, Montana</i>	31	64
Charles Hart: Ecology Michael Ivie -- Plant Sciences & Plant Pathology <i>A Faunal Treatment of the Cerambycidae of Montana</i>	32	75
George Schaible: Plant Sciences & Plant Pathology Gary Strobel -- Plant Sciences & Plant Pathology <i>Characterization of Novel Endophytic Isolate Or10-4 and Analysis of Increased Bio-Activity by Addition of Esters</i>	33	90

Student, Mentor, Project	Poster #	Abstract Page #
Mark Boyd: Agricultural Economics & Economics William Dyer, Barbara Keith -- Plant Sciences & Plant Pathology, Land Resources & Environmental Sciences <i>GST Study in Wild Oats</i>	34	29
Natasha Pettinger -- Cell Biology & Neuroscience Bern Kohler -- Chemistry & Biochemistry <i>Charge Transfer Dynamics in Photosensitizer-Hydrogenase Systems</i>	35	86
Virginia Price - Physics Nathan Pust -- Electrical & Computer Engineering <i>IRIS Spectrograph Competition</i>	36	87
Ryan Scanlon: Earth Sciences Mark Skidmore -- Earth Sciences <i>Stable Isotopic Investigatino of Basal Ice, Taylor Glacier Antarctica</i>	37	90
David Rey: Earth Sciences David Mogk, Colin Shaw -- Earth Sciences <i>Quantitative analysis of reactive transport processes in potential carbon sequestration reservoir rocks</i>	38	88
Patricia Glatz: Mechanical & Industrial Engineering Ed Adams -- Civil Engineering <i>Modeling Snow Temperature in Complex Topography</i>	39	49
Forrest Jarvi, Aaron Whittenburg: Sociology & Anthropology Michael Neeley -- Sociology & Anthropology <i>A Comparison of Broken and Complete Bladelets from TBAS 102, a Natufian Site in West-Central Jordan</i>	40	77
Elizabeth Byron, Alex Wittorff: Invited Guest, Byron HS Mari Eggers, Sue Broadaway -- Microbiology <i>Inorganic Nutrient Variability in Prairie Potholes</i>	41	67
Sophia Froelich: Cell Biology & Neuroscience Brian Bothner, Joshua Heinemann -- Chemistry & Biochemistry <i>Oxidative Stress and the Metabolism of Sulfolobus solfataricus</i>	42	73
Amanda Kelley: Chemistry & Biochemistry Martin Teintze -- Chemistry & Biochemistry <i>Guanides as X4 HIV Inhibitors, Antibiotics and Inhibitors of Cancer Metastasis</i>	43	77
Blaine Fritz: Cell Biology & Neuroscience Darla Goeres -- Center for Biofilm Engineering <i>Evaluation of 3M Petrifilm as an equivalent alternative to drop-plating on agar plates in a biofilm system</i>	44	73
Brent Zundel: Civil Engineering Bridget Kevane -- Modern Languages & Literatures <i>San Juan El Espino Road Crossing</i>	45	61
Hannah Arm: Mechanical & Industrial Engineering Sarah Codd, Joe Seymour, Jennifer Brown -- Mechanical & Industrial Engineering, Chemical & Biological Engineering <i>Temperature Control System for Supercritical Flow of Brine and CO2</i>	46	45
Reid Loessberg: Music Rob Maher, Kristi McGarity -- Electrical & Computer Engineering, Music Technology <i>Acoustic Analysis of Campus Classrooms: How Do Acoustics Effect a Learning Space?</i>	47	37
Jude Eziashi: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Chromium Volatility: Assessment of Quantifying Techniques</i>	48	48
Eric Hjelvik: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Determination of Thin Film Thickness</i>	49	50
Alissa Bleem: Chemical & Biological Engineering Ross Carlson, Hans Bernstein -- Chemical & Biological Engineering <i>The Design and Characterization of Artificial Biofilms: Microbial Catalyst Platforms Based on Photo-Autotrophic Syntrophy</i>	50	46
Terri Spray -- Film & Photography Alexis Pike -- Film & Photography <i>Elderly of Gallatin Valley</i>	Framed Artwork 1	39

Student, Mentor, Project	Poster #	Abstract Page #
Terri Spray: Film & Photography Christina Anderson -- Film & Photography <i>Still a Family</i>	Framed Artwork 1	39
Trudi Fisher: English Doug Downs -- English <i>Hooks are for fishing: Preparing students for writing across their curriculum</i>	51	71
Jennifer Thornburg: English, Liberal Studies Jerome Coffey -- English <i>The Dream of the Rood</i>	52	93
Shelby Rogala: History & Philosophy Kristen Intemann -- History & Philosophy <i>The ethics of aid: Is voluntourism ever ethical?</i>	53	89
Jesse Cook: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Lactose-functionalized PAMAM Dendrimer Effects on Cancer cell Aggregation</i>	54	70
Amanda Dorch: Chemical & Biological Engineering Garth James -- Center for Biofilm Engineering <i>Three-Species Chronic Wound Model: Targeting Specific Species with Antibiotics</i>	55	48
Lydia Anderson: Ecology David Sands -- Plant Sciences & Plant Pathology <i>Sustainable biocontrol of Striga (witchweed) in Kenya using an enhanced biocontrol fungus</i>	56	62
Sarah Novotney: Health & Human Development Wade Hill -- Nursing <i>A Cross-Cultural Comparison of Standards of Care for Anterior Cruciate Ligament (ACL) Injury</i>	57	43
Hannah Wilson: History Frankie Jackson -- Earth Sciences <i>Comparison of Two Methods Used to Calculate Water Vapor Conductance in Modern and Fossilized Eggshell</i>	58	95
Paul Quigley: Film & Photography Gianna Savoie -- Film & Photography <i>No Limbitations</i>	59	38
Juniper Chapman: English Marvin Lansverk, Doug Young -- English, Agricultural Economics <i>From the Father of Economics to Freakonomics: A Literary Study of Economic Texts and their Socioeconomic Contexts</i>	60	68
Dan Buettner: Film & Photography Christina Anderson -- Film & Photography <i>Less Than 983: Small Towns of Montana</i>	61	34
Dan Buettner: Film & Photography Ian van Coller -- Film & Photography <i>Out of Sight, Out of Mind</i>	62	34
Dan Buettner: Film & Photography Christina Anderson -- Film & Photography <i>Junk Mail</i>	63	34
Andrew Rivers: Psychology Ian Handley -- Psychology <i>An Inkblot for Unconscious Thought: Examination of Nonconscious Implicit Attitude Change</i>	64	27
Amber Ferris: Psychology Jessi Smith, Keith Hutchison -- Psychology <i>Stop Interfering! Understanding how Stereotype Threat reduces Working Memory Capacity by using the Dual Processes Model.</i>	65	24
Gregory Ruegsegger: Health & Human Development Mary Miles -- Health & Human Development <i>Effects of eccentric muscle contraction and a high- or low-glycemic diet on inflammation</i>	66	44
Kristi Stefani: Psychology Ian Handley -- Psychology <i>Just Don't Think! The Role of Unconscious Thought in Attitude Change</i>	67	92

Student, Mentor, Project	Poster #	Abstract Page #
Kala Jauquet: Health & Human Development Mary Miles -- Health & Human Development <i>Cultural and Economic Factors Affecting Diet and Nutrition in Children in Khwisero, Kenya</i>	68	42
Kelly Christensen: Microbiology Wade Hill -- Nursing <i>A Cross-Cultural Comparison of Perinatal HIV Transmission In the United States and Thailand</i>	69	68
Hadeel Alniemi: Cell Biology & Neuroscience Martin Lawrence, Brian Eilers -- Chemistry & Biochemistry <i>Examining A109 Protein in Sulfolobus Turreted Icosahedral Virus from Yellowstone National Park</i>	70	62
Connor Murnion: Cell Biology & Neuroscience Frances Lefcort, Amy Eibs -- Cell Biology & Neuroscience <i>Identification of genes regulated by IKBKAP: Investigating why neurons die in the disease Familial Dysautonomia</i>	71	84
Jaclyn Peick: Cell Biology & Neuroscience Ann Bertagnolli, Lori Christenson -- Montana INBRE, Gallatin County Food Bank <i>Celiac Disease: Wheat's Role in our Lifestyles and The Cost of Going Gluten Free</i>	72	86
Jordan Kennedy: Mechanical & Industrial Engineering Jennifer Brown -- Chemical & Biological Engineering <i>Rheological Characterization of Alginate Gel</i>	73	52
Joshua Stringam: Chemical & Biological Engineering Robin Gerlach, Ellen Lauchnor, Adrienne Phillips -- Center for Biofilm Engineering, Environmental Engineering <i>Continued development of an injection strategy for homogenous calcium carbonate distribution by Sporosarcina pasteurii</i>	74	58
Katherine Warthen: Chemical & Biological Engineering Ellen Lauchnor, Robin Gerlach -- Center for Biofilm Engineering <i>The Effectiveness of Various Herbal Kidney Medications</i>	75	59
Kyle Mehrens: Earth Sciences Adam Sigler -- Land Resources & Environmental Sciences <i>Nitrate-N concentrations and their impact on water quality throughout Gallatin Valley</i>	76	82
Eric Hansen: Civil Engineering Mike Berry -- Civil Engineering <i>Mechanical Properties of Portland Cement Concrete with Reclaimed Asphalt Pavement Aggregate</i>	77	24
Ares Geovanos: Chemical & Biological Engineering Edward Dratz -- Chemistry & Biochemistry <i>Electrokinetic protein extraction from polyacrylamide gels with in-line microfluidic digestion and integrated mass-spectral analysis</i>	78	49
Wesley Beougher: Chemistry & Biochemistry Cate Burgess -- Chemistry & Biochemistry <i>Determining the Structure and Function of AcxR Dependent Sigma54 Regulation of Acetone Carboxylase Expression</i>	79	64
Mark Abbey-Lambertz, Megan Layhee: Land Resources & Environmental Sciences Robert Peterson, Andrew Ray, Adam Sepulveda -- Land Resources & Environmental Sciences, Northern Rocky Mountain Science Center <i>Suppressing invasive bullfrogs with carbon dioxide</i>	80	29
Elizabeth (Betsy) Webb: Education Art Bangert -- Education <i>What is Good and What is Right: Ethics in Montana Municipal Government</i>	81	23
Hillary Stacey -- Chemistry & Biochemistry Charles (Bill) McLaughlin -- Chemistry & Biochemistry <i>Group Online E-chats as Learning Aides for Analytical Chemistry</i>	82	92
Hunter Metcalf: Business Agnieszka Kwapisz -- Business <i>Factors Influencing Student Retention in Higher Education</i>	83	41
Jeremiah Prummer: Business Graham Austin -- Business <i>B2C Communication & Permission Marketing</i>	84	41

Student, Mentor, Project	Poster #	Abstract Page #
Brandon Beck: Psychology Keith Hutchison -- Psychology <i>Subliminal Stroop</i>	85	64
Eric Strubeck: Health & Human Development John Seifert -- Health & Human Development <i>Hydration Perceptions, Hydration Practices and Reaction Times of Fighter and Helicopter Pilots</i>	86	26
Esther Yoon: Cell Biology & Neuroscience Laura Larsson -- Nursing <i>Perceptions of Digital Signage among Health Department Clients</i>	87	96
Michelle Dallas: Film & Photography Ian van Coller, Christina Anderson, Alexis Pike -- Film & Photography <i>Memories</i>	88	35
Jill Melcher: English Lynda Sexson -- History, Philosophy, & Religious Studies <i>Teaching World Religion in the West Through Western Religious Imagery</i>	89	83
Parker Hilton: Film & Photography Ian van Coller -- Film & Photography <i>The Jersey Shore</i>	90	36
Nathan Carroll: Earth Sciences Ilse Mari-Lee, David Varricchio -- University Honors Program, Earth Sciences <i>Pterosaurs as a Teaching Tool</i>	91	68
Nathan Stansfield -- Earth Sciences Colin Shaw -- Earth Sciences <i>Microstructural Analysis of Quartz Samples from Bald Butte Porphyry</i>	92	92
Elizabeth Kruk: Earth Sciences Frankie Jackson, Colin Shaw, David Varricchio -- Earth Sciences <i>Applications of Electron Backscatter Diffraction on Fossilized Dinosaur and Modern Eggshell</i>	93	79
Amanda Zellar: Ecology Rebecca Mattix -- Immunology & Infectious Diseases <i>Treatment of Foot Disease in Captive Asian Elephants in Northern Thailand</i>	94	96
Jyoti Sharma: Mechanical & Industrial Engineering Laura Stanley -- Mechanical & Industrial Engineering <i>Modeling the validity and transfer of eye-scanning patterns for hazard perception from virtual reality training environments to reality</i>	95	57
Kaysha Young: Mechanical & Industrial Engineering Laura Stanley -- Mechanical & Industrial Engineering <i>Hands Free Texting While Driving - Is It Safer than Conventional Texting While Driving?</i>	96	61
Elizabeth Flesch: Ecology Robert Garrott -- Ecology <i>Population trends of bighorn sheep and mountain goats in the Greater Yellowstone Area</i>	97	72
Cameron Clevidence: Ecology Christopher Guy -- Ecology <i>Dietary Assessment of Yellowstone Cutthroat Trout in Yellowstone Lake, Yellowstone National Park</i>	98	69
Tor Bertin: Ecology David Willey -- Ecology <i>Modeling carnivore sign data: A case study with the carnivore guild in a ranch in eastern Montana</i>	99	65
Daniel Barta: Earth Sciences David Varricchio -- Earth Sciences <i>A Cladistic Approach to Understanding Dinosaur Egg Diversity and the Evolution of Reproductive Traits Within Dinosauria: Preliminary Results</i>	100	63
Lena Heuscher: Physics Joseph Shaw -- Electrical Engineering <i>Gallatin Valley Winds</i>	102	76
Mark Gockenbach: Physics Bennett Link -- Physics <i>The Equation of State of Neutron Stars</i>	103	74

Student, Mentor, Project	Poster #	Abstract Page #
Samuel Carlson: Land Resources & Environmental Sciences Brian McGlynn -- Land Resources & Environmental Sciences <i>Quantifying Watershed Storage Dynamics using long duration high frequency measurements of Precipitation, Runoff, and Evapotranspiration</i>	104-105	30
Katelyn Weber: Mathematical Sciences Lucy Marshall, Mark Greenwood -- Land Resources & Environmental Sciences, Mathematical Sciences <i>A Clustering Approach to Hydrological Predictions in Ungauged Basins</i>	106	94
Christopher White: Chemical & Biological Engineering Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Detection of Oil Under Sea Ice Using NMR Technology</i>	107	60
Gary Michelfelder: Earth Sciences Todd Feeley -- Earth Sciences <i>Observations On The Origin Of Across-Strike Geochemical Variations In Quaternary Silicic Lava Flows From The Andean Central Volcanic Zone: Comparison Of Data From Individual Eruptive Centers</i>	108	26
James Mauch: Earth Sciences Jim Schmitt -- Earth Sciences <i>Characterizing and interpreting the morphology of fan-shaped depositional landforms along the Madison Range front, SW Montana</i>	109	81
Christie Blaskovich: Chemistry & Biochemistry Laura Mentch, Ann Bertagnolli -- BridgerCare, Montana INBRE <i>Evaluation of Misconceptions about Unplanned Pregnancy and Contraception Among 20--29 year old Women</i>	111	65
Dewey Brooke: Chemistry & Biochemistry Brian Bothner, Mavis Agbandje-McKenna -- Chemistry & Biochemistry, Biochemistry & Molecular Biology (University of Florida) <i>Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry</i>	112	67
Taisha McWilliams, Craig Kozeluh: Cell Biology & Neuroscience Steve Stowers -- Cell Biology & Neuroscience <i>Optogenetic Circuit Mapping In Drosophila Larvae</i>	113	82
Luke Zanella: Mechanical & Industrial Engineering Robb Larson -- Mechanical & Industrial Engineering <i>Avalanche Airbag Deployment System</i>	114	62
Nicholas Miles: Liberal Studies, Environmental Studies Florence Dunkel -- Plant Sciences & Plant Pathology <i>Addressing grasshopper (Melanopus differentialis) herbivory, and the feasibility of developing biological/locally acquired applications' for determent</i>	115	83
Megan Dunbar: Film & Photography Alexis Pike -- Film & Photography <i>Your Place and Mine</i>	116	35
Jordan Thornton: Art Sara Mast, Rollin Beamish -- Art <i>My Skeletons Prefer the Kitchen</i>	117	40
Robert Rodgers: Art Dean Adams -- Art <i>The Business of Art</i>	118	38
Samuel Bernhard: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Analysis of GAL3 and Lactose functionalized PAMAM Binding by EPR</i>	119	65

AFTERNOON POSTER PRESENTATIONS

SUB Ballrooms A, B, and D
 I:30pm-4:30pm

Student, Mentor, Project	Poster #	Abstract Page #
Melissa Robertson: Microbiology Marcella McClure -- Microbiology <i>Are Significant Differences in Retroid Content Discernable Between Individuals?</i>	1	26
Emma Murter: Nursing Eric Boyd -- Chemistry & Biochemistry <i>Microbial Diversity Associated with Bioherms Inhabiting the Hypersaline Environment of the Great Salt Lake</i>	2	98
Kyle Oliver: Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>Stress engineering for free-standing SU-8 2002 thin film devices</i>	3	55
Krista Drummond: Electrical & Computer Engineering Wataru Nakagawa -- Electrical & Computer Engineering <i>Development and Optimization of Surface Plasmon-Polariton Based Sensing System</i>	4	47
Alisa Dvarishkis: Cell Biology & Neuroscience Steven Stowers -- Cell Biology & Neuroscience <i>Somatosensory Neural Circuit Mapping</i>	5	71
Kyler Kingston: Chemistry & Biochemistry Christa Merzdorf, Elena Kalinina-Turner -- Cell Biology & Neuroscience <i>Role of Zic Family of Transcription Factors in Early Neural Development</i>	6	78
Charles Crellin: Cell Biology & Neuroscience Ann Bertagnolli, Buck Taylor -- Montana INBRE, Community Health Partners <i>Healthy Montana Kids</i>	7	70
Felicia Rogers -- Film & Photography Paul Monaco -- Film & Photography <i>Paranormal Detectives</i>	8	39
Erin Clark: Psychology Bethany Letiecq -- Health & Human Development <i>Perceptions of civil unions, the benefits of marriage, and the legalities of relationship recognition</i>	9	69
Hannah Wahlert, Katelyn Weber, Mackenzie Weber: Political Science, Mathematical Sciences, History Christina Hayes -- Mathematical Sciences <i>LGBT Resource Center Necessary</i>	10	93
Collin Preftakes -- Land Resources & Environmental Sciences Robert Peterson -- Land Resources and Environmental Sciences <i>Bystander exposure to ultra-low-volume insecticide applications used for adult mosquito management</i>	11	31
Thomas Bogen: Land Resources & Environmental Sciences Rich Macur -- Center for Biofilm Engineering <i>Towards standardized methods for the analysis of algal lipids: Total lipid content</i>	12	29
Sarah Riordan: Architecture Ralph Johnson -- Architecture <i>Energy Saving Possibilities in local Medical Clinics throughout the Gallatin Valley</i>	13	38
Natasza Lorentz: Cell Biology & Neuroscience Wade Hill -- Nursing <i>Access to Healthcare in Chiang Mai, Thailand</i>	14	80
Rachel Huleatt: Nursing Wade Hill -- Nursing <i>Asthma and Air Quality in Northern Thailand</i>	15	98

Student, Mentor, Project	Poster #	Abstract Page #
Justin Stewart: Film & Photography Ian van Coller -- Film & Photography <i>Khwisero</i>	16	39
Courtney Peck: Physics Kevin Repasky -- Physics <i>Design, Construction, and Implementation of a Solar Spectrograph for the National Student Solar Spectrograph Competition</i>	17	85
Alyssa Peck: Mathematical Sciences Mark Greenwood -- Mathematical Sciences <i>Methods for exploring life course trajectories of MSGC significant award winners</i>	18	85
Cassidy Fisher: Mechanical & Industrial Engineering Douglas Cairns -- Mechanical & Industrial Engineering <i>The Effects of Defects in Wind Turbine Blade Manufacturing</i>	19	48
Christopher Fisher: Agricultural Economics & Economics Dominic Parker -- Agricultural Economics & Economics <i>Resource Endowments and Economic Development in Central Africa</i>	20	72
Matthew Schmidt: Land Resources & Environmental Sciences Rich Macur -- Land Resources & Environmental Sciences <i>Alkaliphilic Microalgae for Biofuel Production: Scaling-up to 50 Liter Bag Bioreactors</i>	21	32
Abigail Lair: Business Agnieszka Kwapisz -- Business <i>Factors Influencing Adult Full Day Ski Ticket Prices in the U.S.</i>	22	40
Alix Wittmayer: Agricultural Economics & Economics Anton Bekkerman -- Agricultural Economics & Economics <i>Identifying the Relationship Between Feed Intake and Bull Health: A Data-driven Analysis</i>	23	32
Benjamin Schwarz: Chemistry & Biochemistry Trevor Douglas -- Chemistry and Biochemistry <i>Enzyme encapsulation in the P22 viral capsid as a platform for biological nanoreactors</i>	24	27
Wade Wilkison: Mechanical & Industrial Engineering Ronald June -- Mechanical & Industrial Engineering <i>Characterization of Initial Flight Path by Optical Applications and Sensor Technology</i>	25	60
William Dupree: Physics Lisa Davis -- Mathematical Sciences <i>When a Traffic Light Turns Green, a Study of Traffic Flow Using Partial Differential Equations</i>	26	71
Casey Donovan: Mathematical Sciences Lukas Geyer -- Mathematical Sciences <i>Multifractal Analysis of Heart Beat Interval Time Series</i>	27	70
Whitney Ann Gilkerson: Nursing Sandra Kuntz -- Nursing <i>Partnership for Pediatric Environmental Health on the Flathead Reservation</i>	28	98
Annelise Baker: Nursing Edward Dratz, Jared Bowden -- Chemistry & Biochemistry <i>A Screening Method of Hydrophobic Binding Capacity for Human Serum Albumin</i>	29	97
Kara Landolfi, Leanna Hansen: Health & Human Development, Cell Biology and Neuroscience Alison Harmon -- Health & Human Development <i>Evaluation of the Impact of Food Insecurity Education</i>	30	42
Katherine Chambers: University Studies Ann de Onis -- Education <i>The Irish Experience of War</i>	31	99
Nicquel Porch: Cell Biology & Neuroscience Wade Hill -- Nursing <i>Contrasting Alternative Medicine Availability in Western & Eastern Environments</i>	32	87
Thomas Wright: Chemistry & Biochemistry Martin Teintze -- Chemistry & Biochemistry <i>Mechanism of Antibacterial Guanides Specifically Against MRSA USA300</i>	33	95
William Kirk: Physics Hugo Schmidt -- Physics <i>Characterization of Cathode Polarization</i>	34	78

Student, Mentor, Project	Poster #	Abstract Page #
Joshua Sinrud: Physics Hugo Schmidt -- Physics <i>Solid Oxide Fuel Cell Test Rig</i>	35	91
Christopher Kratz: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Zinc-Air Technology: A Proposal for Clean and Sustainable Energy Research</i>	36	52
Yasmin Chaudhry: Civil Engineering Joel Cahoon -- Civil Engineering <i>Hydraulic Rating of Functional Fish Barriers</i>	37	46
Laura Whitmore: Land Resources & Environmental Sciences William Inskeep, Mark Kozubal -- Land Resources & Environmental Sciences <i>Autotrophic Carbon Fixation in Crenarchaeota from Yellowstone National Park</i>	38	32
Kiera McNelis: Chemical & Biological Engineering Otto Stein -- Chemical & Biological Engineering <i>Investigating Impacts of Human Urine as a Fertilizer in Khwisero, Kenya</i>	39	53
Rajit Podder -- Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>Zoom lenses based on variable power optics</i>	40	55
Sarah Mondl, Jesse Shirley, Dylan Abraham: Electrical & Computer Engineering, Computer Science Hunter Lloyd -- Computer Science <i>Computer Vision in Underwater Navigation Systems</i>	41	44
Jesse Shirley, Dylan Abraham, Sarah Mondl: Computer Science, Computer Engineering Hunter Lloyd -- Computer Science <i>AUV - Automated Unmanned Vehicle for the RoboSub 2012 competition</i>	41	54
Dylan Abraham, Jesse Shirley, Sarah Mondl: Computer Science, Computer Engineering Hunter Lloyd -- Computer Science <i>RoboSub</i>	41	58
Jesse Ruzicka: Chemistry & Biochemistry Brian Bothner, Vamseedhar Rayaprolu -- Chemistry & Biochemistry <i>Measuring Virus Rigidity by QCM-D</i>	42	89
Brook Murphy: Cell Biology & Neuroscience Roger Bradley, Dana Rashid -- Cell Biology & Neuroscience <i>Restoring Expression of SNAI2 Protein after Apoptosis of Xenopus laevis Embryos</i>	43	84
Gregory Krantz: Molecular Biosciences Matthew Fields -- Center for Biofilm Engineering <i>Field Scanning Electron Microscopy and Growth Modelling of a Desulfovibrio alaskansis G20 Biofilm</i>	44	28
Linjie Zou: Mathematical Sciences Mark Greenwood, David Yopp -- Mathematical Sciences <i>Statistical Methods for Measuring the Impact of Mastery Learning in College Algebra</i>	45	97
Chelsie Wharton: Mechanical & Industrial Engineering Jennifer Brown, Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Rheological and Rheo-NMR Studies of Biopolymer and Polymer Solutions and Gels</i>	46	59
Michael McCambridge: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Silicon Carbide Oxidation and Environmental Barrier Coating Investigation</i>	47	53
Jeff Ibey: Computer Science Clemente Izurieta -- Computer Engineering <i>Micro-Compressor</i>	48	51
Madison Gabig: Architecture Gregory Young -- Music <i>Musi-Tecture: Using Correlations between Music and Architecture to Explore New Creative Processes and Inspiration</i>	49	35
Ashley Nettles: Film & Photography Ian van Coller -- Film & Photography <i>Bringing Back My Father</i>	Framed Artwork 1	38

Student, Mentor, Project	Poster #	Abstract Page #
Aidan Lynn-Klimenko: Film & Photography Ian van Coller -- Film & Photography <i>Mas o Menos</i>	Framed Artwork 2	40
Collin Avery: Film & Photography Alexis Pike -- Film & Photography <i>Remain Calm</i>	Framed Artwork 3	33
Collin Avery: Film & Photography Alexis Pike -- Film & Photography <i>Down this River</i>	Framed Artwork 3	33
Patrick Bakken: Film & Photography Jon Long -- Film & Photography <i>Discovering Family Lineage</i>	50	33
Paige Madison: Sociology & Anthropology Michael Reidy -- History & Philosophy <i>How Neandertal Conceptions were Built by Nineteenth-century European Scientists</i>	51	81
Erin Rinehart: Health & Human Development Ann Bertagnolli, Lynn Hellenga -- Montana INBRE, Montana Nutrition and Physical Activity Program <i>Montana Public Worksite Breastfeeding Support</i>	52	43
Larissa Donahue: Nursing Ann Bertagnolli, Kris Juliar, Renee Harris -- Montana INBRE, Montana Office of Rural Health/AHEC <i>An Evaluative Approach to Strengthening the Nursing Workforce</i>	53	97
Jacob Danczyk: Mechanical & Industrial Engineering Hugo Schmidt -- Physics <i>Characterization of Anode Nickel Coarsening in Solid Oxide Fuel Cells through Impedance Spectroscopy</i>	54	47
John MacDonald: Chemistry & Biochemistry Phillip Sullivan -- Chemistry & Biochemistry <i>Characterizing Photoswitches to Mimic Nerve Cell Repolarization</i>	55	81
Gourav Krishna Nandi: Mathematical Sciences Russell Walker: Mathematical Sciences <i>Cantor's Theory of Fractional Dimension and Large Infinities</i>	56	85
Tyler Bridges: Earth Sciences David Varricchio -- Earth Sciences <i>Microtaphonomy of Modern Deer Phalanges</i>	57	66
Jamie Raznoff: Plant Sciences & Plant Pathology William Hoch, Norm Weeden -- Plant Sciences & Plant Pathology <i>Development of a Simple Sequence Repeat (SSR) Genetic Map in Ornamental Viburnum</i>	58	31
Hannah Susorney: Earth Sciences Frankie Jackson, Colin Shaw -- Earth Sciences <i>Electron Backscatter Diffraction (EBSD) analysis of fossil turtle eggshell</i>	59	93
Ivy Merriot: American Studies Sara Mast, Terry Beaubois, Jeanne Moe -- Arts & Architecture, Sociology & Anthropology <i>The Big Horn Medicine Wheel: Native Science Research in Astronomical Place-Based Pedagogies</i>	60	25
Joe Geil: Art Dean Adams -- Art <i>Wild clay research</i>	61	36
Nicholas Danielson: Art Dean Adams -- Art <i>Wild Clay Research</i>	62	35
Lindsey Wolfe: Cell Biology & Neuroscience Frances Lefcort -- Cell Biology & Neuroscience <i>A Mouse Model for Familial Dysautonomia</i>	63	95
Kevin Murray: Chemistry & Biochemistry Robert Szilagyí -- Chemistry & Biochemistry <i>Electronic Structure Determination of [Fe]-hydrogenase model complexes</i>	64	84
Benjamin Smith: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Cryogenic Studies of DNA Excimers and Phosphorescence Decays</i>	65	91

Student, Mentor, Project	Poster #	Abstract Page #
Katharine Kujawa: Psychology Julie Wieseler - Psychology (University of Colorado, Boulder) <i>Dorsal root ganglion activation in below-level pain - 602</i>	66	79
Eileen Guthrie: Earth Sciences Colin Shaw -- Earth Sciences <i>Syntectonic microstructures record local strain on the Montana Transverse Zone</i>	67	75
Maxwell Moran: Land Resources & Environmental Sciences Rich Macur, Mark Kozubal -- Center for Biofilm Engineering, Land Resources & Environmental Sciences <i>Biofuel Production Using an Acidophilic Fungus</i>	68	30
Gavin Lommatsch: Electrical & Computer Engineering Joe Shaw -- Electrical & Computer Engineering <i>Airborne Thermal Imaging for Wildlife Surveys</i>	69	53
Daigo Yamamura: Earth Sciences James Schmitt -- Earth Sciences <i>Sandstone diagenesis as a proxy indicator of pore fluid geochemistry: implications for fossilization of vertebrate skeletal material in the Hell Creek Formation (Upper Cretaceous), Eastern Montana</i>	70	27
Eric Metz: Earth Sciences Frankie Jackson, Patrick Druckenmiller -- Earth Sciences <i>A New Polycotylid Specimen from the Bearpaw Shale of Montana</i>	71	83
Steven Hystad: Plant Sciences & Plant Pathology Dave Sands -- Plant Sciences & Plant Pathology <i>Metabolic Suppression of Water Hyacinth (Eichornia crassipes) Utilizing Amino Acid over-producing mutants of Fusarium oxysporum as a Biocontrol Agent</i>	72	30
Gal Keren-Aviram: Chemistry & Biochemistry Edward Dratz -- Chemistry & Biochemistry <i>Human Brain Proteomics in the Systems Biology of Epilepsy Project (SBEP)</i>	73	25
Michael McLoughlin: Microbiology Ed Schmidt -- Immunology and Infectious Diseases <i>The Development of Hepatocellular Carcinoma in Thioredoxin Reductase 1 Deficient Liver Cells</i>	74	82
Invited Guests -- INBRE, AIRO, & Native American Student Retention Initiative (Camper/Eggars)	75-86	
Jordan Dood: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Infrared Study of Exciton Migration in Single and Double Stranded DNA</i>	87	71
William Isbell: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Calibration of Weather Station Instruments and Heat Island Effects</i>	88	51
Thomas Weas: Physics Ron Hellings -- Physics <i>Using 'Filterpolation' with LISA/OMEGA Satellites to detect Gravitational Waves</i>	89	94
Sam Sorensen: Computer Science Clem Izurieta, Brock LaMeres, Wataru Nakigawa -- Computer Science, Electrical & Computer Engineering <i>Smart Power Strip</i>	90	58
Gwendolyn Courtney: Film & Photography Ian van Coller -- Film & Photography <i>Going Grey</i>	91	35
Jonah Barta: Liberal Studies Leah Schmalzbauer, Nancy Mahoney -- Sociology & Anthropology <i>Socio-Cultural and Economic Implications of EWB-MSU Development Projects In Khwisero, Kenya</i>	92	63
Russell Ricker: Mathematical Sciences Albert Parker, Tomas Gedeon -- Mathematical Sciences <i>Creating Soft Clusterings of Data Via the Information Bottleneck Method</i>	93	88
Jake Morison: Physics Galina Malovichko -- Physics <i>Modification of LiNbO₃ Properties with Tetravalent Dopants</i>	94	83
Erin Hafila: Civil Engineering Otto Stein -- Civil Engineering <i>Nitrogen Removal via Ammonium Adsorption to Gravel Sized Particles in Constructed Wetlands</i>	95	50

Student, Mentor, Project	Poster #	Abstract Page #
Patrick Flaherty: Mechanical & Industrial Engineering Joe Eldring -- Mechanical & Industrial Engineering <i>Snowboard Manufacturing Press</i>	96	49
Candace Goodman: Chemistry & Biochemistry Mary Cloninger, Greg Gillispie -- Chemistry & Biochemistry, Fluorescence Innovations Inc. <i>Aggregation Characterization of Lectin Interactions with Sugar-Functionalized Dendrimers</i>	97	24
Elise Young: Animal & Range Sciences David Sands -- Plant Sciences & Plant Pathology <i>Linking common factors in the phenomenon of protein clumping observed in several diseases</i>	98	33
Stefan Piontek: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>Chemical Film Formation at Liquid-Solid and Liquid-Vapor Interfaces: Correlating Film Organization with Molecular Structure</i>	99	87
Heather Blanchard: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>Molecular Partitioning Between Aqueous and Hydrophobic Environments</i>	100	65
Hamilton Lynn, Liz Hummelt: Sustainable Food & Bioenergy, Land Rehabilitation Catherine Zabinski -- Land Resources & Environmental Sciences <i>Determining Nutrient Availability in Gallatin Valley Organic Systems Through Comprehensive Soil Testing</i>	101-102	43
Adam Rothman: Chemical & Biological Engineering James Connolly, Robin Gerlach -- Center for Biofilm Engineering <i>Modeling Kinetics of Ureolytic Bacteria in Flow Systems</i>	103	56
Krishna Chattergoon: Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>High-speed focus control MEMS deformable mirror with controlled air damping</i>	104	46
Warren Colomb: Physics William Randall Babbitt -- Physics <i>Beam Conditioning via Output Coupler and Spatial Filter</i>	105	70
Heather Lee: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Publication and Distributions of the English-language translation of Bocar N'Diayes's Contribution à la connaissance des us et coutumes du Mali (On the Habits and Customs of Mali)</i>	106	80
Bronwyn Rolph: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>English Teaching Program in Mali</i>	107	89
Tessa Mosdal, Bronwyn Rolph, Christie Blaskovich, Samantha Hinckley: Civil Engineering, Modern Languages & Literatures, Art Ada Giusti -- Modern Languages & Literatures <i>Computer Education in Sanambele, Mali</i>	108	54
Christie Blaskovich: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Evaluation of Humanitarian Organizations in France</i>	109	66
Samantha Hinckley: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Effective Art Enhancement of MMAMA.net</i>	110	76
David Connor, Kendra McGahan: Health & Human Development John Seifert -- Health & Human Development <i>The Influence of Pre-Exercise Solid and Liquid Caloric Ingestion on Blood Glucose and Lactate</i>	111	22
Jessica Huggans: Psychology Ian Handley -- Psychology <i>Bottoms Up! Affects of Intoxication on the Unconscious Thought Process</i>	112	76
Craig Kozeluh, Taisha McWilliams: Cell Biology & Neuroscience Steven Stowers -- Cell Biology & Neuroscience <i>Optogenetic Circuit Mapping In Drosophila Larvae</i>	113	78
Douglas Burns: Cell Biology & Neuroscience Roger Bradley -- Cell Biology & Neuroscience <i>Relative Onset of NFPC in Xenopus Development</i>	114	67

Student, Mentor, Project	Poster #	Abstract Page #
Anna Zelaya: Microbiology Matthew Fields -- Molecular Biosciences <i>Microbial community analyses between groundwater and sediments injected with nitrate for biostimulation of chromium reduction at Hanford Site</i>	115	28
Tiphani Lynn: Cell Biology & Neuroscience Charles Gray -- Cell Biology & Neuroscience <i>Characterization of Gamma Frequency Synchronized Oscillations in Macaque Visual Cortex</i>	116	81
Luke Wheeler: Chemistry & Biochemistry Trevor Douglas -- Chemistry & Biochemistry <i>Incorporation of HNP-1 into a Protein Cage Architecture Based on the Bacteriophage P22</i>	117	95
Alexander Miller, Wyatt Maw: Film & Photography Dennis Aig, Paul Monaco -- Film & Photography <i>Silence; Senior Film</i>	127	37
Wyatt Maw, Alex Miller: Film & Photography Paul Monaco -- Film & Photography <i>Silence</i>	127	37
Logan Warberg, Seth Berardinelli, Alison Figueira -- Computer Science Hunter Lloyd -- Computer Science <i>Lunabotics Computer System Analysis</i>	129	59

2012 STUDENT RESEARCH CELEBRATION

GRADUATE ABSTRACTS

Sorted by Student Major

COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

Amy Bloemendal: Health & Human Development

Mentor: John Seifert -- Health & Human Development

Blood glucose/lactate responses from ingesting high fructose corn syrup and sucrose beverages

Fructose has been the focus of many researchers. High fructose corn syrup has replaced sucrose in food products and has gained notoriety concerning possible negative effects on metabolism. Purpose: To examine whether a HFCS beverage alters glucose and lactate responses compared to a sucrose beverage. METHODS: Seven (3 male, 4 female: Mean±SD; 23.7±2.4yrs, 71.5±16.2kg, 173.9±9.6cm) adults volunteered. Subjects participated in two experimental trials after a 12 hour fast. A 10% beverage sweetened with HFCS or sucrose (30 g/300mL) was ingested. Blood samples were taken at -5, 30, 60, 90 and 120 minutes, coagulated for 20 minutes and centrifuged for 10 minutes. An ANOVA with repeated measures was used for statistical analysis. T-tests were used to differentiate means with Bonferroni adjustment (alpha level < 0.05). RESULTS: No interaction effect was observed between time and treatments. No treatment main effect was found for glucose (Means±SD: sucrose 4.0±0.92 mM/L; HFCS 4.28±1.06mM/L) or lactate (Mean±SD: sucrose 2.10±0.67mM/L; HFCS 2.15±0.68mMol/L). There was a significant time effect within blood glucose levels. Mean glucose concentration at 30 minutes was increased over baseline (Mean±SD: 5.6±0.98mM/L), and 60, 90, and 120 minutes. CONCLUSIONS: Glucose and lactate responses were not different from one another after ingestion of HFCS and sucrose.

David Connor, Kendra McGahan: Health & Human Development

Mentor: John Seifert -- Health & Human Development

The Influence of Pre-Exercise Solid and Liquid Caloric Ingestion on Blood Glucose and Lactate

Energy supplements for endurance training and racing are often used as an effective way of improving performance. Pre-exercise feedings may increase glycogen synthesis and provide additional substrate for exercise, yet most athletes prefer not to eat solid food right before an endurance activity due to potential gastrointestinal issues and possible side effects in regard to blood glucose response to the feeding. Caloric feedings may be desirable before certain sub-maximal training events. However, it is not known whether a cereal feeding would be tolerated, compared to liquid feeding, when ingested prior to exercise. PURPOSE. The purpose of this study was to investigate blood glucose levels (BG), lactate, rating of perceived exertion (RPE), and respiratory exchange ratio (RER) when iso-caloric liquid or solid food was consumed 10 min prior to moderate intensity exercise. METHODS. Nine low-risk subjects, six males and three females, participated in the study. Each subject completed a maximal heart rate test prior to the two exercise trials to determine target heart rate throughout the study. For one trial, subjects consumed a sports drink containing 40g carbohydrate and 10g protein 10 min prior to exercise. For the second trial, subjects consumed cereal with skim milk consisting of 44g of carbohydrate and 6g protein 10 min prior to exercise. Each exercise trial consisted of riding a cycle ergometer at 65% of maximal heart rate for 50 min. Blood glucose lactate, and RPE were recorded at 25 and 50-minute time points. RER was collected between 20-25 minutes and 45-50 minutes. An ANOVA with repeated measures was performed on the dependent variables. Alpha level of significance was set at p < 0.05. RESULTS. Average BG and lactate were significantly greater for the Liquid trial (4.93 ±0.94 mM/L and 3.7 2.2 mM/L) compared to Solid trial (4.52 ±0.5 mM/L and 2.3 1.2 mM/L). There were no significant differences between trials for RPE and RER. CONCLUSIONS.

The blood glucose findings support the idea that gastric emptying is slower with solid feeding than with fluid feeding. Although the effect was small, the increased blood glucose concentration secondary to liquid feeding represents increased energy available to muscle cells. Interestingly, the women in the study seemed to have overall lower BG and lactate levels compared to the men. One limitation of the study is that only one dosage and one timing of pre-exercise ingestion was investigated. By varying dosage and timing, the exact differences on gastric emptying and subsequent physiological variables could be quantified.

Eric Strubeck: Health & Human Development

Mentor: John Seifert -- Health & Human Development

Hydration Perceptions, Hydration Practices and Reaction Times of Fighter and Helicopter Pilots

Military operations can be conducted over extended periods of time in varying environments. Pilots also have to overcome vibration, noise, and accelerations. **PURPOSE:** The purpose of this study is to describe hydration perceptions and practices, perceived stresses, and reaction times of pilots before and after a training flight. **METHODS:** 14 male pilots (Mean \pm SD: 40 \pm 6 y, 93 \pm 10 Kg) provided subjective and objective data regarding their hydration perceptions and practices. Urine specific gravity (Usg) was used to quantify hydration status. Auditory reaction times were used as a measure of performance. **RESULTS:** There was no change in mean Usg, (Pre 1.014 \pm 0.009, Post 1.014 \pm 0.007). Subjective thirst increased among the pilots (Pre 2.45 \pm 1.33, Post 3.41 \pm 0.82). Mean reaction time slowed (Pre 0.190 \pm 0.027 s, Post 0.198 \pm 0.031 s). The relationship between Usg and reaction time was poor (post R = 0.07). **CONCLUSIONS:** Differences in reaction time could be explained by flight length and aircraft. Helicopter pilots reported a greater pre to post flight change in mental fatigue which could explain their slowed reaction time. Pilots could be better hydrated at the start of missions.

Elizabeth (Betsy) Webb: Education

Mentor: Art Bangert -- Education

What is Good and What is Right: Ethics in Montana Municipal Government

To determine the effects of a formal ethics program on observations of misconduct, reporting of misconduct, and perception of ethical culture, two Montana First Class cities were selected to study. A 38-item survey was utilized and independent-samples *t* tests were calculated. Three years after implementation, a formal ethics program made a significant difference in Ethics Code Awareness, Perceptions of Ethics Program Effectiveness and Perceptions of Access to Ethics Information. No significant differences were found between employee groups on Ethical Decision-Making, Perceptions of Ethical Resources Scale - Time and Money, Perceptions of Informal Ethical Norms, and Perceptions of Ethical Leadership. There were no significant differences in observations of misconduct or reporting of misconduct among the employee groups.

Anna Bartkowiak: Health & Human Development

Mentor: Adina Smith -- Health & Human Development

Graduate Counseling Students' Growth

The poster presentation will address the subjective experience of personal and clinical growth of graduate students in Counseling Program at Montana State University, over the span of 2 years of curriculum and training. The design of the study conducted by Adina Smith, Ph.D. and other faculty of Counseling Program, is based on grounded theory. At this point of time, the study is cross-sectional, as it includes different points of development of two cohorts, across the tracks (Mental Health, Marriage and Family and School Counseling); and over time, it will evolve into longitudinal study -- following the same cohort throughout the span of 2 years of training. The researchers conducted extensive literature review on professional development of counselors, and designed a questionnaire for focus groups that were conducted and transcribed within the last three months. The results of the initial round of focus groups indicate that there are substantial differences in experience of personal growth in students and delineated areas of the growth that students observed while enrolled in the program. The presentation will report how the students in different tracks across the cohorts perceive their personal progress, using the language aligned with the way students expressed in during focus groups.

COLLEGE OF ENGINEERING

Eric Hansen: Civil Engineering

Mentor: Mike Berry -- Civil Engineering

Mechanical Properties of Portland Cement Concrete with Reclaimed Asphalt Pavement Aggregate

This analysis of the mechanical properties of Portland cement concrete with reclaimed asphalt pavement as aggregate was completed to determine if a mix design could be achieved that would be suitable for use as a rigid pavement. It was found that it is possible to design a mix that meets the necessary compressive strength and handling characteristics needed for rigid pavement. This analysis contains the results of ASTM C39/C39M-11a Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens, ASTM C78/C78-10 Standard Test Method for Flexural Strength in Concrete, ASTM C496/C496M-11 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens, and ASTM C469/C469M-10 Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.

COLLEGE OF LETTERS & SCIENCE

Amber Ferris: Psychology

Mentor: Jessi Smith, Keith Hutchison -- Psychology

Stop Interfering! Understanding how Stereotype Threat reduces Working Memory Capacity by using the Dual Processes Model.

Consensus is building that stereotype threat interferes with working memory, but how so? We examined error monitoring and goal maintenance as possible mediating mechanisms triggered by stereotype threat. Grounded in the dual process model (Kane & Engle, 2005) 187 MSU men were first given the OSPAN to assess working memory capacity (WMC), then engaged in a mostly incongruent or mostly congruent Stroop task which was presented as a measure of verbal processing skills (stereotype threat condition) or not (neutral condition). Stroop errors and reaction times were assessed. The regression model was significant for Stroop errors $R^2 = .65$, $F(7, 174) = 18.41$, $p < .001$, indicating a significant three way interaction between stereotype threat, list(congruent), and WMC ($\beta = -.12$). Only main effects of WMC and list were observed for reaction time. Results suggest that for people lower in WMC, stereotype threat primarily interferes with maintaining task goals.

Candace Goodman: Chemistry & Biochemistry

Mentor: Mary Cloninger, Greg Gillispie -- Chemistry & Biochemistry, Fluorescence Innovations Inc.

Aggregation Characterization of Lectin Interactions with Sugar-Functionalized Dendrimers

The ability to characterize aggregation is significant in developing a mechanistic understanding of the process and in designing strategies to control it. Aggregation is involved in tumor proliferation, amyloid-related diseases (such as Parkinson's and Alzheimer's diseases) and pathogen infection. Of the many diverse methods to study aggregation, fluorescence offers exceptional speed and ease. Steady-state fluorescence is more common than time-resolved fluorescence owing to long acquisition times associated with the latter. Our innovative approach, referred to as direct waveform recording, is capable of acquiring high quality time-resolved data at steady-state speeds. The work presented here demonstrates the applicability of this measurement in the study of complex aggregate formation with glycodendrimers.

Meghan Huntoon: Psychology

Mentor: Jessi Smith -- Psychology

I'm Incredible!: Consequences of Violating the Modesty Norm

Past research examined whether women's tendency to feel uncomfortable with self-promotion (which violates modesty norms) can be offset via misattribution. Results showed when provided with an external source for discomfort, the quality and quantity of promotion increased as did women's subjective experience. The current project examines whether women suffer consequences when self-promoting compared to men. Results showed that when essay quality is ambiguous judges rate the same essay detailing personal accomplishments more positively when it is thought to be authored by a man compared to when it is thought to be authored by a woman. The findings suggest that women suffer consequences for violating modesty norms. Career implications associated with women's self-promotion are discussed.

Gal Keren-Aviram: Chemistry & Biochemistry

Mentor: Edward Dratz -- Chemistry & Biochemistry

Human Brain Proteomics in the Systems Biology of Epilepsy Project (SBEP)

Epilepsy is a neurological disorder that manifests as recurrent seizures. Many cases are resistant to antiepileptic drugs and may benefit from surgical procedures to identify and remove the epileptic foci.

The project takes advantage of unique human surgical specimens, removed from electrophysiologically mapped brains to compare electrically active brain to adjacent quieter normal regions of the same individuals. We present a pilot proteomic study and initial integration with the project's database of clinical, histological, genomic and metabolomic information. We used Differential in Gel Electrophoresis (DiGE) to compare protein abundances in three fractionated cellular compartments of six patients.

About 4400 protein isoform spots were resolved for each patient and the identities of a subset of 400 significantly changing spots was determined by LC-MS/MS. Hierarchical clustering of the spot expression patterns was used to group changing proteins, followed by gene ontology enrichment analysis. Combination of the two analysis tools allowed for enhanced interpretation of the changes in cellular processes taking place in the tissues that trigger seizures. Changes in cell populations and increased vascularity, predicted from the proteome, were validated by histology. Integrating the findings to develop human epilepsy models seeks to deepen understanding of the disorder and suggest new drug targets.

Amber Kleven: English

Mentor: Lisa Eckert, Robert Petrone -- English

Yearbooks as a Force in Representing and Developing Adolescence

The findings of this research indicate that high school yearbooks serve as a means of perpetuating both the idea of adolescence as a social construct and stereotypes of youth. In other words, I explore how adolescence is a social construct that becomes further developed through the creation, distribution, and further use of yearbooks. For example, the people and events represented in yearbooks usually work to maintain the status quo and do little to represent the student bodies of high schools accurately and fairly. Reasons why this is so are explored, in addition to background building of how the social construct of adolescence came to be.

Ivy Merriot: American Studies

Mentor: Sara Mast, Terry Beaubois, Jeanne Moe -- Arts & Architecture, Sociology & Anthropology

The Big Horn Medicine Wheel: Native Science Research in Astronomical Place-Based Pedagogies

The Big Horn Medicine Wheel, located a few miles south of the Montana border, is an American Sacred Site long honored by many diverse peoples. A deep time-cut travois trail leads up to nearly 10,000 ft in the Big Horn Mountains, providing many past generations of travelers with a route to the wheel and to the protection of its high altitude, white limestone "huts." Here, a traveler could meld with the voice of the wind, wrap themselves in the resonance of sequined-studded stars, and prepare to request an audience with the universe. Researchers in astronomy and archaeology--using Western Science methods--have erected a few noteworthy conclusions concerning the Medicine Wheel, but remain at a loss to explain the wheel's original purpose. Using methods of Native Science, an abundance of new data reveals the coalescent nature of the Wheel's multiple properties, conveying value to the integrated systems

of the Wheel and its environment. Methods that combine the oral histories, the patient immersion in place-based cognition, and the willingness to learn from “inert” materials such as the wind, stars, and stones, uncover a rich pedagogy for learning sky-earth relational knowledge, accessible through the processes of perception, recognition, cognition, immersion, and assimilation.

Gary Michelfelder: Earth Sciences

Mentor: Todd Feeley -- Earth Sciences

Observations On The Origin Of Across-Strike Geochemical Variations In Quaternary Silicic Lava Flows From The Andean Central Volcanic Zone: Comparison Of Data From Individual Eruptive Centers

In an effort to better understand the origin of across-strike K_2O enrichments in silicic volcanic rocks from the Andean Central Volcanic Zone, we compare geochemical and isotopic compositions of Quaternary lava flows erupted at three well-characterized composite volcanoes situated along a narrow southeast striking transect between $21^\circ S$ and $22^\circ S$. Trends observed include the following: at a given SiO_2 content lavas erupted with increasing distance from the arc front display systematically higher K_2O , Y, REE and HFSE contents; Rb/Sr ratios; and $^{87}Sr/^{86}Sr$ ratios (0.7055 - 0.7165). We suggest that silicic magmas erupted along the arc front reflect melting of relatively young, mafic composition amphibolitic source rocks with a garnet- (feldspar poor) rich residual mineralogy and that the lower crust becomes increasingly older with a more felsic bulk composition in which residual mineralogies are progressively more feldspar-rich, but garnet-poor. One implication of this interpretation is that large-scale regional trends in magma compositions at continental volcanic arcs may reflect a process wherein the continental crust becomes strongly hybridized beneath frontal arc localities due to protracted intrusion of subduction-derived basaltic magmas, with a diminishing effect behind the arc front because of smaller degrees of mantle partial melting and primary melt generation.

Alexandr Mikhailov: Physics

Mentor: Aleksandr Rebane, Mikhail Drobijev -- Physics

Validity of Two-Level Approximation for Two-Photon Absorption in the Lowest Electronic Transition of Dipolar Molecules

In dipolar molecules two-photon absorption (2PA) tensor contains a term proportional to the change of permanent dipole moments between the final and ground states. We employ simple asymmetrical potential well models to investigate the contribution of this two-level term relative to other higher-level contributions. Our simple model of dipolar molecules consists in placing $N=10$ π -electrons in a one-dimensional infinite potential well of width A with asymmetric floor. We study different model potentials for which analytical expressions for the 2PA amplitudes can be obtained. These include linear slope, rectangular step, and antisymmetric sinusoidal potentials. We solve the corresponding Schrödinger equation both analytically and numerically, and show that for a reasonable values of the potential amplitudes (ΔV not larger than $5E_1(0) = 5\pi^2\hbar^2/2mA^2$), the “two-level” contribution to the 2PA cross section is at least an order of magnitude larger than the contribution from all other terms.

Melissa Robertson: Microbiology

Mentor: Marcella McClure -- Microbiology

Are Significant Differences in Retroid Content Discernable Between Individuals?

All entities in a genome that encode a reverse transcriptase (RT) enzyme are called Retroids. Retroids have come about from ancient viral infections and are ubiquitous throughout mammalia. These Retroid agents have been able to alter gene function, expression and genome structure in the course of evolution. The studies presented here focus on the analysis of the Retroid content of humans and chimp to provide a context to determine if significant differences between the human composite reference genome (HGC) and the first fully sequenced, publicly available, individual human genome (HGI) can be discerned. One of the goals of this research is to try and identify any unique Retroids in an individual human genome. The chimpanzee genome (PT) is included in this study for comparison of differences between species. The Retroid content of the genomes is determined by the Genome Parsing Suite (GPS) (McClure et al. 2005). The GPS is software developed to find, classify and cut out all of the Retroid agents in a genome.

Benjamin Schwarz: Chemistry & Biochemistry

Mentor: Trevor Douglas -- Chemistry and Biochemistry

Enzyme encapsulation in the P22 viral capsid as a platform for biological nanoreactors

The capsid of the *Salmonella typhimurium* bacteriophage P22 presents a platform for encapsidation of protein cargo through genetic fusion. The capsid spontaneously assembles via interactions between a scaffold protein and the interior of the coat protein shell. By fusing proteins to a truncated scaffold protein it is possible to package cargo inside the capsid which has potential to generate thermostable, dynamic, targetable nanoreactors. The present work proves this concept with the encapsidation of two thermophilic enzymes, the monomeric alcohol dehydrogenase AdhD and the tetrameric β -glucosidase CelB both from *Pyrococcus furiosus*. Both enzymes are shown to be active in the packaged form and present within the capsid in large numbers, 85 monomers /capsid in CelB and 250 monomers/capsid in AdhD. The functionalized capsids were shown to retain the temperature dependent maturation seen in the wild type.

Geoffrey Wicks: Physics

Mentor: Aleksander Rebane, Mikhail Drobijev -- Physics

A New Femtosecond Nonlinear Transmission Experiment for Accurate Determination of Intrinsic Two Photon Absorption Spectra of Non-Fluorescent Chromophores

We have developed and tested a new femtosecond experiment for measuring the intensity dependent transmission of two photon absorbing (2PA) chromophores in a broad range of wavelengths. This technique offers a very high accuracy (~0.05% transmission change) and is of particular importance for characterization of the 2PA properties of Platinum complexes and other compounds with low fluorescence emission. As a preliminary demonstration of this new technique we have measured the intrinsic 2PA spectra and the 2PA cross sections of some known chromophores that have been previously characterized by the fluorescence method of 2PA spectrum evaluation.

Daigo Yamamura: Earth Sciences

Mentor: James Schmitt -- Earth Sciences

Sandstone diagenesis as a proxy indicator of pore fluid geochemistry: implications for fossilization of vertebrate skeletal material in the Hell Creek Formation (Upper Cretaceous), Eastern Montana

Enclosing sandstone matrix is often invoked as an entombing medium facilitating preservation of vertebrate skeletal material by isolation from contact with pore fluids. We employed optical petrography, x-ray diffractometry, and scanning electron microscopy analysis of a fossil-bearing sandstone in the Hell Creek Formation to document pore fluid geochemistry during diagenesis. Presence of fine-grained massive muddy sandstone (Sm), abundant coal stringers, and overlying and underlying floodplain mudrocks indicate a crevasse-splay origin. The channel sandstone shows evidence of secondary porosity development through acidic pore fluid migration including feldspar grain skeletonization and complete dissolution, suspended exploded-grain fabrics in biotite indicating dissolution of early calcite cement. The bone-bearing sandstone contains skeletonized and altered feldspar grains also indicating migration of acidic pore-fluids. Enclosed bones show minimal evidence of alteration; they are surrounded by a concretionary zone of calcite and iron oxide cement characterized by isopachous calcite-rims on detrital grains indicating meteoric phreatic calcite precipitation. Presence of well-preserved bone in sandstone extensively altered by acidic fluids suggests that early precipitation of surrounding concretion growth enhanced bone preservation, chemically buffering it from the later corrosive effects of acidic pore waters. This indicates that early concretionary entombment is an important factor in vertebrate skeletal preservation in sandstones.

Andrew Rivers: Psychology

Mentor: Ian Handley -- Psychology

An Inkblot for Unconscious Thought: Examination of Nonconscious Implicit Attitude Change

A body of literature has been building in the past seven years examining the deliberation-without attention effect. This literature has focused solely on the final explicit output of the unconscious thought process and has thus far ignored its potential impact on implicit cognition. The present study seeks to begin elucidating the relationship between unconscious thought and implicit cognition by testing the prediction that implicit attitudes will vary as a function of the relative use of conscious or unconscious thought in the decision-making process. To do this, we utilize the Affect

Misattribution Procedure indirect measure of attitudes within the classic unconscious decision-making paradigm. Results indicate that, like explicit preferences, implicit attitudes towards targets are more accurate following a period of unconscious thought. This provides suggestive evidence supporting the idea that unconscious processing and integration of complex information is reflected in implicit measures of attitude in addition to conventional explicit choice tasks.

Anna Zelaya: Microbiology

Mentor: Matthew Fields – Molecular Biosciences

Microbial community analyses between groundwater and sediments injected with nitrate for biostimulation of chromium reduction at Hanford Site

The Hanford site in Washington, USA was an active producer of weapons grade plutonium from 1943 to 1987, causing billions of gallons of waste and contaminants, such as chromium, much of which remains to be either removed or remediated. On-site clean-up is being currently overseen by a joint effort comprised of the Washington Department of Ecology, the Environmental Protection Agency, and the Department of Energy. Previous studies in the Field's lab showed that in-situ reduction of chromium (Cr(VI)) to insoluble Cr(III) was achieved by injection of hydrogen release compound (HRC®). In order to assess other possible nutrient sources that may act to stimulate microbially-mediated reduction of Cr(VI), nitrate was injected into chromium-contaminated wells at the Hanford DOE site in 2010. Groundwater and sediments samples (pre and post injection) were collected. Chromosomal DNA was extracted and 16S rRNA gene fragments were prepared for 454 sequencing using a GS Junior Sequencer (Roche). Sequences were trimmed and refined by length, primer errors, and ambiguous repeats. Sequences with a high percentage of low quality score values were removed. Chimera's were also removed, and python scripts previously developed were used to sort through sequence data. Dereplicates were run through NCBI-BLAST database, and highest scoring hits were used to obtain phylum and genus of closest relatives. Predominant populations (richness and diversity) were compared between samples.

INTERDISCIPLINARY PROGRAMS, THE GRADUATE SCHOOL

Gregory Krantz: Molecular Biosciences

Mentor: Matthew Fields -- Center for Biofilm Engineering

Field Scanning Electron Microscopy and Growth Modelling of a *Desulfovibrio alaskans* G20 Biofilm

Microbially Induced Corrosion (MIC) is a major concern for industrial ferrous metal pipelines and can result in pipeline failure. Sulfate Reducing Bacteria (SRB) have been implicated in contributing to MIC due to their production of corrosive H₂S gas. *Desulfovibrio alaskans* G20 (G20) is a SRB isolated from a producing oil well in Ventura, California. This study evaluates whether G20 pure culture can form a biofilm on steel substrate, and attempts to characterize the G20 biofilm with the Biological Accumulation Model (BAM).

2012 STUDENT RESEARCH CELEBRATION

UNDERGRADUATE ABSTRACTS

Sorted by Student Major

COLLEGE OF AGRICULTURE

Mark Abbey-Lambertz, Megan Layhee: Land Resources & Environmental Sciences

Mentor: Robert Peterson, Andrew Ray, Adam Sepulveda -- Land Resources & Environmental Sciences, Northern Rocky Mountain Science Center

Suppressing invasive bullfrogs with carbon dioxide

Current management strategies for the control and suppression of invasive amphibians have had little overall effect on their abundance and distribution. This study demonstrates the effects of elevated levels of CO₂ on anuran larvae. Because it is recognized as a successful invader worldwide, we used the American bullfrog (*Lithobates catesbeianus*=*Rana catesbeiana*) as a model organism for testing the effects of elevated CO₂ on pre- and prometamorphic tadpoles. We estimated that the LC50 value for bullfrog tadpoles was 371 mg CO₂/L. At higher concentrations of CO₂, 100% mortality was documented. Overall, tadpoles that succumbed to experimental conditions had a lower body condition index than those that survived. We documented changes in blood chemistry during prolonged exposure to elevated CO₂. Specifically, blood pH decreased by more than 0.5 pH unit after 9 h of exposure and both blood pCO₂ and blood glucose increased. The findings of this study suggest that CO₂ treatment may be a useful tool for controlling invasive amphibian larvae. Moreover, we documented concentrations of CO₂ that must be achieved in order to use this technique as a strategy for bullfrog control.

Thomas Bogen: Land Resources & Environmental Sciences

Mentor: Rich Macur -- Center for Biofilm Engineering

Towards standardized methods for the analysis of algal lipids: Total lipid content

The use of microalgae for biodiesel production has attracted significant interest in recent years. Lipids are precursors for biodiesel and accurately evaluating the potential of algae to produce lipids is critical if a algal-based biodiesel market is to be created. However, there are currently no standardized methods for evaluating lipids in algae and laboratories currently use a wide variety of methods to extract and quantify lipids. It is well known that different methods provide different values for lipid content and quality, and consequently, the use of diverse methods has created a situation where direct comparison of data generated by different laboratories is often challenging, if not impossible. We examined four different direct transesterification methods to determine which was the most effective for algae. The methods studied were the Griffiths method, Johnson method, American Oil Chemists Society (AOCS) method, and the National Renewable Energy Laboratory (NREL) method. The results indicate that the most effective method for evaluating total "fuel potential" of algae was the Griffiths method. Consequently, we recommend that the Griffiths method be considered for further evaluation as a standard method for quantifying total algal lipids.

Mark Boyd: Agricultural Economics & Economics

Mentor: William Dyer, Barbara Keith -- Plant Sciences & Plant Pathology, Land Resources & Environmental Sciences
GST Study in Wild Oats

Wild oats (*Avena fatua* L.) are a major problem in cereal grain crops. Near continuous use of triallate, a preemergence herbicide, selected for wild oat populations that are resistant to the herbicide in several areas of Montana. Subsequent use of other herbicide families has led to the evolution of a wild oat biotype with resistance to at least four different herbicide modes of action. Preliminary evidence supports the idea that resistance is due to enhanced transcription of one or more genes for cytochrome P450 monooxygenases. The purpose of my project is to investigate the hypothesis

that increased glutathione S-transferase (GST) activity is also involved in the multiple herbicide resistance phenotype. In the greenhouse, two herbicide resistant and two herbicide sensitive wild oat lines were treated with three herbicides with different modes of action. Plant tissue was harvested after 24 and 48 hours, and frozen at -80C. Tissue was ground under liquid nitrogen and proteins extracted into a Tris-based buffer. Total protein assays are conducted using the Bradford procedure and GST activity assays are being performed by monitoring absorbance of the CDNB conjugate at 340 nm. My objective is to determine if there is a difference in the GST activity between the sensitive and resistant lines. GST activity levels before and after herbicide application will also be compared to see if activity increases in response to the application of the herbicides. These experiments are ongoing and the GST response comparisons will be discussed.

Samuel Carlson: Land Resources & Environmental Sciences

Mentor: Brian McGlynn -- Land Resources & Environmental Sciences

Quantifying Watershed Storage Dynamics using long duration high frequency measurements of Precipitation, Runoff, and Evapotranspiration

Understanding mountain water storage and redistribution is critical to understanding water availability. Climate change has the potential to change these important storage and redistribution dynamics. Previous studies have estimated watershed storage, but all have relied on modeled evapotranspiration (ET) for calculation. Vegetation and landscape heterogeneity make modeling of ET complex and imprecise. In this study we propose to calculate dynamic catchment water storage using a water balance approach. We will utilize ET measured on an eddy flux covariance tower located in the Stringer Creek watershed in the Tenderfoot Creek Experimental Forest. Measured ET will be combined with measured precipitation (P) and runoff (Q) to calculate ΔS , using the mass balance equation $\Delta S = P - (Q + ET)$. We will then compute the relative amount of water stored in the watershed through time via a data based direct observation approach further corroborated by data from soil moisture probes, groundwater wells, and data from a novel COSMOS neutron scattering sensor, to find the absolute amount of water stored in the watershed (S) through time. Comparisons made between S, ET, and Q measurements will elucidate the relative influences of vegetation and soil water redistribution on Q and changes in watershed S across time. This study seeks new insights into the interplay between vegetation and soil water redistribution and their influence on catchment scale water budgets. This will provide a better understanding of factors affecting water availability in the Rocky Mountain West and for the first time accurately calculate watershed scale storage - discharge relationships and storage - ET relationships.

Steven Hystad: Plant Sciences & Plant Pathology

Mentor: Dave Sands -- Plant Sciences & Plant Pathology

Metabolic Suppression of Water Hyacinth (*Eichornia crassipes*) Utilizing Amino Acid over-producing mutants of *Fusarium oxysporum* as a Biocontrol Agent

Eichornia crassipes (water hyacinth) is a free-floating plant native to South America and is described as one of the most thriving noxious weeds to freshwater ecosystems. Introduced in Lake Victoria in the 1980's water hyacinth has significantly impacted local inhabitants health by providing habitat for disease carrying insects diminished local economies dependent on lake access. Symptomatic water hyacinths were assayed for bacterial and fungal organisms. Of the plants surveyed, the most prevalent fungal organism was *Phytophthora*, a relatively host-specific water mold, belonging to the class, Oomycetes. When coupled with exogenous lysine, tryptophan, threonine, and valine treatments, plants displayed visible characteristics of complete metabolic breakdown within 36 hours. Further evaluation of *Phytophthora* is needed to determine whether this fungal organism can be a suitable bio control agent.

Maxwell Moran: Land Resources & Environmental Sciences

Mentor: Rich Macur, Mark Kozubal -- Center for Biofilm Engineering, Land Resources & Environmental Sciences

Biofuel Production Using an Acidophilic Fungus

Novel strain MK7, an acidophilic fungus isolated from a geothermal spring in Yellowstone National Park, shows significant potential for use in the biofuels industry. Experiments, funded through the USP program, have shown that it can produce biofuels and biofuel precursors from lignocellulosic materials, glycerol and waste algal biomass. Under aerobic conditions, MK7 produces intercellular lipids that can be converted into biodiesel. Under microaerophilic or anoxic conditions, ethanol and hydrogen can be produced. One of the most notable features of MK7 is its ability to grow under extremely acidic conditions (pH range: 0.6 - 6.5). Consequently, strain MK7 can grow on acid pretreated

substrates such as wheat straw without the need for pH neutralization. Cellulose is the primary molecule targeted for biofuels production and acid pretreatment is commonly used to degrade lignin and hemicellulose and release cellulose from lignocellulosic materials. Strain MK7 neutralizes the pH during growth on acidified substrates. This ability to neutralize pH makes strain MK7 valuable to the biofuels industry since the addition of pH buffering salts is costly and creates significant downstream water quality problems. These attributes suggest that the extremely acidophilic fungal strain MK7 has the potential to become an important player in the biofuel industry.

Jankiben Patel: Plant Sciences & Plant Pathology
Mentor: Chaofu Lu -- Plant Sciences & Plant Pathology
Generation of a T-DNA Mutagenized Camelina Population

A mutagenized *Camelina sativa* population is being generated with the insertion of T-DNA, which creates random mutations in Camelina plants. Random mutations in Camelina can be detected with a selection marker. Transformation is feasible in Camelina plants due to the infiltration method which easily allows the insertion of T-DNA. The vector used for this experiment has two main advantages: its presence of fluorescent protein marker and it has a plasmid backbone which will be used for plasmid rescuing. Transgenic seeds are obtained with a DsRed fluorescent protein selection marker which makes the Camelina seeds glow red under green light when view through a red filter. Genetic transformation events will be studied by further growth of transgenic seeds. DNA will be extracted and digested from younger leaves and after the DNA extraction, plasmid rescue will be performed for DNA sequencing. Gas chromatography will be used to detect the fatty acid composition of the oil from transgenic seeds. The goal of this project is to identify genes that affect oil quality in camelina seeds.

Collin Preftakes -- Land Resources & Environmental Sciences
Mentor: Robert Peterson -- Land Resources and Environmental Sciences
Bystander exposure to ultra-low-volume insecticide applications used for adult mosquito management

A popular and effective management option for adult mosquitoes is the use of insecticides applied by ultra-low-volume (ULV) equipment. However, there is a paucity of data on human dermal exposure to insecticides applied by this method. The objective of the current study was to estimate dermal exposures to the insecticide active ingredient permethrin using water- (Aqua-Reslin®) and oil-based (Permanone® 30-30) formulations with passive dosimetry. No significant differences in deposition of permethrin were observed between years, distance from the spray source, front or back of the body, or the placement of the patches on the body. However, exposure to Aqua-Reslin was significantly greater than Permanone 30-30 and average concentrations deposited on the body were 4.2 and 2.1 ng/cm², respectively. The greater deposition of Aqua-Reslin is most likely due to the higher density of the water-based formulation which causes it to settle out faster than the lighter oil-based formulation of Permanone 30-30. The estimated average absorbed dermal exposure for permethrin from Aqua-Reslin and Permanone 30-30 was 0.00009 and 0.00005 mg/kg body weight, respectively. We also found that ground deposition of ULV insecticides can be used as a surrogate for estimating dermal exposure. The estimated exposures support the findings of previous risk assessments that exposure to ULV applications used for mosquito management are below regulatory levels of concern.

Jamie Raznoff: Plant Sciences & Plant Pathology
Mentor: William Hoch, Norm Weeden -- Plant Sciences & Plant Pathology
Development of a Simple Sequence Repeat (SSR) Genetic Map in Ornamental Viburnum

The goal of this project was to augment a new genetic map of *Viburnum* with simple sequence repeat (SSR) and sequence-tagged site (STS) markers, which in addition to improving the resolution of the map, will provide landmarks that are transferable among populations. A segregating population resulting from a cross between *V. carlesii* and *V. lantana* was screened with 49 pairs of SSR primers developed from *V. lantana* and 31 pairs of STS primers developed from genes in *Medicago truncatula* and *Pisum sativum*. Ten of the SSR and five of the STS primer pairs produced polymorphic bands. Each polymorphic band was scored as present or absent for each individual within the population, and these markers were added to the existing genetic map using Quickmap software. This improved *Viburnum* map provides a foundation for increasing breeding efficiency through marker-assisted selection, and may also offer useful tools for future comparative genomic and QTL studies, and serve as a genetic model for the family *Caprifoliaceae*.

Matthew Schmidt: Land Resources & Environmental Sciences

Mentor: Rich Macur -- Land Resources & Environmental Sciences

Alkaliphilic Microalgae for Biofuel Production: Scaling-up to 50 Liter Bag Bioreactors

The use of microalgae for the production of biofuels is in the spotlight due to a reputation for high photosynthetic efficiency, rapid growth rates, high oil productivity and potential for growth in saline or brackish waters in landscapes not suited for crop production. Research and engineering efforts are now focused on overcoming a variety of hurdles to reduce production costs and attain economic viability. Extremophilic algae have unique attributes that can potentially be used to overcome some of the problems associated with biofuel production, including resistance to competitive organisms. The objective of this research was to characterize the growth of three extremophilic algal strains in 250 mL shaker flasks, and then characterize growth of the most promising strain in a larger scale (100 L) bag reactor. Of the three algae examined, strain PGV-8 showed the most promise for scaling-up based on growth rate (cell counts) and oil production as measured by Nile Red fluorescent staining. Strain PGV-8 demonstrated a maximum doubling time of about 1.5 d and produced significant quantities of oil in a 100 L bag reactor system, revealing that it has potential for use in larger scale systems.

Laura Whitmore: Land Resources & Environmental Sciences

Mentor: William Inskeep, Mark Kozubal -- Land Resources & Environmental Sciences

Autotrophic Carbon Fixation in Crenarchaeota from Yellowstone National Park

Autotrophy in the archaea has recently been described as an important and under-studied source of global carbon fixation. Several archaeal species are found in ferric oxyhydroxide mats from acidic geothermal springs in Yellowstone National Park. The springs are an exceptional natural laboratory for studying microorganisms in constrained systems. However, primary productivity had not been demonstrated in these systems. The goal of this study was to confirm autotrophic growth in pure *Metallosphaera yellowstonensis*, a dominant community member in Fe(III)-oxide mats, and relate this to in situ microbial communities. *M. yellowstonensis* was grown chemolithoautotrophically with pyrite as the electron donor, oxygen as the electron acceptor, and $^{13}\text{CO}_2$ as the sole carbon source. At post log-phase, biomass was analyzed using isotope-ratio mass spectrometry (IRMS) at Pacific Northwest National Laboratory. The results demonstrated that *M. yellowstonensis* is capable of inorganic carbon fixation. Furthermore, the isotope fractionation value was consistent with an operating 3-hydroxypropionate/4-hydroxybutyrate cycle, characteristic of other Sulfolobales. Ex situ Fe(III)-oxide mat samples were incubated with pyrite, oxygen, and $^{13}\text{CO}_2$, and analyzed by IRMS. The data show that under limited organic carbon, these communities are capable of CO_2 fixation. Currently, transcriptomics and q-rt-PCR are being utilized to confirm the expression of key autotrophy genes.

**Please join the Hughes Scholars at the 2:00 oral session where we will share our science outreach experiences.

Alix Wittmayer: Agricultural Economics & Economics

Mentor: Anton Bekkerman -- Agricultural Economics & Economics

Identifying the Relationship Between Feed Intake and Bull Health: A Data-driven Analysis

How soon can we predict sickness in bulls before clinical signs appear? This study seeks to answer this question by identifying changes in bulls' feeding behaviors and understanding whether these changes can be used as early signals of oncoming sickness. Using a database of bull characteristics from Midland Bull Test, we empirically examine the relationship between sickness and daily feed intake, which is collected using the GrowSafe System. Preliminary results indicate that in 2010, 35% of bulls showed symptoms of illness. Among these bulls, animals with lower feed intake were more likely to be sick. Furthermore, bulls with a higher birth weight (which could be a signal of complications during birth) were more likely to get sicker sooner than bulls with lower birth weight. Conversely, bulls with higher weaning weight are more likely to be sick later in life, when a more developed immune system can help overcome the illness. Ongoing research seeks to determine whether there is a relationship between a bull's birth location and its likelihood of sickness, and whether vaccination programs and/or sires can be used to predict the likelihood of sickness. With further research we hope to find answers that will benefit livestock producers in Montana.

Elise Young: Animal & Range Sciences

Mentor: David Sands -- Plant Sciences & Plant Pathology

Linking common factors in the phenomenon of protein clumping observed in several diseases

Proteins perform many important functions at the cellular level. However, if proteins do not fold properly, they are prone to aggregating and sticking together, preventing them from performing their functions, and even making them toxic. This phenomenon is present in many neurodegenerative diseases including Parkinson's, Alzheimer's, and prion diseases. The process and factors involved in the aggregation of misfolded proteins, and the manner in which they affect different cells are not well understood. Through extensive research, I gathered information on the various proteins involved in neurodegeneration, the factors that lead to their aggregation, and how they are involved with toxicity to brain cells. By gathering this information I was able to clarify many of the potential factors involved in the clumping of α -synuclein, a protein involved in Parkinson's and Alzheimer's, including the role of oxidation and immune response to the aggregates and their breakdown products. This will lead myself and others towards further research, with the goal of finding a method of inhibiting protein clumping or its toxic effects.

COLLEGE OF ARTS & ARCHITECTURE

Collin Avery: Film & Photography

Mentor: Alexis Pike -- Film & Photography

Remain Calm

My photographs are about a particular process of observation which I acquired during adolescence. As a child, I was afraid of confrontation, so as a way to escape difficult mental and physical situations I had designated hiding zones located throughout the house and yard where I could disappear. During these times of self introspection, I became fixated on certain physical details of the space. The subtle nuances and intimate moments of silence were mine alone. It is this way of seeing which has influenced my personal photographic practice. Observation has become my new way of escaping. My images are not about finding the extraordinary in the everyday, but instead are about finding the everyday extraordinary.

Collin Avery: Film & Photography

Mentor: Alexis Pike -- Film & Photography

Down this River

In the photography project entitled, *Down this River*, I investigated the local watershed and rivers of western Massachusetts. The rivers have a large impact on me personally as I am an avid whitewater kayaker and outdoor enthusiast. For the past seven years I have been frequenting the Deerfield River in western Massachusetts to enjoy the challenging rapids, great atmosphere, and most importantly, the people. The men and women that travel to come paddle this local river are a breed of their own. The river provides many with a much-needed escape from the humid workweek of the city. Everyone (both locals and visitors) comes together to enjoy the beauty of this natural adventure park. No matter how many years it has been, I still see the same people every time I make my excursion to the river. My photographs are meant to be a visual document that will provide a historical record of the local watershed with the intention of showing and the positive and negative effects of humans on the environment.

Patrick Bakken: Film & Photography

Mentor: Jon Long -- Film & Photography

Discovering Family Lineage

Today, the 200-year-old Bakken Mill is still standing strong and operational. In the summer of 2011, I traveled to Norway to research my family's lineage and attend an international family reunion. It was truly a spectacle. Being in the physical place where your family started was sensational. It is something that I wish everyone has a chance to do in his or her lifetime. I was fortunate and able to spend more than my originally planned time over there. In total, I spent a

month living with and traveling in Norway with my long lost family; learning about Norwegians and the culture I came from, as well as the people in my ancestry.

Dan Buettner: Film & Photography

Mentor: Ian van Coller -- Film & Photography

Out of Sight, Out of Mind

My project, titled *Out of Sight, Out of Mind*, is a series of 29 collages constructed from litter I have gathered from various locations around Bozeman, Montana. Each collage is composed of one bag's worth of trash from a single location, such as a parking lot or a stretch of road. Part volunteer work and part artistic expression, I sought to create a project that satisfied my urge to make photographs while simultaneously benefiting my local community directly. The project is focused on themes of sustainability, the environment, community, and consumerism. All of the glass, plastic, and metal gathered over the course of the project were deposited into their respective recycling bins. *Out of Sight, Out of Mind* is also the project I worked on for my first Senior Thesis course for the School of Film and Photography at Montana State University.

Dan Buettner: Film & Photography

Mentor: Christina Anderson -- Film & Photography

Junk Mail

My project is a criticism of consumerism and the advertising industry, both of which are the forces that manufacture modern culture and social values. By cutting up and arranging junk mail and other paper-based advertisements, I constructed collages that examine society's relationship with mass media, as well as the environmental impact of mass-produced advertisements that are forced on every household non-consensually. The result is a series of photographs that ranged from, bright, colorful and detailed "explosions," to simple, isolated and monumental images, to text-dominated compositions.

Dan Buettner: Film & Photography

Mentor: Christina Anderson -- Film & Photography

Less Than 983: Small Towns of Montana

This project (entitled *Less Than 983*, which refers to the population of the largest town in the series) is a photographic documentation of a selection of small towns, each with a population of less than one-thousand residents, across southern Montana. I sought to make photographs of the towns to give viewers a glimpse of an environment with which they may not be familiar. The photographs reveal the differences and similarities that arise in architecture, infrastructure, and landscape between towns. I traveled to over twenty different towns and photographed sites I found to be visually interesting and of cultural importance within the communities. The photographs were approached in both a fine art and a documentary style by being concerned with formal and aesthetic qualities, unique subject matter of possible historical relevance, and compositions that describe and represent each place accurately. The project has taken a finalized form of a book, a popular format for documentary photography and fine art alike, in which nineteen towns are each represented by about a half-dozen photographs that provide a sense of place that piques the viewers' interest in the charming, and often quirky, qualities of small town life.

Gwendolyn Courtney: Film & Photography

Mentor: Ian van Coller -- Film & Photography

Going Grey

In the photographic project entitled *Going Grey*, I explored the reasonings behind a women's choice to stop dyeing their hair. A minority of aging women have set an example for aging women of today by being proud of what they have, by letting their hair be as natural as it can be, grey hair and all.

I photographed in and around Bozeman, Montana. Each woman I photographed ranged from the ages of 27 to almost 70. The interview process involved questions about opinions on aging, and advice for younger women and their decision on why they have left their hair grey. The camera I used was a 4X5 view camera. I developed many relationships with strangers through this editorial project; I gained a strong understanding and confidence from the women I've met. I wish to explore different areas of the United States to expand and gain further knowledge. This

research gave me the opportunity for woman of all ages to take notice and to promote natural aging, and to be confident in who they are.

Michelle Dallas: Film & Photography

Mentor: Ian van Coller, Christina Anderson, Alexis Pike -- Film & Photography

Memories

What I'll be working on this semester is using photographs from trips I've taken in the past and creating several mini-series. In each series I will be comparing cultures and subject matter or interests. The photos were taken over a period of 15 or so years. I will be pairing different themes, attempting to create comparisons between location, time, people and culture. I will also be adding in photos taken this semester to compare. I chose this topic after realizing how fun it can be to make snapshots. And sometimes even though the image quality is terrible, we still like looking at them because of the memories they create. They are more about content than composition. Most people want to have something tangible after a trip is over. I found myself thinking that I would never know if I would be traveling to some of these places again so I wanted to photograph everything, and I feel like many people do the same thing. Hopefully viewers will recognize some of these places and relate to the concept as well.

Nicholas Danielson: Art

Mentor: Dean Adams -- Art

Wild Clay Research

My USP provided me the opportunity for exploration and risk taking in my ceramic studies. This project helped set the foundation for years of future research and production in my studio practice. I gathered and tested eight different native and noxious plant materials from the Gallatin Valley for testing as glaze surfaces for ceramic objects. Those materials are: Camelina straw (*Brassicaceae*), Horsetail Grass (*Equisetum hymale*), Sedge (*Cyperaceae*), Sage Brush (*Artemisia var.*), St. John's Wort (*Hypericaceae*), Canada Thistle (*Asteraceae*), Wheat straw (*Triticum*), and Pine, Fir, and Cottonwood ash. I collected each sample from land throughout Gallatin County and burned each specimen to accumulate approximately 5,000 grams of ash from each plant. I washed and screened each ash sample and applied them to ceramic test tiles and pots. Each sample was tested in oxidation, reduction, and salt/soda kilns at cone 10, or 2350 Fahrenheit, on two different clay bodies. The clays represent both a high iron body and white porcelain clay. Finally, I photographically documented each test for archival and dissemination. Furthermore, my ceramic practice will continuously evolve from my research. I will address the results and acclimate the finding to my ceramic ware.

Megan Dunbar: Film & Photography

Mentor: Alexis Pike -- Film & Photography

Your Place and Mine

Your Place and Mine is a photographic survey of the human condition focusing on fleeting moments of solitude. I am using self-portraiture as a common denominator to explore the relationship between my chosen subject and myself. I intend to replace a traditional portrait with an example of the introverted self and an identity typically hidden from the public. For this, I chose people whom I have drawn inspiration from. These are images of my family members, teachers, classmates, and friends. This series is the start of many future investigations of those things that make us human. These photographs are made using a traditional 8x10 view camera and color transparencies (color slide film). Each image is one-of-a-kind and is displayed in its own uniform light box, emphasizing the singularity of each moment while considering their relationship.

Madison Gabig: Architecture

Mentor: Gregory Young -- Music

Musi-Tecture: Using Correlations between Music and Architecture to Explore New Creative Processes and Inspiration

Comparisons of music and architecture have been drawn for centuries, going back to Goethe, who said "Architecture is frozen music." This quotation was the inspiration for a project that focused on the aesthetic rather than the acoustic relationships between music and architecture. A closer look at the specifics of these two disciplines, especially terminology and sources of inspiration, can provide composers and designers the benefit of an expanded palette and perspective when designing and composing new works. Building on the faculty mentor's published works by

researching the creative process in both music and architecture, the project will culminate in an interactive website designed to inspire and inform. The research will involve four components: 1) interviewing practicing architects and musicians to discover common approaches and techniques when designing buildings and composing music; 2) reviewing the products of the Musi-Tecture class, which was taught by two professors to eight architecture majors and eight music majors; 3) reviewing the few published articles on this interdisciplinary subject; and 4) designing an innovative website that will allow users to listen to music while viewing complementary architecture; to see side-by-side definitions of common terminology; to explore the creative process in these two disciplines; and have links to websites that will allow them to design their own buildings while listening to music or improvise music while viewing an architectural design.

Joe Geil: Art

Mentor: Dean Adams -- Art

Wild clay research

My USP experience allowed me to successfully prospect for and test local clay materials for use in ceramic art. I used clays from Beaverhead, Gallatin, and Fergus counties. The majority of these clays mature at earthenware temperatures and one in particular has potential for use as a studio clay body. All of the clays being tested can be developed in to unique surface applications on high-fire ceramic art. I have fabricated and tested a burner system using waste vegetable oil as a fuel source. After three firings, the oil system has been a successful supplement to our wood fired kiln. I plan to build more efficient burners and alter the firing process to realize the full potential of this fuel source. Through various events, I have been able to connect with colleagues and the general public to discuss my research of these materials and process. Collaborating with Nick Danielson, we will provide informational booklets at NCECA at the end of this month. With my mentor, Dean Adams, we were able to send the clay samples to a testing lab for analysis which I will have for archiving and dissemination by the end of March.

Parker Hilton: Film & Photography

Mentor: Ian van Coller -- Film & Photography

The Jersey Shore

Over the course of three months I traveled the 217-mile length of the New Jersey shoreline making formal portraits of tourists, locals, and landscapes in an effort to build on and contend with the media's representation of the area. Having grown up in the area I felt the need to showcase not only the un-televised diversity in the area, but also the aspects of the popularized world that major networks may have looked over. The resulting project involved hours of travel as well as almost 100 rolls of film. All processed and edited by myself in an effort to show the fine art photography world as well as all others who were interested the amount of depth and diversity that exist on the stretch of beach written off by the majority of the nation. After photographing from June to August and looking over the processed film I discovered that my suspicion was correct and that the New Jersey Shore not only houses a diverse group of locals and tourists, but also a very scenic landscape seemingly overlooked by the media.

Milenka Jirasko: Architecture

Mentor: Maire O'Neill -- Architecture

Surfaces of Auschwitz

Although numbers are uncertain, recent research estimates that 1.1 million lost their lives at Auschwitz between 1940 and 1945. The camp has been continuously open to the public since 1946; in the year 2011 alone, 1.4 million visited Auschwitz. Its impact on visitors is undeniable. But what about the impact of visitors on the camp? This exhibit is the result of a research trip to Poland in summer 2011; it seeks to show the behavior of visitors in four key Auschwitz buildings to understand how light level, signage, the presence or absence of guides, and contact with original surfaces all influence visitors in a historic place, leading to -or preventing- attention, excessive noise, and vandalism. The research and exhibit are one student's attempt to understand how historic places of suffering may be opened to influence the public, while still protecting and leaving space for ghosts.

Benjamin Larson: Architecture
Mentor: Bill Clinton -- Architecture
Stav-Kirke [Norwegian Stave Churches]

"It is in the details that one can find the singularity that will set one apart from the others." In most modern buildings, we cram our buildings full of stuff to attempt to generate a meaningful experience within. Posters and artwork cover paint and sheetrock which then cover stud walls and steel frames. Details are created to please an engineer or help a carpenter. Only vaguely to we ever understand what is really holding the building up around us. In Norwegian Stave Churches all of the excess gets stripped away and a history of 800 years is exposed in the wood. There is no paint, no plaster, no false walls or subfloors. Every piece of the building contributes to the function or the structure. There is a deliberate stroke in each detail, a thought in each notch. Each of the 29 remaining stave churches shows us that the essence of building comes in the true design and construction rather than in all of the stuff that we cram inside. This exhibit focuses on breaking apart and learning about the details of stave churches in the hopes that we can rediscover craftsmanship and take pride in our design work again...

Reid Loessberg: Music
Mentor: Rob Maher, Kristi McGarity -- Electrical & Computer Engineering, Music Technology
Acoustic Analysis of Campus Classrooms: How Do Acoustics Effect a Learning Space?

Acoustics are often a little understood part of room design, yet the acoustics of a room are crucial to the success of a space designed for learning. With too much background noise, or a room with a poor frequency response, the intelligibility of a speaker can be severely inhibited. In a space that has these or similar issues the learning environment is at risk of being impaired. To gain an understanding of standard classroom acoustics, this project consists of an objective examination by way of a software based frequency analysis test, as well a subjective review of background noise and frequency response in a selection of Montana State University classrooms. The end result of this project is a qualitative analysis of these campus facilities, their overall functionality including what factors may inhibit the learning environment. The final report includes recommendations for possible improvement in these facilities, as well as an analysis of why certain locations have good/poor acoustic qualities.

Wyatt Maw, Alex Miller: Film & Photography
Mentor: Paul Monaco -- Film & Photography
Silence

Silence is part of my senior capstone project in the School of Film and Photography. It is a film that depicts the struggle of liberty vs. tyranny amidst the backdrop of the French Revolution. The film centers on a young woman who, ravaged by the events taking place around her, decides to slay the man responsible for the chaos. Filming of *Silence* took place in the middle of November. It was an incredibly rewarding experience. I have directed many short films in the past but never one of this scope and scale. We brought in actors from New York, constructed a large scale set and ordered most of our props and costumes from Hollywood. Hundreds of hours were spent prepping for the film and shooting the film. I am very pleased with how everything turned out and cannot thank the cast and crew enough for the hard work and determination they put forward to make this film a success.

Alexander Miller, Wyatt Maw: Film & Photography
Mentor: Dennis Aig, Paul Monaco -- Film & Photography
Silence; Senior Film

I approached producing *Silence* as a challenge to put myself in the position to coordinate the execution of an ambitious period piece -- one far removed from Montana history and landscape. This involved a number of difficult pre-production tasks, which included extensive location scouting by myself and writer/director Wyatt Maw, casting professional actors that fit the director's vision, and filling a crew roster with fellow students and local artists -- all to create a small, yet historically rooted tale of violence and sacrifice set in Revolutionary France. This project was made possible through the generous USP grant, which assisted in the costs associated with shooting on location out of town, constructing an elaborate production design, and working with professional actors -- in a sense a full on exercise in real-world film production outside of the small MSU environment. Thanks to the preparation and resources the grant allowed and the generous help of the film department, the shoot went successfully and smoothly. The finished product

is a culmination of the hard work and dedication put forth by every person listed in the credits. And I personally learned the importance of diligence, preparation, and resourcefulness that goes into making a successful production.

Ashley Nettles: Film & Photography

Mentor: Ian van Coller -- Film & Photography

Bringing Back My Father

Addressing the social stigma behind paranoid schizophrenia, *Bringing Back My Father* is a photographic project that uses my experiences with a schizophrenic father to raise awareness about the disease. It will be a visual representation of the distress felt by paranoid schizophrenics, and the effect it has on friends and family. The goal of the project is to inspire those who are affected by paranoid schizophrenia, both victims and families, to give hope that a life once shattered can become a beautiful and manageable thing.

For my project I am taking self-portraits, as many of the things I do in my life are in direct relation to my father. The images are in environments that inspire memories of my father, such as where I grew up or places we liked to hang out. I am using items that are related to my father in each image, my way of metaphorically putting my father back into my life as a healed and healthy person. The images of myself combined with the tangible mementos of my father reflect the piecing together of a life affected by paranoid schizophrenia, and the relation to the real and imagined worlds we live in.

Paul Quigley: Film & Photography

Mentor: Gianna Savoie -- Film & Photography

No Limbitations

No Limbitations is a documentary about Sam Kavanagh, a Paralympic cyclist, who is competing in the London Paralympic Games. This presentation will highlight our pre-production work thus far as well as show our goals towards completing this project. The presentation will be in poster format showing pictures of Sam participating in various athletic events as well as interacting with his day-to-day life. The poster will define a short story summary of the documentary.

Sarah Riordan: Architecture

Mentor: Ralph Johnson -- Architecture

Energy Saving Possibilities in Local Medical Clinics throughout the Gallatin Valley

The purpose of this project will be to research energy saving possibilities for Medical Clinics in the Gallatin Valley. The objective will be to look at local Medical Clinics in Bozeman, MT and document the current land use, energy, water and waste average consumption/production.

Research will be done on sustainable strategies based on Regional, National, and International LEED and NETZERO certified developments. Sustainable strategies will be applied and presented as an alternative for sustainable practices and the savings within Montana. The results will be utilized to demonstrate the potential energy saving that can be achieved for building and the cumulative saving if all medical clinics were built or remodeled to the design standards revealed by this research project.

Robert Rodgers: Art

Mentor: Dean Adams – Art

The Business of Art

It has become interesting to me to see paintings and other works of art in a professional setting, whether it is a restaurant, office, or some other work place not used specifically for displaying art. I have often wondered what the process is for displaying work in such a setting. Can an artist, such as myself, work with a business to both accommodate their needs for a specific aesthetic that they have built into their workplace and maintain the artist's integrity of work? The thought has often crossed my mind that I could easily create an image that would be pleasing to a number of businesses, but in creating this work I would be completely abandoning my own personal style. My proposed solution to this problem is that I work with a business in town to develop a series of creative works that can successfully contribute to said business while maintaining my personal flair. I believe that many artists succumb to the

pressure of professional success and sacrifice their creativity to sell work. My hope for this project is to show that I can retain my identity while still being commercially viable.

Felicia Rogers -- Film & Photography

Mentor: Paul Monaco -- Film & Photography

Paranormal Detectives

As a culmination of my academic education at the Montana State University School of Film and Photography, I pitched and produced a ten-minute fiction film, titled *Paranormal Detectives*, during this Spring Semester 2012. Part classically-filmed and part gritty-mockumentary, my film revolves around a down and out documentarian, Scott, and his crew who joins a famous team of ghost hunters for a one night investigation at a haunted theater. Scott is determined to prove that their ghost hunting methods are false to save his career but at the end of a night of hilariously inept investigating, a ghost appears that the camera cannot see. Overall, this film underscores that it is the relationships between those that search for the dead that really matter and that, even with our technological advances nowadays, not everything can be captured and explained.

Terri Spray: Film & Photography

Mentor: Christina Anderson -- Film & Photography

Still a Family

My project will consist of taking photographs to document the phenomenon of a single parent raising a large family and going to school at the same time. I intend to show how our life is different than the average family but also show how it is similar. I will include photographs of each of my 6 children that are still living at home as portraits, as well as capturing everyday life and what that consists of for us. My project will record the struggles, time constraints and benefits of having many children. It will bring light onto the single parent and the absence of the other parent. It will show the impact that going to school is having on our family. I will include as much of our daily life as is possible to make a comprehensive study into large single parent families. The photographs will be the main documentation of the project and will probably be made into a book or slide show to archive the project.

Terri Spray -- Film & Photography

Mentor: Alexis Pike -- Film & Photography

Elderly of Gallatin Valley

My project is to photograph and collect stories from elderly residents of Gallatin Valley rest homes. I plan to go into the homes, offer to take a portrait that I will provide a copy of for them, and then sit down and ask questions about their childhood memories, early adult life and families that will spur them to share stories that make up who that person is. I am also, interested in what they can add to the knowledge of the history of the place they are from. I would especially like to focus a good many of the stories on people from our local area of Montana. If they are not from here originally, I want to get the story of how they came to live in Gallatin Valley. I will then take the stories and portraits and make them into a displayable print form, as well as a book that I will either hand-make or have made by a publishing company. I want the information and photos in the book to be accessible to the subjects, as well as their families, in addition to the general public that will find the stories entertaining and informative. My goal is to include a minimum of 10 subjects in the final project, but hopefully will have time to add several more. The project is a research into the recent past that is oftentimes overlooked until it is too late to get first hand accounts. I want to share with people the stories of everyday, ordinary people that have lived very long rich lives. This project is also my senior seminar project for this fall term in the school of Film and Photography.

Justin Stewart: Film & Photography

Mentor: Ian van Coller -- Film & Photography

Khwisero

The book *Khwisero* was created over the 2011 summer as I traveled to Khwisero, Kenya as a member of Engineers Without Borders (also known as EWB). This book is a documentation of all the work EWB has done with schools in the Khwisero district. It contains portraits of all the head teachers of the schools where EWB has implemented projects at. It also contains pictures of all the projects as well as the history of EWB's work in Khwisero. The club can use the book

for many purposes. They've already started to use it as a teaching tool for new members. The book was created in a platform that allows for additions to be made to the book by future members, and the book can continue to be a valuable resource for the club as long as they see fit.

Dustin Talbert: Architecture

Mentor: Ralph Johnson -- Architecture

Reevaluating the Efficiency and Function of Regional Storage Units, a New Approach to Storage

Conduct research to develop cost saving energy efficient strategies for storage space designs. Perform a thorough research of local/regional models as well as LEED certified typologies. Research will provide good insight to local shortcomings as well as show what LEED comparable alternatives have accomplished. The research will be used to create presentation boards that present alternative solutions for future designs that are more efficient and sustainable.

Jordan Thornton: Art

Mentor: Sara Mast, Rollin Beamish -- Art

My Skeletons Prefer the Kitchen

I will be creating a painting installation that, using primarily acrylic paint and found cabinet doors, was inspired by the following quote from Howard Thurman: "Don't ask what the world needs. Ask what makes you come alive, and go do it. Because what the world needs is people who have come alive." Conceptually, the project has diverged from the quote and become a series of "portraits" of what would be inside my cabinet or the cabinet of someone I know that inspired me. I will be further researching how this connects to Thurman's quote as well as creating a specific artist's statement that gives the viewer insight on how to interact and interpret the installation. Visually, I will be collecting found cabinet doors, drawers, etc. to paint on and creating imagery using acrylic as well as pages from my sketchbooks, letters, photos, and anything that is important to visualizing the concept. The cabinets will be installed in a cluster around a corner of a room. The doors will open. Images, whether paint or collage, will be on both sides. Across the room from the cabinets will be seating and a table of some sort with a handmade book that contains process imagery, research information, or anything important to the concept. The furniture will be painted as a continuation of the cabinets. The installation will be interactive. The audience will be encouraged to open the doors and flip through the book.

Aidan Lynn-Klimenko: Film & Photography

Mentor: Ian van Coller -- Film & Photography

Mas o Menos

This project is a photographic examination of the apprehension of aging and the emptiness of memory. These images were taken across South America, from Ecuador down to Brazil.

COLLEGE OF BUSINESS

Abigail Lair: Business

Mentor: Agnieszka Kwapisz -- Business

Factors Influencing Adult Full Day Ski Ticket Prices in the U.S.

Skiing is a popular past time, not only in Montana, but all across the U.S. However, the ski resorts differ widely in their ticket prices and characteristics they offer. The main objective of my research is to identify factors that influence the price of adult ski tickets at resorts across the U.S. My study will be based off of a large sample of ski resorts found via the website skicentral.com which list the 325 ski resorts in the United States. Analysis of this data will be performed using a multiple step regression model. Research will be executed to discover the relationship between adult ticket prices and factors that affect the quality of ski resorts. A model will include the following independent variables: ski area, the number of ski trails, and the number of different types of lifts, age of the ski area, annual snow fall, vertical rise of the resort, number of trails, number of lifts, percent of high-speed chair lifts and gondolas, and presence of a

terrain park. Additionally, the impact of the population of the nearest town and the proximity to other ski areas as measure of the competition will be examined. Analysis of these variables will show their effect on lift ticket prices. Other variables will include: if the resort has base lodging, a terrain park, ski lessons, race programs, and rentals. Some ski areas have a dual resort option and the effect of this variable on the ticket price will be examined.

Hunter Metcalf: Business

Mentor: Agnieszka Kwapisz -- Business

Factors Influencing Student Retention in Higher Education

Universities are in constant search of increasing student success. Measures include the retention rates and graduation rates of their student body. These rates vary significantly across universities. For example, the retention rates can be as low as 54% to as high as 98%. Little has been done to determine exactly what steps to perform in order to do so. This study attempted to determine factors that significantly influence the retention rates of full-time students and the graduation rates within 4 and 6 years. Moreover, we analyzed 4-year graduation rates by gender. Sample data on 400 universities were collected from the top 650 best U.S. undergraduate institutions as ranked by the *Forbes Magazine*. By examining a wide range of variables we were able to explain roughly 80 and 90 percent of the variation in retention and graduation rates. In this study, we use aggregate data (such as an average student to faculty ratio, average students' SAT scores, or average faculty salary) rather than individual student factors. This highlights the difference between our study and previous studies. Results were analyzed to indicate several factors of significant influence that are elaborated upon and explained in depth in the research.

Jeremiah Prummer: Business

Mentor: Graham Austin -- Business

B2C Communication & Permission Marketing

Most businesses do a poor job of communicating with their customers in a way that is relevant to them. This study examines a variety of different methods of electronic communication used by businesses to communicate with their customers. It looks at the communication preferences of different consumer demographics and analyzes which messages are most welcomed on each form of communication. Data will be broken down by business demographic, consumer demographic, types of information, and methods of delivery. The final result will be a paper that gives the marketer a better understanding of which methods of communication will be best for their customers, and what kind of information they should be sending their customers across each medium. At the time of the Research Celebration data collection will be completed and we will be able to present a summary of our likely findings.

COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

Natasha Cronsell: Health & Human Development

Mentor: Amy Cory -- Health & Human Development

Parent Perspectives on Opportunities for Healthy Physical Activity and Recreation for Young Children in Bozeman

Research has shown that for young children, 0-5 years old, physical activity plays a vital role in brain development and mastery of motor skills. We also know that making physical activity a regular part of life in the early years indicates better health later in life. In Bozeman, opportunities for young children to be physically active both indoors and outdoors exist. From a public health perspective, the fact that these opportunities exist means little without the context of what parents know about the opportunities, and about the importance of physical activity in their young child. This project examines (1) young children's physical activity needs, (2) existing resources for meeting these needs within Bozeman, and (3) parent perspectives of these resources. By looking at these components together, we can better assess how our community is serving this population. This project utilizes data collected by the City of Bozeman Recreation Department regarding opportunities for physical activity for children as well as qualitative data regarding parent perspectives collected by the Early Childhood Community Council of the Gallatin area. The final product of this

research is a community guide to the existing opportunities for physical recreation in Bozeman, specific to families with young children.

Yanet Eudave: Health & Human Development

Mentor: Bethany Letiecq -- Health & Human Development

Coping and Mental Health among Documented and Undocumented Mexican Migrants in a New Frontier Settlement

Latino immigration in the United States has shifted over the past 20 years from traditional urban settlement areas like California, Texas, and Arizona to rural areas such as Southwest Montana. In these non-traditional rural and frontier settlement areas, there has been minimal research on the mental health of Mexican migrants. The purpose of this study was to examine the context of how Mexican migrants cope in a non-traditional rural-frontier settlement area and if coping strategies differ as a function of documentation status. This study utilized secondary data gathered from a community-based participatory research (CBPR) project called "Salud y Comunidad: Latinos en Montana." For this study, the results of 120 interviewer-assisted survey questionnaires focusing on mental health correlates and migrant coping were analyzed. Findings revealed that migrants experienced different mental health outcomes and utilized different coping strategies as a function of documentation status. Undocumented migrants experienced significantly more depression symptoms as compared to their documented counterparts. Undocumented individuals also reported using significantly more negative coping strategies than documented migrants, including self-blame, self-destructive patterns and substance abuse. This research suggests that documentation status matters for migrant mental health and coping and holds important implications for intervention efforts in rural and frontier settlements.

Kala Jauquet: Health & Human Development

Mentor: Mary Miles -- Health & Human Development

Cultural and Economic Factors Affecting Diet and Nutrition in Children in Khwisero, Kenya

The purpose of this research project is to identify economic and cultural factors influencing food availability and diet in Khwisero, Kenya. Information gained in the study was used to explain malnutrition rates of children including stunting, wasting, and Kwashiorkor. Research was performed in Khwisero, Kenya for one month while working with Engineers Without Borders. A three-day dietary analysis was obtained by recording all food and drink consumed by the researcher. Information on economic and cultural factors influencing diet and nutrition were obtained through nine household interviews and extensive informal conversation with community members. The dietary analysis showed deficiencies of vitamins A, E, C, B12, potassium, zinc, iron, calcium, niacin, and magnesium. Foods rich in these nutrients are not widely available to Khwisero residents due to poor farming practices and high poverty rates. Cultural beliefs and traditions about diet and nutrition have impacted types of foods grown and consumed, as some foods are valued higher than others. Kwashiorkor was established as the most commonly found symptom of malnutrition among primary school children caused by a protein deficiency. Population and food availability was found to be the cause of the disease, as protein content in the diet was sufficient given proper caloric intake. Education of women, better farming practices, and culturally shifting cooking and eating habits may be beneficial in improving diet and malnutrition rates in Khwisero.

Kara Landolfi, Leanna Hansen: Health & Human Development, Cell Biology and Neuroscience

Mentor: Alison Harmon -- Health & Human Development

Evaluation of the Impact of Food Insecurity Education

There seems to be a general awareness that in today's world not everyone always has enough to eat, yet a lack of specific knowledge about what is termed food insecurity often arises. Food insecurity means not having reliable access to sufficient amounts of nutritious food through normal access channels to lead an active and healthy life. Professor Alison Harmon developed an educational experience where pre-health professionals can get a taste of food insecurity by limiting student's food expenses to \$3 per day, or \$15 over five days. From journals completed daily, qualitative data was sorted to characterize strategies related to maximizing one's budget, food choices and overall diet quality; physical, emotional, and mental consequences during the exercise; insights and observations of the participants, participant feelings about completing an application for food assistance and visiting a food bank, and participant predictions related to how the experience would benefit them in their professional practice. Implications of this research are intended to assist educators in creating student experience that foster empathy and understanding about

food insecurity issues. A simulated food insecurity experience can be useful in increasing competence for health professionals working with limited resource clients.

Hamilton Lynn, Liz Hummelt: Sustainable Food & Bioenergy, Land Rehabilitation

Mentor: Catherine Zabinski -- Land Resources & Environmental Sciences

Determining Nutrient Availability in Gallatin Valley Organic Systems Through Comprehensive Soil Testing

Our projects investigated the effects of different forms of organic matter and the effects of production intensity on plant available nitrogen in two separate agricultural operations in the Gallatin Valley; a research experiment located in Townes Harvest Garden and a commercially operative organic vegetable farm, Field Day Farm. In order to determine plant available nitrogen levels among different soil treatment plots and cropping areas on these farms, we cultivated annual ryegrass in greenhouse pots using soil composites collected from different treatments. The ryegrass pots were maintained for 8 weeks, at which time cuttings of biomass from each composite were taken and analyzed to determine nitrogen content within plant tissues. We compared our bioassay results to traditional laboratory analyses for KCl-extracted nitrate. The methods being performed were modeled after Liu, et al. (2011). The results from soil analysis show that the hay mulch provided the most plant available nitrogen, followed by the nitrogen mineral fertilizer treatment, the control, and the barley straw mulch. We will compare tissue nitrogen levels from the greenhouse assay to our soil results. Overall, understanding nitrogen uptake could provide information useful to farmers who are trying to maximize crop yield while lowering soil inputs.

Sarah Novotney: Health & Human Development

Mentor: Wade Hill -- Nursing

A Cross-Cultural Comparison of Standards of Care for Anterior Cruciate Ligament (ACL) Injury

Background: Statistics show that there is on average about 200,000 ACL tears annually in the United States and about 60,000 to 75,000 of the people with an ACL tear will experience a reconstruction surgery (Gammons, 2010). Some evidence exists showing improved outcomes utilizing eastern medical traditions. The purpose of this study was to compare and contrast standards of care (SOC) for ACL injury between the Western and Eastern traditions utilizing examples from the United States and Thailand.

Methods: This project used a qualitative approach from the perspective of descriptive phenomenology to identify central tenants of Western and Eastern approaches to care for ACL injuries. For this project, the interview was guided by a predetermined set of open-ended questions, varying for different fields of participants. Findings: In the United States, ACL injuries are more common than in Thailand. Also, because the United States does not follow eastern traditions such as sitting in a cross-legged position throughout the day, practice yoga, meditation, or Thai-Chi like exercises frequently, Americans thus are exposed to more knee injuries. Thailand and the United States follow very close procedures to healing an ACL injury, however there are more traditional Thai methods and remedies that can be used on patients such as Thai massage and herbal ball treatments. Implications: Although Thailand does offer alternative approaches to healing, Thailand is greatly Western influenced in terms of treating an ACL injury. Due to the amount of doctors trained under Western schooling, the United States and Thailand share close methods of care for an ACL injury. It is not extremely common in either Thailand or the United States to use holistic approaches to heal ACL injuries; it is mainly dependent on the patients want and/or belief in the traditional/complimentary practices.

Erin Rinehart: Health & Human Development

Mentor: Ann Bertagnolli, Lynn Hellenga -- Montana INBRE, Montana Nutrition and Physical Activity Program

Montana Public Worksite Breastfeeding Support

The Nutrition and Physical Activity (NAPA) Program is grant-funded by the Centers for Disease Control and Prevention (CDC) and was established to decrease the prevalence of obesity and other chronic diseases. One of the specific goals of NAPA is to increase breastfeeding initiation, duration, and exclusivity as breastfeeding has been shown to have a positive impact on health including the prevention of obesity. One of the challenges to breastfeeding duration is the mothers' return to work after maternity leave. In 2009, Montana established a worksite breastfeeding law in which public worksites must have a written policy supporting employees who breastfeed. They must provide a clean private space and allow the employee flexible break times for expressing milk. To date there has been no system established to track compliance with this law. As a pilot study, I surveyed Montana public worksites to determine their current status of having a written policy, providing proper space, flexible break times, and support for employees who breastfeed. Of

the survey responses received 78.7% were aware of the MT breastfeeding laws and 58% reported having a written breastfeeding policy. Most worksites do provide flexible break times, but find it challenging to provide the space.

Gregory Ruegsegger: Health & Human Development

Mentor: Mary Miles -- Health & Human Development

Effects of eccentric muscle contraction and a high- or low-glycemic diet on inflammation

Downhill running promotes eccentric muscular contractions and is a common cause of muscle damage. After muscle-damaging exercises, such as exercise that promotes high-force eccentric muscular contraction, inflammatory cells produce an array of cytokines to produce, and mediate, an acute inflammatory response. One cytokine associated with the inflammatory response after exercise is interleukin-6 (IL-6). During the inflammatory response IL-6 provides feedback inhibition to prohibit the synthesis of pro-inflammatory cytokines that stimulate a further inflammatory response and induces synthesis of anti-inflammatory mediators. It has been shown that differences in glycemic index enhance the synthesis of several inflammatory cytokines, and possibly IL-6. The aim of this research was to compare the effects of downhill running coupled with either a high (HGI) or low-glycemic index (LGI) diet on serum IL-6 levels in overweight women. Participants (n=20) completed a standardized downhill running protocol and were randomly provided with a HGI or LGI diet for a 24 hour period post-exercise. IL-6 was measured using standard approaches at times pre-, 0, 24, and 48 h post-exercise. For the subjects analyzed (n=10, 5 LGI, 5 HGI) there were significant differences in IL-6 and Δ IL-6 levels between pre and 0 h post-exercise (p=0.02 and 0.04 respectively) but no significant differences between interventions (p=0.16 and 0.32 respectively). Because of the small sample size, these results are inconclusive and analysis of the remaining subjects is needed to determine the influence of glycemic index alteration on IL-6 levels and the magnitude of 24 and 48 h post-exercise inflammation.

COLLEGE OF ENGINEERING

Dylan Abraham, Jesse Shirley, Sarah Mondl: Computer Science, Computer Engineering

Mentor: Hunter Lloyd -- Computer Science

RoboSub

I have and will continue to work on the development of the decision, task-managing, internal modeling, and communication modules of the core program for MSU's entry to the 2012 AUVSI RoboSub autonomous submarine competition. In addition to this, I lead the coding team and am in charge of overall coding design decisions for the project. My presentation will focus on the design decisions and goals for this year's entry, as well as the more technical details of how the decision making will be handled.

Erik Anderson: Electrical & Computer Engineering

Mentor: Joseph Shaw -- Electrical & Computer Engineering

Winterization and Upgrade of Remote Weather Station

The Optical Remote Sensor Laboratory (ORSL) operates a weather station at the field test site of the Zero Emissions Research and Technology Center (ZERT), located on the Montana State University (MSU) Agriculture Experiment station a few miles west of campus. The weather station uses a wireless link to transmit data to ORSL in Cobleigh Hall on the MSU campus. The ZERT weather station was traditionally not operated in the winter, because ZERT's research is confined to the summer months and because the cold weather causes frequent loss of battery power and a weakened wireless link. However, ORSL has expanded its use of the ZERT weather station to include long-term climate monitoring, which requires that it be operated year-round. To achieve this, the power system of the weather station must be upgraded. General improvements must also be made to improve overall performance and to protect against lightning strikes and other damage. The upgrade of the ZERT weather station consists of three phases. First, the components of the weather station's wireless link are tested in low temperatures to assess their performance and capabilities in cold weather. The power system of the weather station is then redesigned based on the results of the low temperature tests to ensure optimal year-round performance. Finally, the redesigned components are deployed at the ZERT field site and field tested to determine their effectiveness.

Hannah Arm: Mechanical & Industrial Engineering

Mentor: Sarah Codd, Joe Seymour, Jennifer Brown -- Mechanical & Industrial Engineering, Chemical & Biological Engineering

Temperature Control System for Supercritical Flow of Brine and CO₂

The Magnetic Resonance (MR) Lab in the College of Engineering would like to study the transport properties of supercritical CO₂ using MR techniques. In order to achieve this it was necessary to design a system to ensure supercritical temperature and pressure of the CO₂ throughout a flow loop that was compatible with the MR spectrometer magnet. A water jacket system was designed that housed high pressure PEEK tubing (diameter = 0.125") inside larger diameter tubing (diameter = 0.75"). The CO₂ flows through the smaller diameter tubing and hot water flows through the larger diameter tubing to create a water jacket. This design allowed the CO₂ to be held above 31.1°C and ensures the CO₂ is maintained in a supercritical state for the entire flow system. MR measurements have been made of CO₂ and brine flowing. Below the supercritical temperature, two phase flow is evident. Above the supercritical temperature the CO₂ is completely dissolved in the brine and a single phase flow is observed.

Kayla Babbitt: Mechanical & Industrial Engineering

Mentor: Stephen Sofie -- Mechanical & Industrial Engineering

Design and Development of a Seebeck Coefficient Measurement System

Numerous processes in current society generate substantial waste heat. The use of thermoelectric (TE) materials, a unique group of materials capable of directly converting a temperature difference to electrical energy, is one such way to harness this underutilized energy source. Thermoelectric materials are solid-state devices with no mechanical moving parts and, thus, are completely silent and available in very small to large configurations for modularity in a wide range of heat recovery applications. The extent with which TE's convert temperature into voltage is characterized by the materials Seebeck Coefficient which can allow for predictions of device efficiency. The objective of this project was to design and build a Seebeck Coefficient measurement system for diced (~ 2 mm³) ceramic semi-conducting thermoelectric materials that represents a significant departure from measuring simple metal wires. The system will be integrated with Agilent Benchlink Data Logger program in order to record temperature differences and voltage differences. With this data, the optimal temperature difference to produce the maximum output voltage can be determined for the material. This measurement system will be used in later research in order to determine the Seebeck Coefficient of compound semiconductors fabricated through the use of a directional solidification furnace.

Kevin Bangen: Mechanical & Industrial Engineering

Mentor: Chris Jenkins -- Mechanical & Industrial Engineering

Membrane Tearing

The objective of this project is to continue the study of tearing in membranes. The objective of previous work was to study the damage mechanics in biological tissue with an emphasis on suture, staple, and adhesive behavior. We plan now to continue with similar work and investigate the effect of initial cut orientation on the tear propagation evolution, particularly on the tear propagation direction. Because the level of complexity is considerably greater now than for the previous work, we will commence with the investigation using thin polymer (Kapton, Mylar) membranes. Biological membranes will be returned to in a later phase of work. The hypothesis to be tested is that the cut geometry (cut length and orientation) will affect the tear propagation evolution, as will the presence of wrinkling.

Bridget Bergin: Mechanical & Industrial Engineering

Mentor: Sarah Codd -- Mechanical & Industrial Engineering

NMR Technologies for Monitoring Biological and Geochemical Processes in the Subsurface

Reducing the negative impact of environmental contamination has become an important issue for society. It is challenging to manage multiple locations where the possibilities of high levels of subsurface contamination exist. A solution to this problem is creating and implementing bioremediation technologies in these areas [1]. Currently, direct sampling of the subsurface requires collecting and sifting through contaminated samples which pose significant safety, regulatory, and cost issues. Because these issues reach the severity they do, an alternative approach using nuclear magnetic resonance, or NMR, is being proposed as an effective monitoring process [2]. High field NMR measurements

are capable of detecting biofilm [3]. However, high field NMR is not suitable for biofilm detection in the subsurface due to the high magnetic field susceptibility effects in these materials [3]. Therefore, it has been proposed to use an in-situ NMR machine that will operate at a low field of 300 kHz. A low field instrument was provided on loan from Vista Clara, Seattle, WA. Samples of clean sand and biofouled sand were compared and the NMR relaxation time clearly differentiated between the two samples. This indicates that low field in-situ NMR devices will be able to monitor bioremediation processes.

Alissa Bleem: Chemical & Biological Engineering

Mentor: Ross Carlson, Hans Bernstein -- Chemical & Biological Engineering

The Design and Characterization of Artificial Biofilms: Microbial Catalyst Platforms Based on Photo-Autotrophic Syntrophy

Biofilm cells exist in environments with much higher local cell densities than those found in liquid environments, leading to significantly elevated levels of localized metabolic by-products. Such metabolites have the potential to play a key role in heterogeneous biofilms via syntrophy, a mutually beneficial process in which one microbe utilizes the by-products of another for its own proliferation. This project examined the metabolic characteristics of a microbial consortia biofilm comprised of two organisms. These artificial communities utilized an autotrophic cyanobacteria, *Synechococcus sp.*, as a primary producer and a heterotrophic *Escherichia coli* as the corresponding consumer strain. Benefits of syntrophic metabolite exchange were characterized through growth rate data, vitamin exchanges, and comparison of biomass productivity under applied conditions. The artificial binary biofilm cultures displayed an approximate 40% increase in biomass productivity and nearly a 1.5-log increase in colony forming units per biofilm over the control *Synechococcus* mono-cultures. Current work on this system seeks to better understand the role of oxygen production and scavenging between the *Synechococcus* and *E. coli* as well as species-dependent spatial partitioning within the biofilm.

Krishna Chattergoon: Electrical & Computer Engineering

Mentor: David Dickensheets -- Electrical & Computer Engineering

High-speed focus control MEMS deformable mirror with controlled air damping

High speed focus control is useful for optical storage read heads, confocal laser scanning microscopy and optical coherence microscopy. Damping due to viscous air flow is the dominant energy loss mechanism for membranes vibrating over a closely spaced backplate. To control air damping and achieve wide bandwidth actuation, a design with vertical air channels through the backplate is proposed. This project focuses on designing, fabricating and characterizing these proposed MEMS deformable mirrors. Characterizations will be both modeled and experimentally verified. Device designs will be optimized to achieve desirable damping properties with bandwidths over several tens of kilohertz with sub-millisecond settling times. Resulting devices will provide optical instruments with fast focus control properties.

Yasmin Chaudhry: Civil Engineering

Mentor: Joel Cahoon -- Civil Engineering

Hydraulic Rating of Functional Fish Barriers

Weirs or screens are used as fish barriers in Montana streams to prevent fish from passing into irrigation or power generation canals, prevent invasive species from migrating, or even as part of structures built to help count or manage fishery resources. Studies of fish behavior relative to barriers are ongoing; however the hydraulics of fish barriers has been less studied, and as a result the design and analysis of fish barriers has tended to be trial-and-error in the field setting. In this project, several different functional barriers similar to those that have been used in the field will be tested for hydraulic performance under systematically varied hydraulic conditions (water velocity and flow depth) to determine rating curves so that designs of fish barriers may be made with confidence.

Andrew Crawford: Mechanical & Industrial Engineering

Mentor: David , Ehson Mosleh, David Racek -- Space Science and Engineering Laboratory

Multiple Spacecraft Adaptability for Small Satellite Ground Operations

The Multiple Spacecraft Adaptability for Small Satellite Ground Operations research involves analysis of MSU's Space Science and Engineering Laboratory's current small satellite ground operations and mission procedures, and adapting those procedures for compliance with upcoming multiple-spacecraft missions. With the recent successful launch of Montana's first satellite, HRBE, currently in Earth orbit collecting and down-linking science data to MSU, there is a fundamental need to examine lessons learned and ground operations efficiency, in advance of the upcoming FIREBIRD satellite launch and mission, which involves multiple spacecraft. The Space Science and Engineering Laboratory is currently configured to run in-house ground operations of spacecraft, including down-linking of science data, up-linking commands to the spacecraft, and monitoring the spacecraft systems health from the space telecommunications operations center located within the lab. With the upcoming FIREBIRD mission slated to launch in 2013, which involves two spacecraft, fundamental changes and new configurations regarding the ground station operations need to be researched and implemented. Research involves antenna-tracking capabilities for multiple spacecraft, data-download and transmit paths using multiple ground station computers, as well as current equipment feasibility and compatibility to handle multiple transmit/receive functions simultaneously from two spacecraft. The research will provide fundamental configuration options for future missions.

Jacob Danczyk: Mechanical & Industrial Engineering

Mentor: Hugo Schmidt -- Physics

Characterization of Anode Nickel Coarsening in Solid Oxide Fuel Cells through Impedance Spectroscopy

Solid Oxide Fuel Cells (SOFCs) are an energy production technology which offer the possibility of achieving very high efficiencies in converting fuel sources to electrical energy. The general design of SOFCs consists of a triple-layered structure consisting of anode and cathode outer layers and a center electrolyte. The principal anode material used in oxygen-ion-conducting SOFCs is a porous cermet of nickel and yttria-stabilized zirconia (Ni-YSZ). The anode is the site of fuel oxidation, and an even distribution of nickel grains, YSZ particles, and open pores is desired for optimal performance. Oxygen-ion-conducting SOFCs operate at high temperatures (500° C-1000° C), which results in amalgamation of the nickel grains over time (Coarsening), reducing power output. This is the major limitation on SOFC lifespan, and mitigating the coarsening process would significantly increase the economic viability of SOFCs. Understanding coarsening is a necessary step in mitigation. Impedance spectroscopy is an observational technique which allows the time growth of nickel grains to be accurately characterized. The dielectric properties of the anode are measured as a function of frequency. The high conductivity of the nickel causes the sample to have low impedance relative to the apparatus, and therefore pellets of anode material with varied nickel volume percentages (10%-30%) will be manufactured so that the nickel percolation threshold may be found. Near and below this threshold the sample impedance will rise sharply, allowing inspection with the impedance apparatus. The pellets will be held at high temperature in the impedance apparatus, so that the dependence of nickel coarsening on time, temperature, and anode composition may be characterized. The findings will increase understanding of the coarsening process and may be incorporated into the design of future SOFCs.

Krista Drummond: Electrical & Computer Engineering

Mentor: Wataru Nakagawa -- Electrical & Computer Engineering

Development and Optimization of Surface Plasmon-Polariton Based Sensing System

Techniques based on the Surface Plasmon-Polariton (SPP) phenomenon are a common approach to realizing high-performance refractive index sensors. In our laboratory, we have designed and built such a system which is capable of measuring the refractive index of liquid samples. This is done by injecting a sample liquid into a fluidic system, consisting of a Polydimethylsiloxane (PDMS) walled chamber designed to hold the sample flush to the surface of a gold coated glass slide. This boundary is then illuminated with a laser beam and the excited SPP is observed. The current SPP-based sensor is capable of detecting refractive index changes (Δn) of about 0.0022. Our goal is to increase sensor performance by investigating several improvements to system components. This includes evaluating enhancements to the fluidic system layout to reduce the required sample volume to make a measurement, modifying the optical layout to increase system angular resolution, and improving the quality of the gold film which will improve the sensitivity of the sensor. This includes testing alternate gold adhesion layer compositions, improving the smoothness of the gold

surface, or comparing different deposition methods to achieve the highest quality SPP. This investigation documents an improvement in overall system performance by showing an increase in system sensitivity through a decrease in measurable change in refractive index. Measuring this optical property can help determine the identity of a liquid, along with determining solute concentrations. Future investigation involving PDMS microfluidics will facilitate interdisciplinary collaboration, including chemical, biological, and medical applications.

Amanda Durch: Chemical & Biological Engineering

Mentor: Garth James -- Center for Biofilm Engineering

Three-Species Chronic Wound Model: Targeting Specific Species with Antibiotics

This project involved growing three-species biofilms with *Staphylococcus aureus* (Sa10943), *Pseudomonas aeruginosa* (Pa215), and *Clostridium perfringens* (Cp816). E-test strip assays were conducted to determine antibiotic minimum inhibitory concentrations (MIC). The results revealed Pa215 was sensitive to gentamicin (MIC=3) and ciprofloxacin (MIC=0.38), Sa10943 was sensitive to gentamicin (MIC=0.25), and Cp816 was sensitive to tetracycline (MIC=8) and ciprofloxacin (MIC=0.15). Biofilms were grown in drip-flow reactors and treated with gentamicin (50 or 100 µg/ml) or ciprofloxacin (250 µg/ml). The control biofilms had mean log cell densities (\pm standard deviation) of 8.94(\pm 0.19), 10.71(\pm 0.23), and 8.21(\pm 0.24) for Sa10943, Pa215, and Cp816, respectively. Treatment with gentamicin at 50 µg/ml resulted in a 0.77(\pm 0.53) log reduction (LR) for Sa10943 and no LR for the other species. Increasing the gentamicin concentration to 100 µg/ml resulted in similar LR of 0.88(\pm 0.52) for Sa10943, but additionally resulted in a LR of 1.10(\pm 0.13) and 0.82(\pm 0.26) for Pa215 and Cp816, respectively. Treatment with Ciprofloxacin at 250 µg/ml resulted in a LR of 0.73(\pm 0.32), 1.62(\pm 0.32), and 1.21(\pm 0.32) for Sa10943, Pa215, and Cp816, respectively. Interestingly, these results showed that both Sa10943 and Cp816 showed antibiotic susceptibilities in the 3-species biofilms that were not predicted by the E-test.

Jude Eziashi: Chemical & Biological Engineering

Mentor: Paul Gannon -- Chemical & Biological Engineering

Chromium Volatility: Assessment of Quantifying Techniques

Chromium volatility is a phenomenon with significant implications in any process that involves flowing a gaseous stream over a Cr-containing solid (e.g., stainless steel) sample at high temperatures. The chromium present within the steel substrate has been observed to migrate into the surface oxide scale that forms during exposure and subsequently vaporizes off the oxide surface as chromium-containing vapor species. In fuel cell environments, the vaporized chromium species could interact with the cathode forming non-conducting species and would be deleterious to the cell function. The primary objective of this University Scholars Program (USP) project is to research and explore chromium volatility as well as the techniques available to quantitatively measure and account for the chromium lost from a steel sample in the hopes that once the chromium evaporating from a metal surface can be calculated, materials can then be developed to reduce this chromium evaporation and lengthen cell lifetime. Two techniques, Rutherford Backscattering Spectroscopy (RBS) and the Transpiration method are applied to quantify vaporized chromium and compared and the relative advantages and disadvantages of both techniques are evaluated. The anticipated significance of the project will be contribution to ongoing research aimed at combating a reoccurring problem observed in industry.

Cassidy Fisher: Mechanical & Industrial Engineering

Mentor: Douglas Cairns -- Mechanical & Industrial Engineering

The Effects of Defects in Wind Turbine Blade Manufacturing

Current manufacturing techniques of wind turbine blades have been found to cause flaws in the forms of porosity, in-plane waviness, and out-of-plane waviness. Dr. Cairns' group is currently working on characterizing these defects and understanding their effects on the blades' lifespan. As a member of this group, I will be an active participant in each step in this process; manufacturing coupons, testing said coupons, and analyzing the results. We will be creating a polymer-matrix composite that models the material and manufacturing of wind turbine blades, allowing our tests to more accurately represent the actual results of stress upon the blades. These coupons will be tested under compression and tension, to create a damage progression curve. This will help us to create a model that is necessary to determining the overall effects these manufacturing flaws have on the blades' lifespans. With these results, the USDOE's Blade Reliability Collaborative can work towards potentially creating blades that are both cost-effective and

defect free, allowing them to more efficiently fulfill the desired lifespan of 20 years, and be a more feasible means of energy.

Patrick Flaherty: Mechanical & Industrial Engineering
Mentor: Joe Eldring -- Mechanical & Industrial Engineering
Snowboard Manufacturing Press

The purpose of this creative project is both academic and research oriented. The goal was to apply basic engineering principles to the design and construction of a rapid prototyping snowboard manufacturing press. The two main driving factors in snowboard performance are shape geometry and material selection. Current press designs are generally tailored for large production runs of single board geometry, and thus limit the ability to quickly change board parameters such as length, tip/tail shape, and camber profile. In addition to the geometric versatility of the new press design, virtually unlimited laminate lay-up combinations can also be implemented. These design alterations can then be tested on-snow, and correlations between manufacturing technique, static test results, and qualitative rider feedback can be developed. Another project goal was the involvement of other students, and this past fall the press was utilized as a design project for a 5 person Multidisciplinary Engineering Design team (EGEN 310). Manufacturing of the press is currently underway, with snowboard manufacturing scheduled for fall of 2012. Qualitative testing, open to the public, will then start in early winter.

Ares Geovanos: Chemical & Biological Engineering
Mentor: Edward Dratz -- Chemistry & Biochemistry
Electrokinetic protein extraction from polyacrylamide gels with in-line microfluidic digestion and integrated mass-spectral analysis

Two-dimensional polyacrylamide gel electrophoresis (2-D PAGE) remains a commonly used method in proteomics and provides for the detection of changes in protein isoforms as well as comparison and relative quantification of thousands of intact proteins. In conjunction with differential Z dye labeling, spots on the nanogram scale can be detected, but the more dilute samples are subject to losses and contamination over standard multistep preparation procedures, which may lead to failed identifications by mass spectroscopy. We are developing a system that combines the preparatory steps necessary for mass spectral analysis into a fully automated, microfluidic in-line system. The system identifies dilute proteins by the targeted electroextraction of SDS-complexed proteins, followed by in-line tryptic digestion and direct analysis on an Agilent chip-LC.

**Please join the Hughes Scholars at the 2:00 oral session where we will share our science outreach experiences

Patricia Glatz: Mechanical & Industrial 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. 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. [1] 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 geographic data 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.

Erin Hafila: Civil Engineering

Mentor: Otto Stein -- Civil Engineering

Nitrogen Removal via Ammonium Adsorption to Gravel Sized Particles in Constructed Wetlands

Constructed wetlands are currently used as an alternative to conventional waste-water treatment systems throughout the world. However, several of the chemical processes involved are still in the process of being understood. The removal of ammonium from waste-water is one of these processes. Two mechanisms by which constructed wetlands remove ammonium from the system is by ammonium adsorption or through ammonium volatilization. The focus of this study was to discover the reasons behind abnormally high adsorption rates recorded in a previous study conducted in 2005 for a gravel currently used in one of Montana State University's constructed wetland projects. This sorption study consisted of five experiments. The first experiment was meant to determine the Cation Exchange Capacity (CEC) of the gravel to further define the ability of the gravel to sorb ammonium in a constructed wetland system. The second addresses the basic physical properties that are involved in determining whether the amount of ammonium adsorption occurring in the gravel. The third and fourth experiments sought to establish which of the two main processes involved in the removal of ammonium was the reason behind the overall loss of ammonium from this particular constructed wetland system, and complete a mass balance of a specific amount of ammonium through an adsorption and desorption experiment. These two experiments also looked at the ability of gravel to sorb variable initial concentrations of ammonium over a period of 24 hours. The fifth experiment was meant to determine the maximum sorptive capacity of the gravel of interest. Results of this analysis showed that the gravel's CEC was below the detectable limit of the methodology that was being used, which was calibrated for a soil. An X-ray Powder Diffraction machine was used to determine the components of the gravel, which were revealed to be mainly a type of quartz and a silica based compound as well as 10 to 20% calcium mica. Mica increased the CEC of the gravel dramatically, thus increasing the adsorption ability of the gravel. Adsorption was found to be the single cause of ammonium loss from the system and a concentration of around 500 mg/L of NH_4Cl as N was discovered to saturate the system allowing for all of the adsorption sites to be filled. The pH of the solution never rose above 6.5, effectively preventing chemical reactions from converting ammonium to ammonia and disallowing volatilization to begin. The maximum sorptive capacity was determined to be approximately 180 mg/L of NH_4 as N, which is about 232 mg/L of NH_4 . These results are consistent with the amount of adsorption calculated in the previous research. Overall, sorption may still be affected by factors acting on the system; research opportunities to discover the extent that these factors may change the absorbance of ammonium are many.

Matthew Handley: Electrical & Computer Engineering

Mentor: Dave Klumpar, Ehsan Mosleh -- Space Science & Engineering Laboratory

Using Solar Panel Data to Model In-Orbit Spacecraft Dynamics

The goal of this project is to develop an algorithm to determine the orientation and rate of rotation of the Hiscock Radiation Belt Explorer (HRBE), a CubeSat satellite which has been operating in-orbit since October 2011. It was designed and built on campus at Montana State University (MSU) by students of the Space Science and Engineering Laboratory (SSEL). The algorithm uses solar panel electrical current readings to determine the orientation of the satellite. This data will be used by the SSEL to assess the effectiveness of the satellite's passive attitude control system and aid in the development of attitude control systems for future satellites. Additionally, the data will be rendered graphically to accurately represent the orientation and rotation of HRBE over time. This presentation will cover the steps taken to develop this algorithm, as well as its implementation in the data processing routine. Animations of the satellite's orientation over time will also be on display.

Eric Hjelvik: Chemical & Biological Engineering

Mentor: Paul Gannon -- Chemical & Biological Engineering

Determination of Thin Film Thickness

Thin films are used in the coating of various metals and can change the surface properties of their coated substrates to produce desired results in several applications. Faraday Technologies, a company based in Clayton, OH, is actively pursuing research in this field in order to determine optimal coating compositions and thicknesses for a variety of situations. They are currently searching for a fast, economic, and efficient method to determine the thicknesses of their coatings. A device produced by CSM Instruments, the CalotestTM, boasts an ability to quickly and easily determine the thickness of metallic coatings ranging from 0.1 to 50 μm . This machine does so by spinning a stainless

steel ball with a diamond slurry against the coated substance to produce a “scar” on the surface. Geometrical analysis of this scar via optical microscopy can determine the coating thickness, provided the scar is relatively symmetrical. The goal of this research project is to determine a proficient protocol for use of the Calotest™ in this and other thin film applications. Reported here are preliminary findings from this project in regards to test parameters and resulting scar characteristics, which have significantly informed the development of test protocols to be used in industry.

Jeff Ibey: Computer Science

Mentor: Clemente Izurieta -- Computer Engineering

Micro-Compressor

I set out to compress pictures on hand-held devices in real time, increasing the storage space in SD-type devices. I built a micro-controller that compresses and uncompresses a pictures in real time, with a 75-90 % data save rate.

William Isbell: Electrical & Computer Engineering

Mentor: Joseph Shaw -- Electrical & Computer Engineering

Calibration of Weather Station Instruments and Heat Island Effects

The Optical Remote Sensor Laboratory Montana State University operates two weather stations, one on the roof of Cobleigh Hall, and the other in an agricultural field west of campus. In recent years, temperature readings received from these two weather stations have shown a small but significant bias. This project sought to determine how much of this difference is caused by calibration uncertainties and how much might be caused by a “heat island effect.” First, the relative calibration between the temperature and humidity probes of each station was determined using a common reference probe, after which the reference probe was sent to a factory for recalibration. Secondly, the absolute calibration for each station was determined with the newly calibrated probe. Thirdly, the common reference sensor and a GPS were mounted on a backpack frame and data was collected throughout the campus and the vicinity so that a map of the magnitude and spatial extent of a heat island could be plotted on a satellite image. The presentation will describe the experiment and show results of the data, which currently are being processed.

Chait Johar: Mechanical & Industrial Engineering

Mentor: Barton Scott -- History, Philosophy & Religious Studies

Study of Indonesia as a Paragon of Tolerance in Religion using ISKCON as a Test Case

Indonesia has been hailed as a &”religiously tolerant” country by many notable figures around the world. Indonesia is a country with about 86% Muslims, 5% Protestants, 3% Catholic, 3% Buddhists and about 2% Hindus. Despite this lopsided percentage, Indonesia’s religions appear to thrive peacefully. Through this project, I intended to find out how and why Indonesia has remained a secular nation. In order to narrow this rather broad project, I used ISKCON (International Society of Krishna Consciousness) as a test case. I used ISKCON as my “nucleus” and observed the “electrons” that revolve around it. ISKCON, a worldwide Krishna movement is quite an atypical religious institution that is “stand-alone” in the whole of Indonesia. Thus, through this project I intended to study the smaller aspect of the relation between the surrounding community and ISKCON and use this narrow learning to find answers to the presence and cause of the religious tolerance in the whole of Indonesia. In order to successfully complete this project, I intended to draw upon my fluent Indonesian, background in Religious Studies (through a class and my past), and my research techniques that I had discussed with my faculty sponsor.

Sarah Johnson: Civil Engineering

Mentor: Otto Stein -- Civil Engineering

Soil Redox Potential in Constructed Wetlands for Wastewater Treatment

Wastewater treatment wetlands use microbial processes to remove nutrients and pathogens in wastewater. To determine where these actions take place in the system, we can use redox testing and get a better look at the electrical potential gradient in the soil media. A soils electrical potential indicates the most probable electron acceptors and can explain specific characteristics about the system. This research will explore redox potential at various locations in a wetland system including the redox potential right next to the root. It is assumed that higher readings indicating higher oxygen level will decrease with depth. Due to the diffusion of oxygen near the root, I expect to see high reading near the roots as well. Results will be compared to a bulk reading taken in the center of the column. The data from this

experiment will indicate the redox potential of different locations in the soil media, along with readings taken directly at the root. Comparisons will be made between six different plant species and three different carbon loads. Measuring the redox gradient in the soil media and the surrounding the root system, can provide essential information about nutrient breakdown throughout the system. The information explored and collected in this research will improve the ability for us to understand the treatment system as a whole and will aid in the knowledge of how constructed wetlands treat wastewater.

Ethan Keeler: Electrical & Computer Engineering

Mentor: Wataru Nakagawa, David Dickensheets -- Electrical & Computer Engineering

Near-Infrared Polarization Optics using Nanostructured Silicon

Silicon structures with sub-micron size features can have interesting optical properties, and have been explored in a number of application areas. In addition, these silicon nanostructures can be fabricated using standard materials and processes adapted from the semiconductor industry, streamlining their construction and enabling eventual integration with other silicon-based devices such as micro-electro-mechanical systems (MEMS) or electronic circuitry. The goal of this work is to investigate an optical device realized using a silicon nanostructure: a polarizing beam splitter (PBS), a device that reflects one linear polarization state while transmitting the other. This device consists of a grating in a silicon substrate with a thin layer of gold atop its peaks and inside its troughs. In order to evaluate the optical characteristics of this device in detail, several simpler but related devices, such as subwavelength-period gold gratings (wire-grid polarizers) and silicon gratings (form-birefringent structures), are also investigated. We present the design, fabrication, and preliminary characterization of this family of devices fabricated in our laboratory. In creating all of these devices, the project successfully demonstrated that an optical PBS can be realized using engineered silicon nanostructures. It also quantitatively compared the new PBS device to well known structures of the same nature, and it provided an excellent side-by-side comparison of the different structures used to achieve polarization selectivity. As this work suggests, silicon is an excellent material for creating optical nanostructures, but also potentially enables large-scale integration of electrical and optical systems, which will have boundless possibilities as technology progresses into the future.

Jordan Kennedy: Mechanical & Industrial Engineering

Mentor: Jennifer Brown -- Chemical & Biological Engineering

Rheological Characterization of Alginate Gel

Alginate is a biologically synthesized polymer that is commonly isolated from brown algae and is used as a food additive. With the addition of calcium ions, alginate solutions undergo gelation to form firm gels, which have potential as tissue scaffolds in biomedical applications. Alginate is also produced by *Pseudomonas aeruginosa* and composes a large portion of the extracellular polymeric substance (EPS) of biofilm. Certain mucoid strains, found in the lungs of cystic fibrosis patients, make particularly strong gels and may play a role in progression of the disease. The rheological behavior of alginate solutions and gels are not well understood. In this work, the material properties of algal and various strains of bacterial alginates were rheologically characterized with the aim of increasing understanding of alginate gelation for biomedical and biotechnology applications. Alginate solution underwent rheological characterization as a function of biopolymer concentration. Flow testing was conducted to obtain viscosity and shear thinning behavior was observed, as is typical of polymer solutions. Oscillatory measurements were made to discern the viscoelastic fluid properties of alginate solutions, the storage (G') and loss (G'') moduli, corresponding to the elastic and viscous components of the fluid response respectively. With gelation there was an overall increase in the elastic component of the fluid response.

Christopher Kratz: Chemical & Biological Engineering

Mentor: Paul Gannon -- Chemical & Biological Engineering

Zinc-Air Technology: A Proposal for Clean and Sustainable Energy Research

As the effects of anthropogenic climate destabilization manifest themselves in increasingly aggressive surges, a transition to a carbon neutral environment has become imperative. What is more, the present state of economic affairs in the United States demands a restorative and stimulating alternative to fossil fuels. This transition may be realized through the application of zinc-air technology. Consequently, an investigation of economic feasibility, capital expenses, and environmental costs has been instigated. In addition to providing an assessment of efficiency in present

technology, experimental procedures have been designed and implemented to arrive at suggestions for improvement. Specifically, a comprehensive flowchart containing principles of electrochemistry particular to zinc-air primary batteries, fuel cells, and flow batteries has been assembled to distinguish between systems. Each device handles the demand for cycled energy with a unique mechanism. Primary batteries are discarded after the reactants are spent, whereas fuel cells are drained and reloaded with charged materials. The most intriguing of the three is the flow air battery (ZFAB), which aims to recharge its internal components by reversing current, and correspondingly, reduction-oxidation reactions. A significant interest has peaked in the realization of this capacity to recharge, which requires surmounting of obstructive dendritic formation and hydrogen evolution reactions.

Gavin Lommatsch: Electrical & Computer Engineering
Mentor: Joe Shaw -- Electrical & Computer Engineering
Airborne Thermal Imaging for Wildlife Surveys

Taking the level of wildlife surveying to the next level, infra-red cameras have the potential to accomplish research through more thorough, accurate, and cost-effective methods. Infra-red video captured from a camera attached to the bottom of a plane is analyzed with custom Matlab code to isolate still frames and video clips that illustrate the various types of signals observed during the test flights. These results are used to tailor the code to make it smarter and make the data more easily analyzed and manipulated for data gotten from future flights.

Michael McCambridge: Chemical & Biological Engineering
Mentor: Paul Gannon -- Chemical & Biological Engineering
Silicon Carbide Oxidation and Environmental Barrier Coating Investigation

Silicon Carbide (SiC) fiber-reinforced SiC matrix ceramic matrix composites (SiC/SiC CMCs) have high temperature properties that make them great candidates for the next generation of jet turbine components. They have improved high temperature mechanical properties compared to nickel superalloys. The use of SiC/SiC CMCs is currently restricted by reaction with water vapor that causes surface recession, and eventually leads to failure. At high temperatures, typically over 1000°C, the CMC material will form a silicon oxide (SiO₂) layer that can volatilize to silicon oxy-hydroxide (Si(OH)₄) upon contact with water vapor. This project is a fundamental step in addressing this problem using an environmental barrier coating (EBC) approach. In a similar manner, SiC tubes (Hexoloy™) have potential applications in the poly-crystalline silicon industry. To meet purity requirements, the Hexoloy cannot outgas any significant amount of boron (B) under exposure to chlorine-containing gasses. We have developed a testing procedure to flow hydrogen (H₂) and hydrogen chloride (HCl) over the Hexoloy samples to determine outgassing characteristics. This setup has yielded valuable information on boron outgassing, and provides a basis for developing a procedure to evaluate CMC high temperature corrosion.

Kiera McNelis: Chemical & Biological Engineering
Mentor: Otto Stein -- Chemical & Biological Engineering
Investigating Impacts of Human Urine as a Fertilizer in Khwisero, Kenya

Since 2006, EWB-MSU has implemented 10 composting latrines in Khwisero, Kenya. Composting latrines are improved sanitation projects that turn human feces and urine into agricultural fertilizers for primary schools fields. Urine contains forms of nitrogen and other nutrients essential to fertilizers. In viewing human waste as a resource to be capitalized upon instead of a detriment to well-being, the implementation of composting latrines have the potential to cultivate social, agricultural, and economic profits for primary schools and surrounding communities. This research investigated urine management, correct application as fertilizer, and impacts on agricultural plots at primary schools. Data was collected through a literature review and participative observation at primary schools on urine usage, income generating activities, and agriculture in Khwisero. Results show varying urine application and management methods at primary schools. Some schools incoming generating activities increased more than others after the implementation of composting latrines. From the data, educational material was developed and a participatory training was conducted to inform stakeholders on safe practices. Further research should investigate agricultural impacts of urine fertilizer over the long term, should contribute to continuous improvement on trainings to stimulate interest on income generating activities, and promote collaboration in Khwisero on organic farming practices.

Sarah Mondl, Jesse Shirley, Dylan Abraham: Electrical & Computer Engineering, Computer Science
Mentor: Hunter Lloyd -- Computer Science
Computer Vision in Underwater Navigation Systems

The use of computer vision in navigation, especially navigation in underwater environments is directly dependent on the quality of the images and the ability of the computer to process them accurately. The unique conditions of underwater environments provide a particular challenge in image analysis as glare, light scattering, and particulates in the water can cause interference in pattern recognition. The computer vision system being tested focuses on navigating an underwater competition course that requires the use of path, shape and color recognition. To accomplish this, the robot is tested on a mock course, located in the university pool, which is designed to mimic the conditions found at the competition, and also tested on images obtained from the course in previous years. The algorithms used in this system heavily utilize the open source library Open CV and the code is written using C++ to minimize compatibility issues with the rest of the submarines operating platform.

Dayla Morris: Chemical & Biological Engineering
Mentor: Robin Gerlach, Ellen Lauchnor, Adrienne Phillips -- Center for Biofilm Engineering, Environmental Engineering
Optimization and Kinetics of Ureolysis by *Sporosarcina pasteurii*

The aim of this research was to advance the understanding of the sources of nutrients with which the ureolytic organism *Sporosarcina pasteurii* would thrive more cost effectively. The reason this was researched was to try to make the use of ureolytic organisms in biocementation processes a more feasible option in the future. Two types of experiments were utilized to reach this goal: Media optimization experiments followed by extensive kinetic experiments. The media optimization experiments were designed to determine whether a less expensive source of nutrients could be used in place of lab grade urea and Difco nutrient broth to attempt to make this biocementing method more applicable in the field. These experiments focused on fertilizer with high concentrations of urea as the nitrogen source, molasses as a carbon source, and ice melt as a calcium source. The kinetic experiments were designed to determine rates and fit these rates to kinetic models which were used to predict how these bacteria would grow under different conditions and to compare between different types of nutrient sources. These studies were aimed at the definitive goal of making ureolytic bacteria a practical option for biomineralization projects, like carbon sequestration, in the near future.

Tessa Mosdal, Bronwyn Rolph, Christie Blaskovich, Samantha Hinckley: Civil Engineering, Modern Languages & Literatures, Art
Mentor: Ada Giusti -- Modern Languages & Literatures
Computer Education in Sanambele, Mali

The village of Sanambele, Mali currently possesses a laptop but the villagers do not know how to operate a computer. Those in Sanambele have requested help with learning how to use their computer. I developed a basic user manual for Microsoft Word, Excel and PowerPoint which are three programs that I believe the teachers, students and other villagers will find the most useful. An English and translated French version of the manuals will be taken to the village and left with the community for further reference. The manuals are also going to be used by the members of the Altas Cultural Foundation (ACF) in Zawiya Ahansal, Morocco. I am traveling to Morocco in March to conduct computer education workshops for the ACF members. A copy of the manuals will be left with them for additional guidance. Providing manuals for both the communities in Mali and in Morocco will prevent the members of the community from losing the knowledge they will have received. I hope I will have offered these people a lasting method of improving their education.

Hannah Newhouse: Chemical & Biological Engineering

Mentor: Brent Peyton -- Chemical & Biological Engineering

Optimization of Lipid Accumulation in Green Algae Using a Photobioreactor and Connections between Algal DNA

The lipid in algae, triacylglycerol (TAG), can be made into biofuel using a trans-esterification reaction. Algae accumulate more TAG when stressed, often by pH, light cycle, or nutrient availability. The effects of a different light cycle during stationary phase of growth were assessed in green algae strain 92. Daily measurements of pH, population, and nitrate presence monitored growth. Nitrate depletion indicated stationary phase, at which point the light cycle was changed from 14:10 (light:dark) to 24-hour light. Nile red fluorescence measurements monitored lipid accumulation. Strain 92 DNA was extracted, amplified, sequenced and identified using BLAST results. Cells grown under 24-hour light post nitrate depletion showed higher Nile red fluorescence and dry cell weight than those on the 14:10 (l:d) cycle. Cell yield and pH were comparable for both conditions. The high Nile red fluorescence and dry cell weight in 24-hour light show more TAG accumulated than in 14:10 (l:d). Cells grown under both light cycles had the same cell yield and pH, confirming increased fluorescence is due to TAG accumulation, not higher biomass concentration. The pH similarity confirms that light cycle is the only changing variable. Strain 92 has been identified by 18S rDNA as *Monoraphidium sp.*

Kyle Oliver: Electrical & Computer Engineering

Mentor: David Dickensheets -- Electrical & Computer Engineering

Stress engineering for free-standing SU-8 2002 thin film devices

In this paper we describe a process for creating thin SU-8 2002 films between 1.5 μm and 3.0 μm thick that are hard-baked and can withstand a release etch in either aqueous or plasma silicon etchants. Resulting films are characterized using both wafer bow and membrane bulge tests to monitor in-plane stress and Young's modulus. We explore the influence on final film stress of several process variables including hard bake temperature, exposure dose, film thickness, and various temperature profiles. We observe resultant film stress in the range of 13.8 to 32 MPa, and Young's modulus in the range of 2.1 to 5.2 GPa for free-standing membranes. Illustrative process recipes are described for both patterned and un-patterned SU-8 2002 membrane devices.

Melis Penic: Chemical & Biological Engineering

Mentor: Michael Franklin -- Microbiology

Visualization and Characterization of the Pseudomonas aeruginosa Biofilm Matrix with Fluorescent Staining

The purpose of this study is to obtain 3-dimensional images of *Pseudomonas aeruginosa* biofilms, using fluorescent probes and confocal scanning laser microscopy (CSLM). The extracellular matrix material, which is primarily composed of polysaccharides, is very difficult to image because there are no universal stains for polysaccharides, and the structures of polysaccharides vary for individual strains of bacteria. In this study, we will use new fluorescent stains obtained from Molecular Probes to visualize both the Biofilm cells and their extracellular matrix material. This will allow us to obtain more complete 3-D images of microbial biofilm structures. Our hypothesis is that the cells stick to the matrix rather than the surface. We have chosen *Pseudomonas aeruginosa* as our test organism because it has the ability to produce three different polysaccharides, however each strain primarily only produces one of them. *P. aeruginosa* secretes these polysaccharides in its matrix in order to adapt to the environment. In our experiments, biofilms are cultured in a flow-through reactor. They are forced to form biofilms on glass coupons. At the end of day one, two, and three, biofilms are stained with six different dyes and epifluorescent microscope pictures are taken of both the cells and of the matrix.

Rajit Podder -- Electrical & Computer Engineering

Mentor: David Dickensheets -- Electrical & Computer Engineering

Zoom lenses based on variable power optics

I want to investigate and simulate the performance of a four element zoom lens system based on variable power optics. A zoom lens is a lens with variable power that changes its field of view while maintaining its focus at a fixed position. So in this project we will monitor the performance of the zoom lens system in terms of its zoom ratio and field of view. In particular we are interested in small format zoom lenses, with potential applications for cell phone cameras, binoculars or other optical instruments. I worked on a two lens system and then proceeded to a bigger three lens system under the guidance of Professor David L. Dickensheets. In this project, I would like to carry on my research of

the zoom lenses to a 4 lens system. A four lens system would naturally introduce more system parameters. So with more parameters, I would expect to achieve a higher zooming with respect to the same field of view and similarly a higher field of view with respect to the same zoom ratio I achieved with a three lens system. To make a person with no knowledge in optics understand the compromise between the zoom ratio and the field of view, I would have to be creative in the way I would represent them in plots. I will meet up with my faculty sponsor frequently in order to get this project finished by the deadline and set deadlines for every task that I will break up my project into. All in all this should be a challenging project and I will thoroughly enjoy working on it.

Brian Redman: Electrical & Computer Engineering

Mentor: Joseph Shaw -- Electrical & Computer Engineering

Testing 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. A prototype of a low-cost infrared cloud imager capable of imaging the entire sky dome has been developed. The prototype of this system uses a metal dome to reflect the whole sky to an off-axis infrared camera. The algorithms to analyze the distorted image were also developed. In this presentation, an overview of the instrument design will be presented, and example images will be shown and described.

Adam Rothman: Chemical & Biological Engineering

Mentor: James Connolly, Robin Gerlach -- Center for Biofilm Engineering

Modeling Kinetics of Ureolytic Bacteria in Flow Systems

Microbially induced calcite precipitation (MICP) is a promising technology that can be used in a wide range of applications from carbon sequestration to bioremediation of heavy metals. MICP can be performed by ureolytic soil bacteria, like *Sporosarcina pasteurii* through manipulation of the local and bulk saturation index. The purpose of this research is to develop kinetic parameters for ureolytic bacteria in biofilm flow systems analogous to what could be found in the subsurface and apply these parameters to generate models for how urea is utilized by the biofilm. Both *S. pasteurii* and a recombinant *Escherichia coli* strain were grown in flow systems to generate kinetic data. The biofilm systems were maintained until steady state was reached. Steady state aqueous measurements along with biofilm geometry data were used to generate a basic COMSOL model of the process.

Skyler Rydberg: Electrical & Computer Engineering

Mentor: Wataru Nakagawa, David Dickensheets -- Electrical & Computer Engineering

Fabrication of Optical Nanostructures Using HSQ Masks

Subwavelength-scale nanostructures hold great promise for the development of new, useful optical devices. One of the challenges in realizing such devices is the creation of the desired nanoscale patterns in materials such as silicon with the required precision. Recently, a new resist material for electron-beam lithography, Hydrogen Silsesquioxane (HSQ), has emerged as a solution to this challenge. The purpose of this project is to create a recipe for a 100 nm layer of HSQ to be applied to a silicon substrate by means of spin-coating. After formulation of a recipe to achieve the desired 100 nm thickness, tests were performed to determine which electron beam dosages produced the best features in terms of resolution and contrast. Grating patterns were created with varying periods while maintaining a constant 50% fill factor. Characterization of the gratings was performed to determine the optimal dosage for these features. The optimal dose was found to be $95 \mu\text{C}/\text{cm}^2$. After determining an ideal recipe, the HSQ was used as an etch mask to create hybrid HSQ-silicon gratings with nanoscale features. This capability will enable the development of a number of new optical devices based on nanostructures, for a range of interdisciplinary applications.

Amber Schmit: Chemical & Biological Engineering

Mentor: Christine Foreman, Heidi Smith, Betsey Pitts -- Land Resources & Environmental Sciences, Center for Biofilm Engineering

Microbial isolates from Antarctica

On the surface of glaciers worldwide, there exist aquatic miniature ecosystems in holes in the ice, called cryoconites. Cryoconites form due to preferential melting around low-albedo aeolian particles; which proceed to sink below the surface until finally reaching their equilibrium depth in the ice. Organic windblown sediment collects at the bottom of these water-filled holes. In this sediment there exists a diverse microbial ecosystem that sustains itself despite the extreme environmental characteristics. My work involves the study of the microorganisms within cryoconites. These organisms were obtained from the McMurdo Dry Valleys of Antarctica, and brought back to Montana State University. Here, microbes were isolated on agar plates for further study. When grown on a plate, many of the microbes displayed unique colors of neon pinks, yellows, and oranges. Some of them even fluoresce in UV light. The next stage in learning about these organisms was a basic growth curve test on 48 of the isolates, followed by gram stain tests. Many of the microbes complete the lag, exponential growth, and stationary phases within a few days, while others will take nearly 2 weeks to complete these phases. Most of the isolates were found to be gram negative organisms. It has been found that these microorganisms, when subjected to freeze thaw cycles, overproduce extracellular polysaccharides and create a biofilm. Using the confocal scanning laser microscope, these isolates and their resulting biofilm structures have been imaged. Future studies will continue to focus on imaging these biofilms, as well as imaging the cryoconite granules and associated biofilms that exist on these granules.

Jyoti Sharma: Mechanical & Industrial Engineering

Mentor: Laura Stanley -- Mechanical & Industrial Engineering

Modeling the validity and transfer of eye-scanning patterns for hazard perception from virtual reality training environments to reality

Visual search skills for hazard perception are critical in many domains. They are used by pilots to maintain situation awareness, by doctors reviewing screen images to diagnose health disorders, and by security screeners inspecting for hazardous materials. They are also critical to a teen driver's ability to detect roadway hazards. For teen drivers, poor visual search skills can increase the risk for traffic crashes, which are the leading cause of death for teenagers nationwide. Training visual search skills depends, in part, on the representative nature of the hazardous scenarios. Many training programs use scenarios derived from sometimes decades-old analyses of police accident reports, police driving instructors' interviews and driving instructor questionnaires. The purpose of this research was to use crash databases -- the General Estimates System and the Fatality Accident Reporting System -- to determine whether the hazardous scenarios in recent research studies remain the most problematic, in terms of teen driver crashes. Crash data show the scenarios used for teen drivers generally reflect the estimated crashes in the United States but not fatal crashes. Modified scenarios that include speed limits of 35 mph and 55 mph, single-vehicle and two-vehicle crashes, and creating a fatal-crash scenario would address currently unrepresented teen crashes.

Matthew Sherick: Chemical & Biological Engineering

Mentor: Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering

Analysis of Homogeneous and Inhomogeneous Gelation of Alginate Derived from *Pseudomonas aeruginosa*

Mucoid strains of *Pseudomonas aeruginosa* bacteria produce the extracellular polysaccharide alginate, which forms a physical biopolymer gel upon introduction of a divalent cation. Both acetylated and de-acetylated bacterial alginate have been extracted by refining isolation procedures found in publications, and their gels analyzed using Nuclear Magnetic Resonance (NMR) techniques. Alginate gels have potential applications in the field of artificial tissue engineering due to their ability to form mesoscale structures. This system is also of interest as cystic fibrosis (CF) patients are vulnerable to chronic *P. aeruginosa* infections. Studying bacterial alginate formation and gelation provides a greater insight into the role of water molecular dynamics in gels produced by these infections. Gelation of algal alginate has previously been thoroughly examined using NMR, and a point of interest is to compare the properties of bacterial alginate gels with those of algal alginate gels. In addition, acetylated bacterial alginate isolated from *P. aeruginosa* FRD1 is shown to have different gel properties than de-acetylated alginate isolated from *P. aeruginosa*

FRD1153, with the latter forming a more inhomogeneous gel using a diffusion reaction front process. In addition, homogenous gels were prepared and analyzed with the same NMR techniques.

Jesse Shirley, Dylan Abraham, Sarah Mondl: Computer Science, Computer Engineering

Mentor: Hunter Lloyd -- Computer Science

AUV - Automated Unmanned Vehicle for the RoboSub 2012 competition

This is a project that will be developing the software (artificial intelligence and mission controlling) for a AUV, or Automated Unmanned Vehicle, which is being built for an upcoming competition. It is for AUVSI's RoboSub competition, and it will be a submarine that has to perform various tasks, such as picking up and dropping markers, firing torpedoes, etc., autonomously.

Sam Sorensen: Computer Science

Mentor: Clem Izurieta, Brock LaMeres, Wataru Nakigawa -- Computer Science, Electrical & Computer Engineering

Smart Power Strip

Vampire power, energy consumed by devices in low-power or standby modes, accounts for 22% of an average home's power consumption, according to a 2008 California Energy Commission study. By providing a convenient and largely autonomous system for monitoring and controlling power consumption, the Smart Power Strip aims to minimize or eliminate the average household's annual \$100 spent on powering devices in standby, low-power, or "instant-on" modes while using minimal power itself. Features such as per-device scheduling, power usage data, and remote access through a WebUI provide the user with straightforward tools for convenient power monitoring and regulation.

Joshua Stringam: Chemical & Biological Engineering

Mentor: Robin Gerlach, Ellen Lauchnor, Adrienne Phillips -- Center for Biofilm Engineering, Environmental Engineering

Continued development of an injection strategy for homogenous calcium carbonate distribution by *Sporosarcina pasteurii*

With the current increase of carbon emissions, several techniques of mitigation are being explored. One of those methods is carbon sequestration in underground reservoirs. A potential problem associated with storing CO₂ underground is the possible leakage of the gas back into the atmosphere. This experiment investigated the implementation of ureolytically induced mineralization to plug cracks in caprock that would permit leakage. Specifically the purpose of this experiment was to gain further understanding of the importance of soluble oxygen during microbially induced mineralization. In this experiment such cracks were modeled with a two foot long tube filled with sand. A pulse procedure was practiced in which calcium about the inlet was displaced. Samples were collected at various points along the column to spatially resolve oxygen and calcium concentrations over time. The experiment also entailed both a growth phase and mineralization phase on a daily basis. This experiment was a success. Not only was the required amount of time for efficient calcium deposition determined, correlations between oxygen content and mineralization were also determined. This latest column experiment also had more efficient calcium deposition than all previous five column experiments.

Jean-Paul Toussaint: Chemical & Biological Engineering

Mentor: Ross Carlson, Florence Mus -- Chemical & Biological Engineering

Metabolic analysis of lipid accumulation in a microalga

As concern grows about the supply of fossil fuels, new alternative energy sources are being investigated including renewable biofuels. Microalgae represent a competitive biofuel strategy when compare with "traditional" agricultural crops. Green algae and diatoms are of considerable interest as a biodiesel source because they accumulate significant amounts of energy-rich compounds, such as triacylglycerol (TAG) that can be used to synthesize biodiesel. My research project investigates factors that control TAG accumulation in the marine diatom *Phaeodactylum tricornutum* using physiological and molecular approaches. The first phase of the project identified optimal growth conditions that promote TAG accumulation in *P. tricornutum*. It has been found that nitrogen limitation, pH stress and the addition of bicarbonate or acetate stimulate lipids accumulation in *P. tricornutum* cells by 5 to 10 fold as compared to controls. Fundamental physiological data including photosynthetic pigment content, protein levels and carbohydrate content

have been collected and correlated to TAG synthesis. A transcriptomic analysis is currently in progress to identify and characterize essential genes involved in TAG accumulation. Information on the abundance of specific transcripts under lipids accumulation conditions will permit description of bioenergetic and metabolic processes involved in TAG accumulation and to identify associated regulatory factors. This project advances algal biofuels research by elucidating both the physiological and transcriptomic basis of TAG accumulation in the marine diatom *Phaeodactylum tricornutum* providing a rational basis for TAG synthesis control.

Logan Warberg, Seth Berardinelli, Alison Figueira -- Computer Science

Mentor: Hunter Lloyd -- Computer Science

Lunabotics Computer System Analysis

An interdisciplinary engineering team tasked with building a robot for competitive performance must coordinate and integrate its design decisions to assure a functional and durable final product. To better assess these decisions and their outcomes, each component and subsystem must be thoroughly vetted prior to committing resources to its development and deployment. At this stage, analysis of successes and failures of past designs serves as a valuable guide. With high team turnover each year, these resources exist primarily in the form of faculty advisor experience. This project uses an informed perspective to look back and analyze the design and development of the current Lunabotics computer system, to identify the strengths and weaknesses of components, and to learn from experience. The presentation details the research and analysis that lead to design decisions for the three primary components of the computer system: locomotion, vision, and autonomy. The summary evaluates the effectiveness of this process in light of the performance of the robot within a test environment.

Katherine Warthen: Chemical & Biological Engineering

Mentor: Ellen Lauchnor, Robin Gerlach -- Center for Biofilm Engineering

The Effectiveness of Various Herbal Kidney Medications

Over the past few months I have carried out an investigation into the effectiveness of various herbal kidney stone medications. I hypothesized that I would be able to find the most effective treatment by qualitatively and quantitatively evaluating the effect of each on the formation of Calcium Oxalate crystals, using strict controls. If it is found from further research that any of these herbal medications are effective in removing or reducing the severity of kidney stones, they could be of great use to physicians or patients wishing to utilize more natural treatment, as an alternative to more traditional medication. I investigated the several different ways the medications could be effective. It is possible that the compounds in the medications prevented the formation of the calcium oxalate crystals of which kidney stones are comprised. Previously formed crystals could also have been broken up with the introduction of the medication. Another effect, possibly a combination of the first two options, is that the medication caused the calcium oxalate to form in smaller crystals, making the passing of kidney stones a much easier ordeal than without the medication.

Chelsie Wharton: Mechanical & Industrial Engineering

Mentor: Jennifer Brown, Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering

Rheological and Rheo-NMR Studies of Biopolymer and Polymer Solutions and Gels

Rheology is the study of the flow or deformation of matter. Rheology provides information to better understand and predict how materials behave under shear and elongation forces during industrial or biological processes. Rheological testing was performed on polymer and biopolymer solutions to characterize their material properties upon loading of nanoparticles. Polymers and biopolymers are of interest in many industrial and biological settings because of their broad presence and extraordinary range of properties. The addition of nanoparticles to polymer solutions cause striking changes in how these polymers react under deformation, useful for the design of new materials with controlled shear-dependent properties. Suspensions of silicon dioxide nanoparticles, diameter of 10-20 nanometers, were added at concentrations by weight varying from 1-10% to three different semi-dilute polymer solutions: the polysaccharide locust bean gum, the biopolymer xanthan gum, and polyacrylamide. 1% locust bean and 1% xanthan gum solutions showed an increase in viscosity with the addition of nanoparticles, but with similar respective shear-thinning and weak gel behavior. The rheological behavior of 1% polyacrylamide solution, on the other hand, changed from the shear-thinning typical of entangled polymer solutions to an anomalous shear-thickening behavior with the addition of

nanoparticles. Rheo-NMR velocity imaging performed using a cone and plate geometry revealed the existence of shear banded flow for 1% polyacrylamide solutions containing 10% silicon dioxide nanoparticles. Shear banding is a hydrodynamic instability where the flow field is inhomogeneous with two macroscopic regions of different shear rates. Shear banding has been observed in high concentration (3%) polyacrylamide solutions. Here, polymer-particle interactions have induced shear banding behavior at a low polymer concentration.

Christopher White: Chemical & Biological Engineering

Mentor: Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering
Detection of Oil Under Sea Ice Using NMR Technology

With all of the drilling in the arctic, there is a need to quickly detect oil trapped under sea ice. Oil is challenging to identify under sea ice without drilling because it is very difficult to see, even if the ice is very thin. However, there is a potential for it to be detected using nuclear magnetic resonance (NMR) technology. An Earth's Field NMR (EF NMR) spectrometer could potentially be used as a quick, noninvasive means to detect oil trapped under sea ice. Understanding how an EF NMR spectrometer operates has been a key focus of this research due to the difficulty of obtaining a good signal. The detection of oil under sea ice comes from the comparison of T_2 spin relaxation times between oil and water. At high temperatures oil has a much shorter T_2 time than brine or water and it can easily be differentiated from the other two. Although the T_2 time of oil is short and hence very difficult to measure using EF NMR, measurements were accurately taken at room temperature. The main focus of this project has been to understand how to obtain reliable measurements using an EF NMR spectrometer and to obtain known room temperature T_2 times of oil and sea water to prove its potential. In subzero conditions the T_2 of oil and brine will shift dramatically. The next phase of this project will be to determine if oil and brine are measurable and differentiable in subzero temperatures using an EF NMR spectrometer. Preliminary measurements using a low field spectrometer indicate this will be feasible.

Wade Wilkison: Mechanical & Industrial Engineering

Mentor: Ronald June -- Mechanical & Industrial Engineering
Characterization of Initial Flight Path by Optical Applications and Sensor Technology

Initial rocket flight movements, although small, are crucial and can significantly impact the overall flight path and chances for success. In small rockets, powered by various model engines, there is large variability in construction and performance that can have disastrous effects without caution and adherence to recommended standards. These flight movements and associated safety issues were studied previously resulting in the current model rocket regulations defined by the National Association of Rocketry (NAR). The focus of this research project was to determine whether current standards are adequate for safely maintaining and monitoring amateur rocket projects. Four test status categories were established to examine launch and safety conditions for $n=16$ rocket launches. First, all initial preparation was categorized as "setup stage follows regulation." Secondly, the launch environment itself was analyzed in terms of personnel safety. All 16 launches followed these basic regulations and therefore met organizational or specific personnel regulations. The third safety category was the flight path, which ranked each path based on the angles of deviation from vertical. "Safe flight" was defined as 0 to 10 degrees, and "moderate concern" was defined as 10 to 30 degrees. Optical images were gathered using a Canon 60D and angles were determined using image analysis with Image J software. All flight paths of the first 8 launches were categorized as "safe flight" with mean difference of 2.856 ± 1.322 . In the second flight series only 2 flight paths fell outside the "safe flight" range at values of 10.48 and 10.79 degrees. This series averaged 7.37 ± 3.09 degrees. Finally, the fourth testing category included the deployment of a parachute or drag inducer and landing implications. Two launches did not fully deploy a drag inducer but all 16 launches resulted in safe and undamaged landings. In conclusion, the NAR regulations appear sufficient: there were no injuries or damage during this study and almost all launches ($14/16 = 87.5\%$) were defined as "safe flight." These data emphasize the benefits of defining and using well-established protocols for rocketry safety. Proper adherence to NAR regulations can result in research, education, and enjoyment.

Kaysha Young: Mechanical & Industrial Engineering

Mentor: Laura Stanley -- Mechanical & Industrial Engineering

Hands Free Texting While Driving - Is It Safer than Conventional Texting While Driving?

Motivation: The research aim of this project was to observe any safety benefits that hands free (voice activated) texting may have over manual texting during simulated driving. Background: Many states have instated cell phone use bans; these restrictions generally target specific types of phone use and demographic groups. Currently ten states and Washington D.C. have bans on hand held cell phone use while driving for all adults, yet no state restricts hands free use by the average adult. Methods: Fifty participants (25 friend pairs, ages 18-30) drove in a mid-fidelity simulator where they engaged in a single task (driving only) and two dual tasks (hands free and conventional texting, coupled with driving). Results: When compared to not texting, drivers that used conventional texting methods experienced a significant degradation of driving abilities, demonstrated through their increase in lane deviations, increase in reaction time (0.71 seconds) and 2.8 times more likely to be involved in a crash. The crash likelihood was less when using voice activated texting methods. Conclusion: These findings confirm that texting while driving is distracting. Voice activated texting is not equivalent to driving without texting; however, it did prove to be a safer alternative to conventional texting while driving.

Hauwa Yusuf: Computer Science

Mentor: Clemente Izurieta -- Computer Science

EAS: Efficient and Accurate Statistics

Statistics is a field of study that deals with collection, organization, analysis and interpretation of data. Often, collected data is either too large to perform calculations by hand, and/or researchers do not have the statistical skills to properly analyze a set of data. Instead of acquiring the mathematical skills required or outsourcing statistical analysis to statisticians, researchers often carry out statistical analysis by themselves, using powerful statistical analysis software such as R. However, because R is open source, the mathematics and mechanics of available packages in R are manipulated by their creators to suit a specific need. Therefore, there are many packages in R which perform very similar tests but due to differences in mathematics and mechanics of the package, yield different results on the same of data set. The majority of users are unaware of the mathematical differences of the packages, and choose arbitrary packages to perform a test. Their choice is partly driven by simply finding a package that contains the name of the test they seek. This can lead to the researcher unknowingly providing erroneous results. This project implements a web application that seeks to minimize statistical errors due to improper use of statistical analysis tests, while improving the user experience with the R statistical analysis software.

Brent Zundel: Civil Engineering

Mentor: Bridget Kevane -- Modern Languages & Literatures

San Juan El Espino Road Crossing

Development efforts in Central America confront cultural, historical, and language barriers that threaten the sustainability of projects. Many engineering projects have been completed that merely reinforce dependency and fail to engage community members in a meaningful way. Montana Tech's chapter of Engineering Without Borders (MT-EWB) has begun initial assessments for a project in the Atiquizaya region of El Salvador that will reroute an eroded road, replace a too-small culvert that passes underneath the road, and halt the erosion from the water that falls 30 feet down a ravine after passing through the culvert. While these form substantial engineering challenges, this project seeks to produce a basic cultural history of the area. It further lays the groundwork for understanding the area's social dynamics, placing them in important historical context, and achieving community participation in the development efforts. The nature of community participation and the impact of groups of "gringo" engineers, most of whom do not speak Spanish, will further be assessed. The primary method that will be used to examine these many factors will be in-depth interviews, conducted in Spanish, with various members of the community -- from average townspeople to leaders. Results will be presented after the assessment trip in mid-March, although this project will hopefully extend multiple semesters. The project will provide MT-EWB with a basic understanding of the area that serves to encourage community empowerment, rather than mere dependence on U.S. technological expertise.

Luke Zanella: Mechanical & Industrial Engineering
Mentor: Robb Larson -- Mechanical & Industrial Engineering
Avalanche Airbag Deployment System

The original goal of this project was to explore the design options, feasibility, and function of a high pressure (compressed air) flood valve that would operate independently of regular o-ring use. The goal was to implement a metal on metal seal in such a way that a gas under 3000psi and one that could easily and readily be broken and resealed. Such a device was devised, yet proved an impractical solution from an affordability standpoint. Additionally the design would have come short of requirements when deployed in the field, due to the corrosive environment presented in winter backpack.

From there the target was re-evaluated and the goal was set as developing a design of a flood valve that used the traditionally design approach, and utilizes o-rings as a means to seal the high pressure cylinder. The main target being to minimize cost through the use of pre-manufactured components and reducing the need for custom configuration and thus dropping overall cost. The final goal is to create a system that would potentially be competitive in the burgeoning avalanche airbag market, through the use of innovative yet simplistic design approaches that consider ease of manufacturing and maintenance.

COLLEGE OF LETTERS & SCIENCE

Hadeel Alniemi: Cell Biology & Neuroscience
Mentor: Martin Lawrence, Brian Eilers -- Chemistry & Biochemistry
Examining A109 Protein in Sulfolobus Turreted Icosahedral Virus from Yellowstone National Park

Sulfolobus Turreted Icosahedral Virus, or STIV, is an archaeal virus that infects the unicellular organism *Sulfolobus solfataricus*, a member of the domain Archaea. *Sulfolobus* thrives in hot and acidic environments, much like the hot springs in Yellowstone National Park. Understanding of archaeal viruses is quite limited compared to that of Bacteria and Eukarya, with only roughly 50 known archaeal viruses compared to some 2000 of the other domains. For this reason, research with them is very important. Our goals with STIV research include learning more about archaeal viruses and their life cycles, gaining a better understanding of the requirements for life in extreme environments, and discovering more about a common ancestor from which the three domains of life emerged. Small scale work can be insightful to this larger picture. To learn more about STIV, the proteins making up its genome are examined. In many cases, the function of certain proteins is unknown. By determining the structure of the protein through x-ray crystallography, a corresponding function can be assigned by comparing the structure to those of known proteins in an internet database. A109 protein in STIV was the specific protein of interest.

After expression of A109 in *E.coli* cells, the protein underwent purification through nickel affinity chromatography as well as both size exclusion and mono Q chromatography. Purification was followed by crystallization trials which if successful would allow for examination of protein structure. Work with A109 has reached crystallization trials. The assignment of function is the ultimate goal with regards to A109 protein in STIV. Further work would be aimed at moving beyond crystallization trials to the x-ray crystallography step and discovering the structure and function of the protein.

**Please join the Hughes Scholars at the 2:00 oral session where we will share our science outreach experiences.

Lydia Anderson: Ecology
Mentor: David Sands -- Plant Sciences & Plant Pathology
Sustainable biocontrol of Striga (witchweed) in Kenya using an enhanced biocontrol fungus

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 cost efficient, preferably at a cost that is less than that of herbicides. 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*, a deadly weed limiting subsistence agriculture in Africa. *Striga* can reduce farmer's yields of maize by 50% or more. Tests have shown that the amino acids tyrosine and leucine inhibit striga

without inhibiting maize, the principal food crop in Kenya. The amino acid excretion was verified using a bacterial bioassay. The fungus is incorporated into the fields using toothpicks that have been inoculated with FoxyS. The inoculated toothpicks are put in a pot of cooked rice so the fungus can grow into the rice and can easily be planted with the crops. This is incredibly cost effective since it only takes one inoculated toothpick to protect a field.

Samuel Atkins, Dylan Strike: Cell Biology & Neuroscience, Sustainable Foods & Bioenergy

Mentor: Jaime Jelenchick Jacobsen -- University Honors Program

Bozeman Eats: A Documentary Film Surveying Food in the Gallatin Valley

The Gallatin Valley has all the necessary resources at its disposal to make major strides towards a more sustainable future of producing and consuming food. There is a great deal of enthusiasm in and around Bozeman regarding local food, yet there is a frustrating disparity between the capacity to produce local food, and the reality of its consumption. By profiling a handful of farms in the region and creating a multi-faceted portrait of local food, my partner, Dylan Strike, and I are capturing the unique story of food and people in Gallatin Valley. Our film, *Bozeman Eats*, explores not only what it takes to get food from the farm to the table, but also the notion that from inception, local food has the possibility to proliferate through our community in a variety of manners, reach a variety of culinary audiences - even those previously strangers to "organic" food - and to meet again as a shared foundation for the growth of beneficial relationships within our society. Our documentary will be shared with the entire community to promote enthusiasm for local eating, and to improve awareness of how accessible a future of sustainable and healthy local food really is.

Daniel Barta: Earth Sciences

Mentor: David Varricchio -- Earth Sciences

A Cladistic Approach to Understanding Dinosaur Egg Diversity and the Evolution of Reproductive Traits Within Dinosauria: Preliminary Results

Only a small percentage of fossil eggs contain identifiable embryonic remains. Consequently, knowledge of eggshell structure and reproductive strategies remains incomplete for many dinosaur clades. Most previous cladistic analyses of dinosaur eggs and eggshell focus on dinosaur egg types (ootaxa) with identified embryos and aim towards understanding the evolution of avian reproductive traits. To provide a broader phylogenetic framework for dinosaur ootaxa by which gain and loss of eggshell and reproductive characters might be better understood across the entire clade, a comprehensive cladistic analysis of representatives of each major dinosaur oofamily was undertaken. We utilize a greater number of characters than most prior studies and subject three oofamilies (Faveoolithidae, Dendroolithidae, and Arriagadoolithidae) to cladistic analysis for the first time. Cladistic analyses of eggshell remain complicated by apparent homoplasy between some ootaxa, as evidenced by the polytomy of Faveoolithidae (?Sauropoda), Dendroolithidae (Therizinosauria), and Dictyoolithidae (?Theropoda) consistently recovered in strict and majority-rule consensus trees in this study. Strong support is also found for a clade of derived theropod and avian eggshell. Future work includes adding taxonomically unassigned ootaxa to a dinosaur skeletal data matrix to form hypotheses (constrained by eggs with embryos) of likely assignment to parent dinosaur clades for unidentified ootaxa.

Jonah Barta: Liberal Studies

Mentor: Leah Schmalzbauer, Nancy Mahoney -- Sociology & Anthropology

Socio-Cultural and Economic Implications of EWB-MSU Development Projects In Khwisero, Kenya

This paper explores the borehole implemented by Engineers Without Borders at Montana State University at Emwaniro Public Primary School in Khwisero, Kenya. During my six weeks in Khwisero I was interested in determining any unforeseen implications this project may be having on its recipients. This paper draws on twelve interviews that focused on the social, economic, and cultural benefits and drawbacks of this project. Specifically, I wanted to know if the social lives of women who used to carry water have changed by altering their water source; and I wanted to explore the changes in traditions, culture, customs, and economy the borehole project is having on individual households. After analyzing my results I found that there was little change in the social lives of women. The borehole has, however, altered traditional customs causing a shift in gender roles and a significant minority of the population did report a negative economic impact. This paper responds to certain global factors that may be contributing to this issue. An additional finding was that school children now spend more time in school than they used to and are healthier. Potable water at the school has eliminated the need for children to carry water to school hence freeing up time to spend in the classroom. Also, children can now wash their hands after using the latrine contributing to a decrease in

disease. Overall, the borehole seems to be having a positive impact on the lives of its recipients. However, the fact that many are having a problem with affording the fee for water should not be overlooked. This paper suggests that this segment of the population may increase in the near future.

Brandon Beck: Psychology

Mentor: Keith Hutchison -- Psychology

Subliminal Stroop

The current experiment was designed to demonstrate a hypothesized subconscious addition to current dual-route processing theories of cognition. In an attempt to do so, a new paradigm was created to elicit, and observe, the interaction between two phenomenon which in contemporary psychology, are believed to exist outside the realm of explicit consciousness. In its design is a sequential learning task, disguised as a simple color naming procedure, which was intended to elicit unconscious top-down processing (i.e. implicit learning). For half of the participants, this task included a subliminal priming technique, in which, individuals received the correct answer (via a subliminal prime) to the current trial of the color naming task just before it occurred (this was done to elicit unconscious bottom-up processing). After an initial three blocks of trials, which were intended to serve as an implicit learning phase, participants were subjected to a fourth block of trials wherein neither group received subliminal primes which served as a testing phase; and a fifth block which was random and intended to strengthen the assumption that implicit learning had taken place under the sequential pattern. Reaction times from these blocks were attained and used as the dependent measures within the current design. Results show a marginal interaction between implicit learning and subliminal priming in that the administration of subliminal primes seems to have inhibited the former. These data are the first to suggest the presence of multiple subconscious information processing routes within the human mind. Perhaps what is most interesting about the current dataset, is that the lack of evidence for implicit learning within the priming condition suggests the presumed bottom up pathway is dominant relative to the proposed top down route. These later results are consistent with current dual processing theories that involve conscious stimuli. (This experiment is still underway and approaching statistical significance)

Wesley Beougher: Chemistry & Biochemistry

Mentor: Cate Burgess -- Chemistry & Biochemistry

Determining the Structure and Function of AcxR Dependent Sigma54 Regulation of Acetone Carboxylase Expression

The overall emphasis of my project is to provide mechanistic insight into carboxylation reactions that represent the terminal steps in the convergent pathways of alkene and ketone metabolism. The specific goal includes determining the molecular basis for AcxR dependent sigma-54 regulation of acetone carboxylase expression within *Azotobacter vinelandii*.

Ethan Berg, Sean Stettner: Cell Biology & Neuroscience, Bioengineering

Mentor: Steve Hamner -- Microbiology

Microbial Source Tracking of Escherichia coli in the Little Big Horn River, Montana

The method of microbial source tracking was used to determine the source of the gram-negative bacterium *Escherichia coli*. When *E. coli* is isolated from a water source, it indicates a possible public health risk due to fecal contamination of the water. Knowing the source of the *E. coli* can aid in elimination of the contamination. This project was a continuation of an ongoing project that examined *E. coli* isolates from various cattle ranches at various points along the Little Big Horn River and its tributaries in southeast Montana. This experiment used polymerase chain reaction (PCR) coupled with gel electrophoresis to create a database of DNA fingerprints. Multiple primers were to be used originally, however the BOXA1R and (GTG)₅ primers displayed far too complex fingerprints for accurate analysis, therefore the ERIC primer set was used as a basis for creating the fingerprint database. That database was created using the GelCompar II software by Applied Maths. Using this software, all fingerprints were compared using a similarity matrix to create a list of possible matches of *E. coli* obtained from the various ranches, the river, and its tributaries. Preliminary results suggest possible matches between some of the manure lots on the largest ranch and various drainage sites into the river. Current work is being done using the BOXA1R and (GTG)₅ primers to confirm validity of the matches found by the ERIC primer set.

Samuel Bernhard: Chemistry & Biochemistry

Mentor: Mary Cloninger -- Chemistry & Biochemistry

Analysis of GAL3 and Lactose functionalized PAMAM Binding by EPR

In order to better understand the binding characteristics between lactose functionalized PAMAM dendrimers and the galactoside lectin Galectin-3, the synthetic production of heterogeneously functionalized TEMPO and Lactose PAMAM dendrimers were undertaken. To analyze the relevant lectin/ carbohydrate relationship, these dendrimers will be subjected to electron pair repulsion (EPR) studies. The implication of analyzing several dendrimer generations through EPR is that a quantitative understanding of the relationship between dendrimer size/ degree of functionalization and binding strength can be determined. In terms of progress, a significant portion of the synthesis has been completed. Optimized yields have been determined and characterization has been completed on the reactions that lead to the production of the Lactose tether.

Tor Bertin: Ecology

Mentor: David Willey -- Ecology

Modeling carnivore sign data: A case study with the carnivore guild in a ranch in eastern Montana

Track deposition patterns by carnivores on a 54 km² ranch in eastern Montana were recorded with a sand strip passive index survey method over the course of 33 days. Carnivore tracks identified included coyotes (n = 17), bobcats (n = 8), feral cats (n = 6), pumas (n = 1), and long-tailed weasels (n = 1). Using temporal, weather, and habitat covariates, coyote intrusions were modeled with generalized linear models using a negative binomial distribution and log link. An information theoretic approach, using the Akaike information criterion adjusted for sample size (AICc) to compare the relative support of multiple models, indicated that habitat type had a strong influence on coyote track deposition, and that weather and temporal covariates were comparatively poor descriptors of coyote track patterns. Autocorrelation functions revealed no evidence for daily temporal autocorrelation of coyote intrusion numbers in either habitat, and a Spearman's rank correlation coefficient suggested little between-habitat daily intrusion correlation (r = -0.21). Use of open areas by coyotes has been well documented in the literature, and the data analyzed in this report are in agreement with said studies.

Heather Blanchard: Chemistry & Biochemistry

Mentor: Robert Walker -- Chemistry & Biochemistry

Molecular Partitioning Between Aqueous and Hydrophobic Environments

The overall objective of this research is to explore and predict the thermodynamic consequences of functional group alterations in biphasic partitioning behavior of closely related solutes. The predominant focus of the research is the effect of the primary, secondary, and tertiary 7-amino group on coumarin molecules. Partitioning experiments across planar interfaces were performed but only the primary amine coumarins showed reproducible quantitative behavior. Temperature dependent studies yielded a change in enthalpy of 18.6 KJ/mol and a change in entropy of 65.3J/mol, revealing that solute migration from the aqueous to the nonpolar organic phase was endothermic but led to increased system disorder. The principle of biphasic partitioning was also examined in 2-dimensional systems using the interior of phospholipids vesicles as the hydrophobic medium. The primary amine coumarin, C151, in DLPC and DMPC vesicles was found to partition exclusively into an environment similar to that of ethyl ether instead of water or alkane. This result shows that the molecules are most likely setting within the vesicle bilayer. The tertiary amine coumarins, C152, was found to partition exclusively into the aqueous environment. Future work examining 2-dimensional partitioning will be performed using an in-house designed total reflection sample chamber that can be installed into our current steady-state fluorescence spectrometer.

Christie Blaskovich: Chemistry & Biochemistry

Mentor: Laura Mentch, Ann Bertagnolli -- BridgerCare, Montana INBRE

Evaluation of Misconceptions about Unplanned Pregnancy and Contraception Among 20--29 year old Women

Many pregnancies are unplanned, especially in certain age groups, and they may be prevented with increased understanding of contributing factors, including misinformation about contraceptive measures. According to the Guttmacher Institute, 49% percent of pregnancies were unintended in 2001 [Finer and Henshaw, 2001] and women between 20--29 years old accounted for 54% of unplanned pregnancies among all unmarried women [U.S. Bureau of

the Census, 2001]. Furthermore, between 1994 and 2001, unplanned pregnancies in the United States increased among the 25---34 year old age group [Finer and Henshaw, 2006]. Despite the fact that this age group represents the highest rate of unplanned pregnancy in the United States, relatively little research has focused exclusively on the “twenty---somethings.” The goal of this research was to gain greater knowledge about the 20---29 year old female population by compiling previous research on this topic. The National Campaign published focus group results that studied unmarried 20---29 year old males and females in larger U.S. cities in 2007. This study revealed that this population does not believe getting pregnant is a ‘big deal,’ believes planning for pregnancy is for people who are financially stable, has an ambivalent attitude toward becoming pregnant, and is lacking accurate information about contraception and fertility. The knowledge gained from this research will aid BridgerCare and Montana Advocates for Sexual Health (an ---campus group, MASH) to develop educational programs to address misinformation about contraception in Bozeman, Montana and at Montana State University (MSU).

Christie Blaskovich: Modern Languages & Literatures
Mentor: Ada Giusti -- Modern Languages & Literatures
Evaluation of Humanitarian Organizations in France

Many visitors to France are interested in volunteering in the country in order to connect with the Francophone culture, while benefiting the community. However, there has never been a guide written for Anglophones to volunteer in France. The study of the humanitarian organizations, Secours Populaire and Willing Workers on Organic Farms (WWOOF) during 2010---2011 in southern France will be incorporated into a guide, being written by Ada Giusti PhD, which will provide information about the volunteer opportunities within the Francophone world. The study of these two organizations revealed the requirements, expectations of volunteers, and the effectiveness of their programs in the community. The personal responses from volunteers, directors, and the community will be included in the guide to allow future volunteers to make informed decisions about each organization.

Justin Brewer: Cell Biology & Neuroscience
Mentor: Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience, Immunology & Infectious Diseases
Isolation and Cloning of zic Genes in Chick

Deficiencies or mutations of various genes, particularly those of the zic family, lead to a number of birth defects, including anencephaly and spina bifida. Currently, research into the role that zic genes play during embryonic development has primarily been done using *Xenopus laevis* and mouse; however, the use of chick embryos offers new possibilities and methods of researching zic genes. Since only zic1 has been isolated from chick, it has not been possible to use chick for zic gene research. The objective of my research is to isolate and clone the other zic genes in chick (zic2-4). I am using a phage chick cDNA library containing phages carrying the genes. Phage has been arrayed in liquid culture and screened using PCR. Positive wells are diluted, arrayed, and screened again. This process is then repeated a third time to further reduce the number of phage in the pool. The phage is then plated on solid medium and plaques will be screened using PCR. Positive plaques will be isolated and undergo excision to convert to useable plasmids. Currently, we have isolated liquid pools of zic3-containing phages and have begun isolating zic3-containing phages in solid medium.

Tyler Bridges: Earth Sciences
Mentor: David Varricchio -- Earth Sciences
Microtaphonomy of Modern Deer Phalanges

Dissolution of dinosaur bones in EDTA (Ethylenediaminetetraacetic Acid) often reveals forms in the shape of blood vessels, bone cells and red blood cells. Researchers have interpreted these structures as original dinosaur soft tissue or alternatively, bacterial biofilms. However, no one has yet observed the taphonomy of soft tissue structures within vertebrate bones on a microscopic scale. Thus, the internal processes of vessel and cellular decay as well as the growth of bacteria and their possible role in rapid soft tissue mineralization remain largely unexplored. To better understand these potential processes, I undertook a series of experiments examining how microtaphonomic processes vary across differing environments. The decay of modern deer phalanges was observed across a suite of laboratory conditions modeling aqueous anoxic, aqueous oxic, intensely radiated and frozen environments, each subdivided into three sediment types - mud, sand and a mud/sand mixture. Phalanges were removed and observed under a Field Electron

Microscope roughly every three months for the duration of a year. Image analysis revealed that under these experimental conditions, bacterial activity was largely inversely proportional to the preservation of internal soft tissue. Bones in environments with less bacterial activity had consequently less decay with desiccation being more prevalent, whereas environments that displayed large groupings of bacteria had little recognizable soft tissue remaining. This study could be furthered significantly by using mass spectrometry on standard soft tissue found and X-ray crystallography for any kind of mineralization. These tests would determine if and how bacteria chemically affect original soft tissue.

Dewey Brooke: Chemistry & Biochemistry

Mentor: Brian Bothner, Mavis Agbandje-McKenna -- Chemistry & Biochemistry, Biochemistry & Molecular Biology (University of Florida)

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 isosahedral 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. 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. Also, due to low sequence similarity, there is even concern over whether this is a true PLA2 type domain. To address these questions, 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 question of substrate specificity.

Douglas Burns: Cell Biology & Neuroscience

Mentor: Roger Bradley -- Cell Biology & Neuroscience

Relative Onset of NFPC in Xenopus Development

Development of the central and peripheral nervous systems in vertebrates involves an epithelial to mesenchymal transition mediated by a host of developmental proteins. The transcription of these protein's genes occurs in a stepwise manner, each one determining a given cell's developmental fate. Neural Fold ProtoCadherin (NFPC) is a developmental protein involved in the formation of neural crest, the tissue that later will form the peripheral nervous system. Past experiments have revealed that when NFPC mRNA is prevented from translation, the cells enter apoptosis; when rescued from apoptosis the embryos have significantly impaired motor function as well as impaired cartilage and eye development (Bradley, R. PhD). These results indicate a crucial role for NFPC in neural crest development. The goal of this research was therefore to determine the time of onset relative to other known neural crest developmental genes. Protocadherins are a relatively new category of biomolecules and their purposes are many, far exceeding those of classical cadherins. It is, however, likely that NFPC functions much like a classical cadherin; binding homophilically to neighboring cells. Therefore a logical next step for future research is to determine what molecules NFPC binds to intracellularly and what functions and signaling cascades these are part of. Given the prevalence of protocadherins across vertebrates, it would then be interesting to search for corresponding molecules and their functions in human development.

Elizabeth Byron, Alex Wittorff: Invited Guest, Byron HS

Mentor: Mari Eggers, Sue Broadaway -- Microbiology

Inorganic Nutrient Variability in Prairie Potholes

Our question was: do inorganic nutrient levels in prairie potholes allow an adequate environment for aquatic vertebrate survivability? The hypothesis states: Phosphorus concentrations will be the rate limiting inorganic factor for aquatic vertebrate survivability in prairie potholes.

Using standard protocol, surface, middle, and bottom samples were collected and pH, Dissolved Oxygen, and Water Temperature were measured at the deepest point in each of four ponds. The samples were analyzed for Nitrogen and Orthophosphate with test kits and Phosphates were measured with a Spectrophotometer in a commercial lab.

Summer, fall, and winter samples were collected. We found great variability throughout the ponds. Overall, the ponds had high Nitrogen and Phosphorus levels with Phosphorus being higher on the bottom. They were alkaline. Low Dissolved Oxygen levels were found on the bottom except at fall turnover. Two ponds had stressfully low Dissolved Oxygen levels under the ice throughout the water column. We found that all of our ponds had adequate or excess Nitrogen and Phosphorus levels to support aquatic vertebrates. Eutrophication from farm and ranch operations could stress or kill fish, due to algae blooms and ensuing low oxygen levels. Water column oxygen levels are also threatened by ice cover in the winter.

Nathan Carroll: Earth Sciences

Mentor: Ilse Mari-Lee, David Varricchio -- University Honors Program, Earth Sciences

Pterosaurs as a Teaching Tool

The description of a new azhdarchid pterosaur from the Two Medicine Formation of Montana provides new information on this distinctive group of animals. The body plan of this pterosaur also provides for a unique public outreach opportunity. Both the size and shape of this pterosaur makes it ideal for constructing a 1:1 scale puppet that can be used to introduce audiences to pterosaur biology and ecology. The puppet is accompanied with an engaging, interactive presentation about the diversity and evolution of life in the Cretaceous. This time period is often portrayed to the public as the "Age of Dinosaurs," but the diversity of the Mesozoic included much more than just dinosaurs, as evidenced by the assemblage of animals found at Jack's Birthday Site, a fossil bone bed. This site, found in the Two Medicine Formation of Montana, is one of the best faunal assemblage samples from this area. Although this site is rich in dinosaur fauna, it also documents the presence of birds, pterosaurs, lizards, and mammals. The life-sized puppet is an experiment in engaging and teaching broad audiences about pterosaurs, the site from which this specimen was found, and methods of paleontology.

Juniper Chapman: English

Mentor: Marvin Lansverk, Doug Young -- English, Agricultural Economics

From the Father of Economics to Freakonomics: A Literary Study of Economic Texts and their Socioeconomic Contexts

This project entails a study of the evolution and trajectory of the economic theory and discourse community through time. Specifically, I study the intersection of literature and economics in the works of Adam Smith (*The Wealth of Nations*, 1776) and Steven D. Levitt and Stephen J. Dubner (*Freakonomics*, 2005). These two authors provide a fascinating opportunity to examine two economic texts that were best-selling phenomena in their days - two very different days. An examination of the various literary and socioeconomic factors that created the opportunity for these texts to not only thrive in popularity, but to become defining factors of the study of economics as a whole, gives us insights on the course of the study, criticism, and development of economics over the last two hundred years. Adam Smith's *The Wealth of Nations* is considered, by most neoclassical economists, to be the foundation of the organized study of the science of economics. Far later in time, apparently very different in scope and aim, but almost equally well-known, came Levitt, Dubner, and *Freakonomics*. Interestingly, these two works have a number of common attributes, both literary and in economic theory. Both contain an intersection of economic theory with literary concerns - inherent in the fact that both exist in a written form - and thus both can be discussed and analyzed from a perspective that not only engages these authors as economists, but as writers. Both authors have remarkably similar preoccupations, though with a few telling differences. In the end, this is a story that deals with a cycle of theory, popularity, and criticism; the return to an earlier paradigm, and the value and impact of our history on our present.

Kelly Christensen: Microbiology

Mentor: Wade Hill -- Nursing

A Cross-Cultural Comparison of Perinatal HIV Transmission In the United States and Thailand

Background: Human immunodeficiency virus (HIV) damages the body by destroying cells that help the body fight off disease and thus the immune system begins to fail. Today, there are over 33 million people living with HIV globally. HIV transmission can occur via the transfer of blood, vaginal fluid, semen, pre-ejaculate, breast milk, and/or perinatal transmission. Perinatal transmission can occur through trans-placental infection, infection during labor and delivery, and through infection via mother's breast milk. While in utero, there are situations that increase the risk of transmission that vary between western healthcare delivery systems like The United States and developing nations like Thailand. Understanding the differences of perinatal HIV transmission and standards of care in both countries can lead to better

care and treatment worldwide. This investigation documented current standards of care for both countries, including diagnosis, treatment, and drugs used. Methods: Structured interviews were conducted to in the United States and Thailand with health care providers that manage care for pregnant women to address study aims. Findings: In general, similarities between the US and Thailand include the use of the ELISA (enzyme-linked immunosorbent assay) for diagnosis and screening of all expectant mothers. Findings also suggest that the availability of antiretroviral drugs is higher in the in the United States, and treatment for prevention may differ. Although combination antiretroviral drugs are used in Thailand, and in similar combinations, the United States uses a variety of drugs to treat severe side effects of the antiviral drugs. Differences were also found when contrasting the healthcare systems of each country. Implications: The universal healthcare system that exists in Thailand provides an opportunity for significant reductions of HIV transmission during the perinatal period. However, some questions exist about the availability of antiretroviral medications and the ability of this system to access the population at risk. Non-traditional treatments utilized in Thai medicine to manage side effects of HIV treatment may offer some economic and health advantages, but more study is needed to fully describe this contrast.

Erin Clark: Psychology

Mentor: Bethany Letiecq -- Health & Human Development

Perceptions of civil unions, the benefits of marriage, and the legalities of relationship recognition

This qualitative study explored participant's thoughts about nontraditional relationships (any relationship outside of a heterosexual marriage), their perceptions about civil unions, their understanding about the benefits of marriage, who should receive such benefits, and the legalities of relationship recognition.

Cameron Clevidence: Ecology

Mentor: Christopher Guy -- Ecology

Dietary Assessment of Yellowstone Cutthroat Trout in Yellowstone Lake, Yellowstone National Park

The Yellowstone cutthroat trout (YCT, *Oncorhynchus clarkii bouvieri*) population in Yellowstone Lake is the largest inland cutthroat trout population in the world. An intensive monitoring program has been in place for the YCT population since the middle of the 20th century; however, diet data have been assessed only sporadically through time. Our objective was to assess YCT diet throughout the ice-free season to determine the relative importance of prey items. Fish were captured by gill nets and trap nets during the 2011 season. Diets were sampled in three seasons: pre-stratified (before 1 August), stratified (1 August – 20 September), and post-stratified (after 20 September). Stomach contents were assessed by frequency of occurrence and mean proportion by weight (MPW) for each taxonomic group. Ontogenetic shifts in diet occur for many fish species; therefore, diet was also assessed by 100-mm length groups. Preliminary results indicated amphipods are the most important prey item in both the pre-stratified and stratified seasons for all ontogenetic length groups. Amphipods composed 0.76 and 0.80 MPW for pre-stratification and stratified seasons, respectively. Chironomids were important in the pre-stratified season (0.15 MPW) and were less important during the stratified season (0.04 MPW). Conversely, *Daphnia spp.* composed a larger proportion of the diet in the stratified season (0.08 MPW) than in the pre-stratified season (< 0.001 MPW). These data will allow for diet comparisons to previous years and contribute to an ongoing study evaluating diet overlap between Yellowstone cutthroat trout and introduced lake trout.

Shane Close: Psychology

Mentor: Ian Handley -- Psychology

Hydration on Psychological Processes

This experiment tested whether individuals correct more for their presumed influence of their expectations when they have experienced evidence suggesting their expectations indeed influenced their experiences. That is, if an expectation is confirmed, this might suggest that the expectation is biasing individuals' experiences. The primary hypothesis is that the influence of the alertness expectations of drinking water and individuals beliefs about expectations will influence cognitive performance differently, depending on whether participants' other water-related expectations were confirmed. If participants expected water would make them happy (and the experiment made them happy) they should realize that expectations bias experiences. As a result, these participants should correct against the influence of their expectations regarding hydration and cognitive performance and not experience a placebo effect in cognitive performance relative to a control group who received no expectations about alertness and water. However,

participants who felt happy but did not expect water to make them feel happy did not have their water expectations confirmed (they had no expectations about water and happiness). Thus, these individuals should experience placebo effects later if they do not believe expectations bias them, but will not experience placebo effects if they believe expectations bias them and correct against that bias.

Warren Colomb: Physics

Mentor: William Randall Babbitt -- Physics

Beam Conditioning via Output Coupler and Spatial Filter

The monoblock laser is a powerful and compact diode pumped solid state (DPSS) passively q-switched Nd:Yag laser; however, the beam it outputs is less than ideal for applications that require a TEM₀₀. Its compactness also makes single frequency modes hard to maintain during high pulse repetition. Yet, through conscious output coupler choice and careful spatial filtering, the beam can be conditioned and stabilized into a usable beam for LIDAR and DIAL purposes. The conditioned beam can be made both frequency and spatially stable, as well as being filtered into a near TEM₀₀ beam.

Jesse Cook: Chemistry & Biochemistry

Mentor: Mary Cloninger -- Chemistry & Biochemistry

Lactose-functionalized PAMAM Dendrimer Effects on Cancer cell Aggregation

The interaction of galectin-3 with a lactose-functionalized PAMAM dendrimer is monitored through aggregation assays with the human cancer cell lines HT-1080 and A-549. It is hypothesized and shown that the generation-2 dendrimer (relatively small) will inhibit aggregation (Figure 3.6 a). Also hypothesized is that the larger dendrimers will induce aggregation by aiding in cross-linking of cells (Figure 3.6 b), but results are inconclusive.

Charles Crellin: Cell Biology & Neuroscience

Mentor: Ann Bertagnolli, Buck Taylor -- Montana INBRE, Community Health Partners

Healthy Montana Kids

In 2010 it was estimated that 23,200 Montana children were without health insurance. Montana has an above average number of uninsured children even though the state offers health insurance for free to children if the family is below 250 percent of the poverty line. This insurance program is called Healthy Montana Kids or HMK. To determine why more children are not signed up for HMK I asked the question, "Why are children that qualify for HMK not insured?" To answer this question I worked closely with Community Health Partners, CHP. CHP provide me of a list of patients that possibly qualified for HMK. I then called the guardian of the patient and talked to them about HMK and offered to send them an application. From calling these families it was determined that the main reasons children are not enrolled in HMK is because either the guardians were unaware of the program or the guardian had not had time to fill out the application. Two months later I recalled the families that I had sent an application to in order to determine if they had filled out and returned the application, needed help filling out the application, or had any questions.

Casey Donovan: Mathematical Sciences

Mentor: Lukas Geyer -- Mathematical Sciences

Multifractal Analysis of Heart Beat Interval Time Series

Due to the multiscale nature of heart beat time series, multifractal analysis is an ideal candidate for studying such time series. We wrote several programs in IDL to calculate the multifractal spectra of data sets, including uniform distributions, Cantor sets, and actual heart data obtained from Physionet.org. We were able to reproduce the spectra of uniform distributions and Cantor sets, but the spectra of heart beat data contradicted current theory on the width of multifractal spectra. Our findings indicated that healthier hearts have narrower spectra than those with congestive heart failure. This most likely indicates that our algorithms are flawed and we don't expect this to overturn current theory. We also saw unexpected linearity in the spectra's dependence on parameters within our programs.

Jordan Dood: Chemistry & Biochemistry**Mentor: Bern Kohler -- Chemistry & Biochemistry*****Infrared Study of Exciton Migration in Single and Double Stranded DNA***

It has long been one of the goals of science to predict material properties from atomic or molecular structure. Nowhere is the need for these types of predictions more important than in the solar energy industry. Although some predictions about the photochemical properties of a material can be made, it is still difficult to determine the movement of excited states and electron transfer dynamics in complex materials. In order to gain a better understanding of how excited states interact with their environment, model systems must be developed that can be tuned to test hypotheses. By studying the excited state dynamics of both single and double stranded DNA systems with infrared spectroscopy, we are investigating how excited states in DNA are influenced by base pairing, phosphate backbone modifications, and sequence substitutions. These studies are furthering understanding of how excited states evolve in time in complex nanoscale systems of potential interest for solar energy conversion.

Troy Duker: History & Philosophy**Mentor: Lynda Sexson -- History, Philosophy & Religious Studies*****The Mosaic Archetype***

My research analyzes the concept of the "black Moses" and its contribution to the religio-political leadership of black American communities. The study focused on Harriet Tubman, Marcus Garvey and Dr. Martin Luther King. These three leaders embraced the title of "black Moses" as a sort of non-canonical rank within black leadership. I termed this phenomenon, "mosaic archetype," meaning that the title "black Moses" refers to the story of Exodus as a grounds for religious and political authority. The narrative of these three leaders is often spoken of in terms of enslavement, exile and journey, mirroring the Children of Israel that Moses led to the Promised Land. This archetype is not to be confused with Jungian terminology, but I employ it simply to mean "model." The goal of my research was to explicate the usage of the Exodus narrative to give greater meaning to the Abolitionist, Black Nationalist and Civil Rights Movements.

William Dupree: Physics**Mentor: Lisa Davis -- Mathematical Sciences*****When a Traffic Light Turns Green, a Study of Traffic Flow Using Partial Differential Equations***

Partial differential equations, PDEs, are used in many applied mathematical models. In the summer research performed, PDEs were used to model traffic flow and the theoretical behavior of cars on simple roadways. As with ordinary differential equations, partial differential equations have many different forms of a variety of orders. The PDE used for traffic flow, and the focus of the current research, was the homogeneous advection equation involving the traffic density as the spacial and time varying function. Methods to solve this equation, and how it related to traffic flow, were studied out of Richard Haberman's text titled Mathematical Models. Only solutions to the linear advection equation were sought, leading to one of the most fundamental wave function solutions to PDEs.

Alisa Dvarishkis: Cell Biology & Neuroscience**Mentor: Steven Stowers -- Cell Biology & Neuroscience*****Somatosensory Neural Circuit Mapping***

Neuroscience is a complex field which works, in part, to map out the series of neuronal circuits and synaptic connections that operate in the transmission of an external signal to the elicited response. Using the *Drosophila* fruit fly as a model organism, the following study aided in a fraction of this intricate question working with optogenetic technology and the blue light-gated cation channel, Channelrhodopsin-2 (ChR2). A transgenic fly line of the mutant variant T159C (ChR2-TC) was constructed through a series of molecular biology techniques and meiotic recombinations. Using the GAL4-UAS system with a *nomp-C* GAL 4 driver, ectopic expression of the variant was accomplished resulting in a line with specific expression of ChR2-TC in the mechanosensory neurons. This line was found to exhibit significantly enhanced sensitivity to blue light as compared to previous ChR2 lines. This increased sensitivity allowed us to induce a more robust behavioral response using narrowly focused light on spatially restricted areas of the larval body; a more naturalistic method not previously possible with the existing ChR2 lines which require whole body illumination to elicit behavioral responses. These behavioral responses, along with those of the wild type and *nomp-C/TNT* lines, were tested and quantified via behavioral assays.

Christopher Fisher: Agricultural Economics & Economics

Mentor: Dominic Parker -- Agricultural Economics & Economics

Resource Endowments and Economic Development in Central Africa

Many resource abundant nations have experienced lower than average economic growth over the past 50 years. The resource curse, as it is named, has widely been accepted among development theorists. While the curse affects many developing nations, it is nowhere more prevalent than in the Democratic Republic of Congo. An economy largely built on the foundation of mineral abundance, the DRC has been plagued with poor growth and extremely high civil conflict rates. Using the DRC, I first consider the literature surrounding the resource curse and examine the theorized mechanisms within the curse model. With these mechanisms in mind, I then propose new data to better understand the relationship between poor outcomes in regions with high mineral content. This study utilizes data on mineral specific mine location as well as conflict location within the DRC. The exogenous variable price, when used in conjunction with the DRC specific spatial data, will help better define the underlying mechanisms of the resource curse by revealing the effects of price on conflict given mineral type and location.

Trudi Fisher: English

Mentor: Doug Downs -- English

Hooks are for fishing: Preparing students for writing across their curriculum

In this research I will be comparing diction and syntax in Cell-Bio/Neurology students' writing to professional CB/N writing to analyze the semantic differences between them. What knowledge gap is represented, between the professional and student writing and language? What knowledge does the gap suggest is still necessary to reach desired learning outcomes for CB/N students? I am particularly interested in instances of student language use that emulate other disciplines, e.g. English or History, in attempting to write in a specifically CB/N discourse. I am looking for traces of what Anne Beaufort calls negative transfer, instances where writers mis-apply prior learning to new sites of writing where that learning doesn't transfer well. (For example, when a student learns in one class to avoid passive voice, and attempts to transfer that knowledge to another class where passive voice is the norm).

This project builds on undergraduate research previously completed by Medina Culver, using Culver's data set (a small corpus of course papers from previous CB/N classes provided by Prof. Thom Hughes) for extended analysis. I will re-analyze the corpus for instances of out-of-discipline language use and identify patterns across those instances. I will coordinate with Dr. Downs on methodology for data analysis, which will be based on established practices of discourse-analysis research. Background reading for the research will help determine methods and parameters for the analysis, specifically considering Beaufort's *College Writing and Beyond* to assess whether students display transfer of knowledge at all and if it is, in fact, negative transfer.

Elizabeth Flesch: Ecology

Mentor: Robert Garrott -- Ecology

Population trends of bighorn sheep and mountain goats in the Greater Yellowstone Area

Bighorn sheep (*Ovis canadensis*) and mountain goats (*Oreamnos americanus*) are important components of the large mammal community in the Greater Yellowstone Area (GYA). We analyzed historic bighorn sheep and mountain goat population counts collected by management biologists using ln-linear regression to estimate herd growth rates. Most mountain goat count units experienced a positive growth rate and increased their distributions over recent decades. Bighorn sheep growth rates were more variable among the 26 recognized herd units in the GYA. We used the historic count data to evaluate the hypothesis that sympatry of non-native mountain goats with bighorn sheep adversely affected bighorn sheep populations. This was accomplished by comparing the growth rates of sympatric herds with that of allopatric herds. There was no evidence that sympatric herd growth rates were significantly lower than allopatric herd growth rates. We caution, however, that many counts in consecutive years suggested larger changes in abundance than what would be reasonable to expect from biological processes. We suspect that variability in counts likely reflects varying detection probability and the overall difficulty of counting mountain ungulates. Therefore, conclusions derived from these data should be further evaluated with more detailed demographic studies in the future.

Angie Ford: English

Mentor: Doug Downs -- English

College Retention Initiatives at a High School Level: When Undergraduate Students Lead Summer Writing Camps

My presentation will outline the process for creating a summer writing camp for rural high school students. The process is a complex one, and little complete literature exists to facilitate this outreach. Challenges increase when the outreach program is initiated by undergrad students. Universities are constantly looking for retention initiatives. But if one of the difficulties new students face is their previous writing experience not having sufficiently prepared them for college writing, why focus only on the students after they arrive on campus? And, could we show undergrad students the value of their own education by offering them the chance to share it with others? My study considers the option of drawing upon writers from within MSU's new Writing major to accomplish this task. My research studied the options available to students who seek to create such an outreach program, looking in detail at alternatives, funding and low-income sponsorship possibilities, and potential challenges. Based on my findings, I created a guidebook, in hopes that, having such a resource available, other students will take up this initiative and create their own summer writing camps, making connections with those who might otherwise not have a fun, safe, and personal connection to college writing.

Blaine Fritz: Cell Biology & Neuroscience

Mentor: Darla Goeres -- Center for Biofilm Engineering

Evaluation of 3M Petrifilm as an equivalent alternative to drop-plating on agar plates in a biofilm system

This project evaluated 3M Petrifilm as an alternative, more efficient method for bacterial enumeration. Using Petrifilm allows the researcher to avoid preparing agar plates for bacterial enumeration. Currently, the majority of scientific literature concerning enumeration of bacteria on Petrifilm is from the food industry. There are no published studies examining the use of Petrifilm for enumeration of biofilm bacteria. A *Pseudomonas aeruginosa* biofilm was grown in a CDC reactor according to ASTM Method E2562. The mature biofilm was exposed to chlorine (buffered water for controls) and neutralized. The biofilm was removed from the surface, disaggregated, and serially diluted. Samples from the dilution tubes were plated in duplicate on Petrifilm Aerobic Count plates and drop plated on R2A plates. The Petrifilm and R2A plates were incubated at 36°C and colonies enumerated after 24 and 48 hours. The experiment was replicated three times by two technicians. The time required for both plating methods was recorded to help assess the efficiency of both methods. The results from this study may demonstrate that Petrifilm could replace drop plating as a more efficient and cost effective method for bacterial enumeration.

Sophia Froelich: Cell Biology & Neuroscience

Mentor: Brian Bothner, Joshua Heinemann -- Chemistry & Biochemistry

Oxidative Stress and the Metabolism of *Sulfolobus solfataricus*

How do organisms adapt to environmental stress at the metabolic level? The Archaeon *Sulfolobus solfataricus* grows optimally at temperatures exceeding 75°C and high acidity, conditions which expose it to extreme oxidative stress (OS). If this organism, especially suited to such an environment, mitigates oxidative damage through changes at the metabolic level, metabolomic analysis could provide evidence of novel pathways protectant against OS. This can in turn be used to understand how metabolic pathways may have evolved in response to OS. Pathways of potential import to OS regulation were compared using the KEGG Pathway Database between *Sulfolobus* (specifically SsP2) and other organisms to determine any potential homology to known pathways. These included sulfur metabolism, carotenoid and retinol synthesis, and the ubiquinone pathway. Metabolites differentially regulated in oxidatively stressed SsP2 cells (compared to control cells) were investigated for evidence in the literature of involvement in OS. The remainder of this project will focus on linking the metabolites to pathways in order to elucidate where differential regulation might occur in SsP2 and whether there is evidence of novel mechanisms for combating OS.

Edward Gall: Liberal Studies

Mentor: Leah Schmalzbauer -- Sociology & Anthropology

Studying Abroad In South America: Ethnographic Images and Short Films

In returning from my adventure to South America, my research did not go as smoothly as I had anticipated. Culture and language shock and the lack of a formal institution to support me led to produce far less media than I initially anticipated. Producing non-fiction documentaries is hard enough in and of itself, let alone attempting to produce them

alone in a foreign country or large metropolis such as Buenos Aires. In the end I found myself capturing more still images than moving images, and although my results do not 100% reflect my hypothesis, I am confident that my still images and select short films do. I have learned a great deal from my time in Argentina and Chile and I now understand that some sort of institution, partner or mentor is necessary if I seek to create a large media project again in the near future.

Mark Gockenbach: Physics

Mentor: Bennett Link -- Physics

The Equation of State of Neutron Stars

Self gravitating objects such as neutron stars are restricted to a maximum mass because of general relativity. Finding the equation of state of neutron stars would determine the maximum mass of a self gravitating object and allow the behavior of matter at densities higher than nuclear density to be studied. To find the maximum allowable mass of a self gravitating object, the Tolman-Oppenheimer-Volkoff (TOV) equation with corrections for general relativity coupled with the mass equation of a sphere with variable density was numerically dependent variables were the central pressure and the mass of the star. The values of the parameters of the TOV equation, determined by observation, were allowed to assume a range of values and therefore the solutions of the TOV equation yielded a range of candidates for equations of state for neutron stars. Each candidate yielded its own maximum mass. The most massive observed neutron star is PSRJ1614-2230 with a mass of $1.97 \pm 0.04 M_{\odot}$. Any candidate which yielded a maximum mass lower than this was discarded as unphysical for the equation of state. The remaining candidates formed a range of physically acceptable equations of state for neutron stars.

Brett Green: Physics

Mentor: John Neumeier -- Physics

Superconductivity in Alkali-doped Dibenzopentacene

In November 2011, a group of Chinese researchers set a new record at thirty-three kelvins for the highest critical temperature of any non-fullerene organic superconductor. The compound was potassium-doped dibenzopentacene in a particulate form. Our project's goal is to reproduce their results and attempt to improve upon the superconducting activity seen so far by crystallizing the dibenzopentacene sample. We will determine both the critical temperature and the temperature-dependent resistivity of both non-crystalline and crystalline dibenzopentacene, and then compare our results with those already published.

Samples, purchased from chemical suppliers, will be doped by direct heating of the dopant alkali with the sample in a sealed quartz tube. The literature also describes a method of doping in solution.

We will employ the gas antisolvent process and solvent pair method, both of which involve precipitation from solution, in our efforts to generate crystals. Should we encounter other possible methods early on, we may try them as well. Analysis will be performed using a "Physical Property Measurement System." We will determine critical temperature by watching for a sudden change in magnetic susceptibility. Electrical resistivity will be found using test voltages and probes.

Brett Green: Physics

Mentor: Hugo Schmidt -- Physics

Characterization of Strontium-doped Lanthanum Manganite Solid Oxide Fuel Cell Cathodes

Lanthanum strontium manganite (LSM) is a perovskite ceramic used as a cathode material in fuel cells. Here at Montana State University, recent attempts to utilize it in fuel cells have been inexplicably failing. In my project, I am sintering LSM pellets at various temperatures (100°C intervals from 1000°C to 1500°C) and performing both x-ray diffraction and electrochemical impedance spectroscopy on the sintered pellets in order to determine what synthesis parameters optimize their performance. The data obtained will be used as a reference for future work in the laboratory on LSM, since our results will likely differ from those seen in scientific literature due to the nuances of different laboratory equipment and methodologies. Our pellets are pressed at 250MPa. Silver paste and silver wire are used to connect the pellet and EIS apparatus. Data is collected at 50°C intervals from around 300°C to 900°C at frequencies ranging from 1Hz to 10MHz. X-ray diffraction data is also obtained and used in the identification of different phases.

Eileen Guthrie: Earth Sciences

Mentor: Colin Shaw -- Earth Sciences

Syntectonic microstructures record local strain on the Montana Transverse Zone

In the north Doherty Mountain area a small ~77 Ma igneous stock with associated dikes and sills has been folded along with the country rock into a series of anticlines and synclines. Carbonate rocks adjacent to the intrusions have been variably metamorphosed to marble. Thermally activated crystal-plastic deformation by dislocation creep and recorded by microstructures in the intrusions and metamorphic rocks must have occurred during cooling of the pluton and so provide a “snapshot” of local deformation at ca. 77 Ma. Lower-T deformation is recorded by calcite twins. These local microstructural indicators of strain can be used to ascertain a relationship with the large-scale NW-SE directed strain that produced folds in the area, which lies along the transpressional Southwest Montana Transverse Zone. Twin analysis reveals a preferred orientation of twin planes deformation, which may be used to calculate stress axes. Twin types may be indicative of temperature regimes of deformation. Petrologic analysis of the 8 samples shows that the deformed marbles vary in calcite and quartz content; from 40% calcite and 60% quartz to ~6% quartz to 94% calcite, contain few other accessory minerals, and show highly twinned calcite grains that vary in size from 1 mm to very fine grained.

David Halat: Chemistry & Biochemistry

Mentor: Rob Walker -- Chemistry & Biochemistry

Studies of Solid Oxide Fuel Cells (SOFCs) and SOFC Materials with High-Temperature Raman Spectroscopy

Materials used in electrocatalytic applications are often subject to extreme nonequilibrium conditions. These conditions include high temperatures (above 1000 K), strong oxidizing or reducing environments, and non-uniform electrochemical potentials. In solid oxide fuel cells (SOFCs), materials encounter all three of these conditions simultaneously. In this work, vibrational Raman spectroscopy and voltammetry were used together to monitor and model the chemical and physical changes in operating SOFCs. The temperature dependence of the Raman spectra of various SOFC materials, such as yttrium-stabilized zirconia (YSZ) and nickel oxide (NiO), was quantified and used to assess sample temperatures in later experiments. By means of temporally resolved Raman measurements, the reduction and oxidation kinetics of ceria and gadolinium-doped ceria (GDC) were determined. These studies provide a basis for understanding the chemical behavior of SOFC materials, which is difficult to measure at elevated temperatures. The deposition of graphite on SOFCs operating with methane was also examined. Electrochemical oxidation of graphite, as monitored with simultaneous chronopotentiometry and Raman spectroscopy, quantified the amount of carbon formed on the cell. This work allows us to correlate performance changes in operating SOFCs with measurable chemical phenomena occurring at the anode. Ongoing research examines reaction kinetics at the triple phase boundary (TPB) of anode-supported SOFCs.

Charles Hart: Ecology

Mentor: Michael Ivie -- Plant Sciences & Plant Pathology

A Faunal Treatment of the Cerambycidae of Montana

The Cerambycidae, or longhorn beetles, are significant pests of forests, ornamental plants, and wood products. Fewer than 50 Montana species records have been published and the distribution data are extremely limited. An unpublished 1936 thesis records 94 species from the state. Most subsequent records remain in generally unavailable gray literature. Additionally, numbers of unidentified specimens have accumulated in the Montana Entomology Collection (MTEC), mostly from Western Montana. In 2010, we started the five-year Montana Wood Borer Project, with special emphasis on eastern Montana. The 6300 cerambycid specimens in the MTEC represent 137 species from 55 of the 56 Montana Counties, a 46% increase in species from the 1936 survey. Analysis of these data using the Chao1 Estimator predicts another 23 species remain to be discovered. This recent work has yielded an additional 184 first-time county records, to a total of 854, a 22% increase in species known from various counties. These new records represent major range extensions of species from the Eastern Hardwood Forests, Great Plains and Pacific Northwest. Overall, the sheer increase in the Cerambycidae known from Montana demonstrates that the geography of the State brings both eastern and western elements together into a diverse profile.

Lena Heuscher: Physics
Mentor: Joseph Shaw -- Electrical Engineering
Gallatin Valley Winds

While day-to-day weather may appear to have no apparent pattern, if the weather patterns are analyzed over a longer period of time, patterns start to emerge. One of the most prevalent weather events in Gallatin Valley is wind. Using wind roses, comparisons of the Gallatin Valley wind patterns can be made over different time periods, such as diurnally, monthly, or seasonally. A wind rose is a diagram that depicts the distribution of wind direction and speed at a location over a period of time. The length of each spoke on a wind rose indicates how often the wind comes from a specific direction. Longer spokes mean the wind comes from that direction more often. The colors on each spoke displays how often the wind from this direction falls within a given wind speed range.

Samantha Hinckley: Modern Languages & Literatures
Mentor: Ada Giusti -- Modern Languages & Literatures
Effective Art Enhancement of MMAMA.net

The "Purpose Board" I am creating will include a brief timeline of Mali, with a focus on the citizens and their lives. MMAMA.net's creation and implementation and the presence of the people affected by it, both Malian and American, will be emphasized. The purpose of the sign is to make a visually and content rich self-contextualizing element for on-site sales of the products made by the villagers. It is needed because it is the most efficient way to attract interest and explain the origins and current conditions surrounding the inhabitants of Sanambelé and MMAMA.net. The board will increase local support and inform all viewers, therefore raising West-African consciousness and support among our peers. I intend to incorporate the experiences of those who have helped with this cause, such as my fellow students, into each step of my project, engaging multiple perspectives around such important and complex issues. This collaboration will undoubtedly include the input of Dr. Florence Dunkel, who started MMAMA.net and has made numerous trips to Africa, and Dr. Ada Giusti, who will be the accompanying faculty and continues to be instrumental in the development and success of MMAMA.net.

Jessica Huggans: Psychology
Mentor: Ian Handley -- Psychology
Bottoms Up! Affects of Intoxication on the Unconscious Thought Process

Dijksterhuis (2004) demonstrates that individuals who are presented complex decision criteria (varied information) arrived at a better choice when distracted from thinking for three minutes following presentation of information versus given three minutes to consciously consider the information, or asked to make an immediate decision. Our study's participants had blood alcohol content (BAC) levels between 0.00 and 0.08% and were presented with varying amounts of positive and negative characteristics about four potential roommates. Participants either thought about these characteristics consciously for three minutes; were distracted by an unrelated math task for three minutes (unconscious information process); or made an immediate decision about their attitude toward the roommates. The experiment is investigating the effects of varying BAC levels in immediate decision, conscious, and unconscious information processes. We predicted if unconscious thinking is distinct from conscious thinking, that as BAC increased, participants would make more accurate judgments using unconscious thought processes about the roommates; in comparison to conscious information processing condition. We predicted there would be no effect on the immediate decision making. If true, this experiment can help the medical community develop communication methods for patients making important medical decisions, while under the influence of intoxicating drugs.

Carla Hutson: English
Mentor: Christa Merzdorf -- Cell Biology & Neuroscience
Are the "wings" of zic1 expression a part of the pre-migratory neural crest?

The transcription factor Zic1 has several important functions during early embryonic development. zic1 regulates several of the genes that contribute to neural crest development in addition to roles it plays in development of the neural tube. The expression pattern of zic1 in *Xenopus laevis* can be described as a "horseshoe" with "wings" on either side. Although the "horseshoe" part of zic1 expression is along the edges of the neural plate, the "wings" lie outside this area. It has been suggested that these "wings" are migrating neural crest cells, but this contradicts the fact that, in

Xenopus laevis, neural crest cells do not begin to migrate until after neural tube closure is completed. *In situ* hybridization is a process used to observe gene expression in an embryo. A RNA probe is introduced into the embryo, and, through a series of reactions, produces a color stain only in the area of the embryo that the gene of interest is active. A double *in situ* hybridization follows the same basic protocol, but the expression of two genes are detected in the same embryo so that comparisons can be made. *en-2*, which defines the midbrain-hindbrain boundary, and *slug*, which is expressed only in the premigratory neural crest, will be used to in double *in situ* hybridizations with *zic1*. Using single- and double in situ hybridizations, this project will address the question of what the “wings” of *zic1* expression are.

Forrest Jarvi, Aaron Whittenburg: Sociology & Anthropology

Mentor: Michael Neeley -- Sociology & Anthropology

A Comparison of Broken and Complete Bladelets from TBAS 102, a Natufian Site in West-Central Jordan

The goal of this project is to evaluate the hypothesis that broken blades and bladelets show no statistically significant differences from the complete blades and bladelets at TBAS 102, and that broken pieces can be considered a representative sample of the lithic assemblage as a whole. TBAS 102 is a Late Natufian site in the Wadi al-Qusayr in Jordan. The Late Natufian dates from 11,500 BP to 10,200 BP in uncalibrated radiocarbon dates. Lithic technology in this period in Jordan is characterized by a microblade industry, which involves the production of short (< 3cm in length), narrow bladelets made of flint and chert raw materials. Our data collection focuses on the incomplete artifacts within the blade and bladelet assemblage. Statistical tests will be used to analyze the quantitative and coded variables of both the broken pieces and intact artifacts to evaluate the plausibility of the hypothesis. These tests will involve the entire excavated assemblage as well as samples drawn in a random and stratified fashion. The goal of using different sampling strategies is to determine whether the comparisons hold or are consistent when a subset of the artifact population is compared. This is potentially useful for archaeologists as samples are less time intensive to analyze and the use of samples may provide the same “signature” as the complete assemblage. The goal is to present our findings on this subject at the research celebration in the spring.

Ian Jefferies: Psychology

Mentor: Ian Handley -- Psychology

The Placebo Effect: The Result of Biased Information Acquisition?

We will observe how people view and rate a series of pictures depending on the expectation they receive. We predict that differences in expectations and the way people are persuaded by their expectations will change their perceptions. Research supports instances where individuals can overcorrect for their expectations and have different feelings for something contrary to their expectations. Participants will be recruited to measure the extent to which individuals are influenced by his/her expectations with a short series of questions, then presenting participants with 9 collages of 9 pictures (equally balanced with 3 pleasant, 3 unpleasant, and 3 neutral pictures) using eye tracking equipment, and finally asking them to rate how pleasant they thought the pictures were to them. The eye tracking equipment will gather data on how participants view the pictures and hopefully how expectations can guide and change their perception. A correlational analysis will be used. We are trying to see if the correction for expectations occurs during the stimuli, after the fact, or both. We hope to find data that could be used for future research regarding expectations, placebo effects, and how to manage them.

Amanda Kelley: Chemistry & Biochemistry

Mentor: Martin Teintze -- Chemistry & Biochemistry

Guanides as X4 HIV Inhibitors, Antibiotics and Inhibitors of Cancer Metastasis

Guanide and biguanide compounds synthesized by the Teintze lab have been found to bind to the CXCR4 chemokine receptor which is used by X4 strains of HIV to enter cells and is involved in cancer metastasis. Therefore, they may be able to inhibit both HIV infection and cancer metastasis. When the chemokine SDF-1 binds the CXCR4 receptor, it activates an intracellular signal transduction pathway triggering chemotaxis of cancer cells, which will metastasize toward a gradient of SDF-1. It's unknown whether the guanide compounds that bind CXCR4 activate the receptor which triggers the ERK MAPK1/3 pathway or are antagonists. For inhibiting either X4 HIV infection or cancer cell metastasis, the compounds should be antagonists. If they activated the receptor, they would cause inflammatory side

effects or cell migration. To determine whether the compounds are antagonists, an ERK phosphorylation assay is being developed. CXCR4 over-expressing Cf2Th cells are grown in wells and treated with SDF-1 in the presence or absence of the guanide compounds. Duplicate western blots are run using the samples and probes with a monoclonal antibody to phosphorylated ERK and an antibody that recognizes all ERK, respectively. The chemiluminescence from the blots will be used to quantitatively determine whether the compounds are acting as antagonists or agonists.

Kyler Kingston: Chemistry & Biochemistry

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

Role of Zic Family of Transcription Factors in Early Neural Development

A screen for genes that are regulated by Zic transcription factors identified a gene that proved to be an aquaporin (*aqp-3b*) (Cornish et al., 2009). Inhibition of this aquaporin suggests that it is required for proper neural tube closure. Neural tube closure defects are seen in 1 in every 500 births (Gilbert et al., 2006), and are due to such improper neural tube closures. Since mutations in Zic2 or Zic3 genes in mouse and humans are known to cause neural tube defects (Merzdorf, 2007), our hypothesis stated that either Zic2 or Zic3 regulates the aquaporin that aids in closing the neural tube. Morpholino oligonucleotides (MOs) were used to address which Zic gene regulates *aqp-3b*, starting with Zic3. Contingently, other genes in the Zic family would have been tested if Zic3 proved not to regulate *aqp-3b*. In this case, Zic1, Zic2, Zic4, and Zic5 would have been researched. Additionally, direct target genes of Zic transcription factors, including *tnrc4*, *Xl.25952*, and *Xl.8933* (Cornish et al., 2009), could have been tested. However, during the summer time only allowed for the testing of Zic3.

William Kirk: Physics

Mentor: Hugo Schmidt -- Physics

Characterization of Cathode Polarization

One method of characterizing a fuel cell is to develop an equivalent circuit that describes the behavior of the fuel cell. This can be done by using Electrochemical Impedance Spectroscopy (EIS). However, it is difficult to differentiate between components during this process, so changes in one part of the cell affect measurements from a different part. By isolating the components in a symmetrical cell, a better depiction of the components' behavior can be achieved making it more apparent what effects are due to polarization from the cathode. Increased polarization may be a result of decreased surface area from coarsening at the cathode/electrolyte interface from the sintering process. Research from the University of Florida suggests characterizing cathode polarization with changing temperature to get a better understanding of cathode operation. This poster will describe symmetric cell composition, and testing, as well as ceramic cathode polarization characteristics.

Craig Kozeluh, Taisha McWilliams: Cell Biology & Neuroscience

Mentor: Steven Stowers -- Cell Biology & Neuroscience

Optogenetic Circuit Mapping In Drosophila Larvae

Understanding how neural circuits process and transform sensory information to produce behavioral responses has been an ongoing endeavor in the field of neuroscience. Using optogenetic and circuit mapping technology, our research has aimed to map the fly larval mechanosensory and thermosensory neural circuits. *Drosophila* larva was used because of its outstanding molecular genetic toolbox, relatively simple nervous system, and nearly transparent body. The initial goal of our research was to spatially restrict the expression of transgenes to one or a small number of segments in the larva to make the responses to optogenetic stimulation as natural as possible. By trying to use regulatory regions from the homeotic gene *AbdA* and by examining existing lines of flies using regulatory regions from the other homeotic genes *Ubx* and *AbdB*, our lab has been experimenting on determining transgenes that will express in a small segment of the ventral nerve cord in the abdominal region. Overall, by seeking to map *Drosophila* mechanosensory and thermosensory circuits, an insight into neural circuitry analysis of more advanced organisms, where this degree of manipulation and understanding is not possible at this time, will be gained.

Elizabeth Kruk: Earth Sciences

Mentor: Frankie Jackson, Colin Shaw, David Varricchio -- Earth Sciences

Applications of Electron Backscatter Diffraction on Fossilized Dinosaur and Modern Eggshell

The use of electron backscatter diffraction on eggs takes a material science approach to the field of paleontology. This technique provides high resolution data on crystallographic orientation and has recently been used to analyze the crystallography of fossilized and modern eggshell. Eggshell microstructure was examined for dinosaur eggs from the Cretaceous Tiantai Basin of Zhejiang Province, China, as well as modern avian eggs. The samples used in this study were radially cut and micro-polished for mapping. They were initially studied under a petrographic microscope and cathode luminescence to determine minimal effects of diagenesis. The EBSD detection on a scanning electron microscope was used to map the average orientation of the crystals pixel by pixel, producing maps and stereographic pole figures. The details of the calcite and aragonite structure of the eggshells, (i.e., preferred orientation, misorientation between adjacent shell units, lattice distortions, and sub-grain structure) were quantified. Avian eggshell will be mapped in order to compare the structure to the fossilized dinosaur eggshell, thereby showing morphologic differences with the aim of determining potential biological implications. The approach of electron backscatter diffraction provides high resolution, quantitative data on the internal microstructure of fossilized and modern eggshell which could be used for future morphological studies.

Katharine Kujawa: Psychology

Mentor: Julie Wieseler - Psychology (University of Colorado, Boulder)

Dorsal root ganglion activation in below-level pain - 602

Spinal cord injury (SCI) is often accompanied by chronic pain which can present below the site of injury. The underlying mechanisms for this below level pain are not known. Pain afferent information is transmitted to the spinal cord is through the dorsal root ganglia (DRG). Deafferentation as is regularly used in standard chronic pain models leads to an increase in sympathetic fibers in the associated and neighboring DRGs. These fibers develop such that they form "baskets" around the cell bodies within the DRG. The increase in sympathetic fibers increases pain in animal models and is associated with pain in human patients. The goal of the current study was to investigate sympathetic basket formation in two models of SCI, contusion models general SCI physiology and avulsion developed specifically to investigate below level pain. At-level (thoracic), above level (cervical) and below level (lumbar) DRGs were analyzed. The at-level DRGs from the contusion model showed the greatest increase in sympathetic fibers compared to avulsion and at-level DRGs showed the greatest increase compared to DRGs distant to the injury. These data support that central nerve injury leads to sympathetic basket formation and that this innervation may drive pain distant from the site of injury.

Erika Lacy: Cell Biology & Neuroscience

Mentor: Mensur Dlakic -- Microbiology

Fluorescent Probes for Detecting Protein Interactions in Bacteria

Protein interactions are essential for many biological functions to occur. Bimolecular Fluorescence Complementation (BiFC) assay is a complementation-based technique used to study protein interactions. One benefit of this approach is that protein interactions as well as the location of that interaction can be studied under normal cellular conditions. BiFC works by the formation of a fluorescent complex when two proteins of interest attached to nonfluorescent fragments of a fluorescent protein interact. In this project we created BiFC constructs to study protein interactions in Bacteria involved in ribosome function. These molecular tools based on the BiFC method can be used as controls in studies of similar interactions in eukaryotic cells.

Eric Lake: Mathematical Sciences

Mentor: Kris Ellingsen -- University 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. Though the book has become much longer than intended, the finished product has successfully made readers fall in love with the characters, and has made an impact on readers.

Heather Lee: Modern Languages & Literatures

Mentor: Ada Giusti -- Modern Languages & Literatures

Publication and Distributions of the English-language translation of Bocar N'Diayes's Contribution à la connaissance des us et coutumes du Mali (On the Habits and Customs of Mali)

On the Habits and Customs of Mali provides an overview of Malian traditions, customs and behaviors in the following fields: general etiquette, hospitality rules, marriage and the matrimonial process, birth and childhood, circumcision and excision, death and funerals, the inheritance process and body modification.

Cheyenne Lesky: Chemistry & Biochemistry

Mentor: Ann Bertagnolli, Darcy Hunter -- Montana INBRE, Montana WIC

Improving Client Turnout at WIC through Text Communication

The goal of the research conducted at Bozeman WIC was to increase the participation of currently enrolled participants by tracking failure to attend rates in the outlying WIC clinics of Belgrade and Livingston by researching and implementing an appointment reminder system. Prior to research, an email reminder system was partially in effect and a mail reminder system implemented. Appointments were tracked and recorded to obtain monthly initial failure to attend percentages for each clinic. The average initial failure to attend percentage for a five month period for the Livingston clinic was 24.48%, for Belgrade the initial average was 18.98%. Surveys were administered to clients at each clinic to determine which reminder system would be best received. In both clinics, the percent of clients that would prefer text communication was the highest, with Livingston at 58% favor and Belgrade at 41%. Text message reminder systems are currently being researched to determine which would be the most cohesive with the WIC system. Due to incomplete data, a text communication reminder system has yet to be implemented. In addition to the reminder system, the surveys also determined that clients would be interested in the implementation of a home based distance learning program with Belgrade having 71% in favor and Livingston having 62%. At this time, all research is ongoing.

Natasza Lorentz: Cell Biology & Neuroscience

Mentor: Wade Hill -- Nursing

Access to Healthcare in Chiang Mai, Thailand

The focus of this study was on access to quality healthcare services in crucial areas of public health. Among those areas examined were acute treatment, chronic care, mental health services, end of life care, and wellness services. Data was gathered by conducting interviews with doctors, nurses, and academics associated with the healthcare field in Chiang Mai during an 18-day visit to Chiang Mai, Thailand and its environs. The information obtained throughout this study highlighted the excellence of the Thai public health system. Since universal healthcare coverage was enacted in 2002, Thailand has seen a direct correlation between increased governmental health expenditure, increased use of public healthcare services, and a decrease in morbidity and mortality. Thailand's low Infant Mortality Rate and Child Mortality Rate are exemplary indicators of the efficacy of the healthcare system and illustrate the exceptional access, quality, and provision of free public healthcare available to the Thai populace. The information gathered during this study is significant in that it adds to the current understanding of the universal health care system in Thailand and by extension, supplements the existing body of knowledge on the international health community.

Tiphani Lynn: Cell Biology & Neuroscience

Mentor: Charles Gray -- Cell Biology & Neuroscience

Characterization of Gamma Frequency Synchronized Oscillations in Macaque Visual Cortex

The ability to discriminate between objects based on visual features may depend on the synchronous firing of neurons in the visual cortex. In previous studies, synchronous activity in the gamma-frequency range (30-80 Hz) has been associated with attention, memory, and visual perception, but no studies have examined the role of gamma oscillations under conditions that closely approximate natural vision. The aim of this project is to develop a more robust method for the detection of these oscillatory events in signals recorded from the visual cortex of a macaque monkey during a free-viewing task. In light of the weaknesses of other methods, our approach to this problem involves a combination of signal processing tools and machine learning algorithms. Once detected, the events can be more accurately characterized in terms of their association with periods of eye movements and fixations and their likelihood of occurring in different visual areas.

**Please join the Hughes Scholars at the 2:00 oral session where we will share our science outreach experiences

John MacDonald: Chemistry & Biochemistry

Mentor: Phillip Sullivan -- Chemistry & Biochemistry

Characterizing Photoswitches to Mimic Nerve Cell Repolarization

It has been shown that a quaternary ammonium structure (nitrogen bonded to four carbons), such as tetra-ethyl ammonium iodide, can block a potassium channel and therefore inhibit the depolarization of a nerve cell. By attaching this quaternary ammonium (or other biologically active structure) to an organic photochromic molecular photoswitch, it is possible to control the nerve cell with light. The goal of this research is to create a photoswitch that will depolarize and repolarize a nerve cell at a physiologically realistic rate using low-power visible light. This “drug” would allow people suffering from retinitis pigmentosa a chance to again “see” since only the rods and cones are damaged and the retinal nerve cells only need a new means by which to respond to light.

Paige Madison: Sociology & Anthropology

Mentor: Michael Reidy -- History & Philosophy

How Neandertal Conceptions were Built by Nineteenth-century European Scientists

Scientific knowledge is not created in a vacuum separate from ideology and bias; people generate scientific knowledge, and those people are products of a specific time period and a specific location. An examination of that time and place helps to provide a better understanding of the forces at work in knowledge creation. A good example of this is illustrated in the early discoveries of Neandertal fossils. Neandertal fossils were the first ancient, human looking fossils to be uncovered, and it is significant that they began to appear in a time of great change in Europe; a time when people were reeling from the French Revolution, a time of British imperialism, and a time when beliefs about the authority of the Bible were questioned and evolution was discussed. The narrative of the Neandertal species was created in that complex and tumultuous environment, and a history of Neandertal fossils must situate the fossil discoveries in the broader context that affected the fossils’ analysis. This project aims to illustrate a few of the ways that broader social, political, and ideological factors influenced the study of Neandertal fossils, and provide a discussion of how that affects the science being done on Neandertal fossils today.

James Mauch: Earth Sciences

Mentor: Jim Schmitt -- Earth Sciences

Characterizing and interpreting the morphology of fan-shaped depositional landforms along the Madison Range front, SW Montana

Diverse fan-shaped depositional landforms exist at outlets of major drainages along the western Madison Range, southwest Montana. Field documentation and Google Earth image analysis allow for morphological characterization of eight landforms and their drainage basins using slope, area, bedrock geology, and surface topography as criteria. Based on morphology, landforms were interpreted as large sheetflood alluvial fans (Cedar Creek, Indian Creek), large debris-flow alluvial fans (Tolman Creek, Mill Creek), small debris-flow alluvial fans (Shell Creek, S of Deer Creek) and glacially-derived terminal and ground moraines (S Fork of Indian Creek, Wolf Creek). Sheetflood, mass wasting, and glacial

processes were identified to explain fan formation. Fan slope and size directly correlate with drainage basin slope and size. Drainages with tilted sedimentary rock layers preferentially form debris-flow fans instead of sheetflood fans. Moraine morphology is tied to glacial processes. Climatic factors (glaciation) caused large scale fan deposition in the Pleistocene, while tectonic factors (down-dropping of the Madison Valley) influenced Holocene fan and moraine entrenchment. Implications include contributing to the understanding of past topographic and tectonic patterns' relation to ancient fan sequences, and demonstrating that cryogenic processes should be considered when interpreting coarse-grain facies deposited in high latitude continental extensional basins during icehouse periods.

Michael McLoughlin: Microbiology

Mentor: Ed Schmidt -- Immunology and Infectious Diseases

The Development of Hepatocellular Carcinoma in Thioredoxin Reductase 1 Deficient Liver Cells

We examined diethylnitrosamine- (DEN) induced hepatocellular carcinoma (HCC, liver cancer) in either normal mice or mice lacking the thioredoxin system, one of the major cellular antioxidant systems, in liver cells. Utilizing a previously established thioredoxin reductase-1 (txnrd1) conditional-knockout model, forty-one male mice whose liver cells were wild-type, heterozygous, or homozygous for disruption of txnrd1 were challenged with DEN at two-weeks of age. Mice were sacrificed eight months later and macroscopically visible tumors were analyzed. Wild-type mice averaged 13.9 tumors, whereas heterozygous and homozygous mice averaged 10.8 and 4.8 tumors, respectively. Contrary to expectations based on the "oxidation model of carcinogenesis", these results indicated that mice deficient in txnrd1 were resistant to DEN-induced HCC. Ongoing studies are being conducted to investigate the mechanisms underlying this protection.

Taisha McWilliams, Craig Kozeluh: Cell Biology & Neuroscience

Mentor: Steve Stowers -- Cell Biology & Neuroscience

Optogenetic Circuit Mapping In Drosophila Larvae

Understanding how neural circuits process and transform sensory information to produce behavioral responses has been an ongoing endeavor in the field of neuroscience. Using optogenetic and circuit mapping technology, our research has aimed to map the fly larval mechanosensory and thermosensory neural circuits. *Drosophila* larva was used because of its outstanding molecular genetic toolbox, relatively simple nervous system, and nearly transparent body. The initial goal of our research was to spatially restrict the expression of transgenes to one or a small number of segments in the larva to make the responses to optogenetic stimulation as natural as possible. By trying to use regulatory regions from the homeotic gene *AbdA* and by examining existing lines of flies using regulatory regions from the other homeotic genes *Ubx* and *AbdB*, our lab has been experimenting on determining transgenes that will express in a small segment of the ventral nerve cord in the abdominal region. Overall, by seeking to map *Drosophila* mechanosensory and thermosensory circuits, an insight into neural circuitry analysis of more advanced organisms, where this degree of manipulation and understanding is not possible at this time, will be gained.

Kyle Mehrens: Earth Sciences

Mentor: Adam Sigler -- Land Resources & Environmental Sciences

Nitrate-N concentrations and their impact on water quality throughout Gallatin Valley

Water is a critical resource for all life. With roughly 3% of the water on earth being fresh water, and of that percentage about 1 % being available to humans, it is clear to see the importance of protecting the water that is available to us. Globally, factors such as climate change, population growth, increasing industrialization and loss of natural resources are all aiding in the reduction of fresh water quality and quantity. This paper addresses local water quality issues, in hopes of gaining a better understanding of issues seen locally, which also occur in many other locations worldwide. Gallatin Valley located in Gallatin County, Montana is the selected study area for this research. The study area has a diverse landscape, which allowed for a unique study, examining many anthropogenic and natural sources of nitrate-N. These sources and the nitrate-N levels associated with them were the main focus for this research. Using well water quality tests from various organizations, data was managed and analyzed using GIS software. Septic density, geology, groundwater flow, well depth and co-indicator chemicals such as chloride were studied to try to identify likely sources of elevated nitrate-N concentrations in groundwater.

Jill Melcher: English

Mentor: Lynda Sexson -- History, Philosophy, & Religious Studies

Teaching World Religion in the West Through Western Religious Imagery

Las Vegas is a particularly interesting manifestation of the Judeo-Christian binary of sin and salvation as fueled by capital. Over half of the American population has been to Vegas, it is the Mecca of American capitalism. It is also home to a powerful evangelical community that draws strength on being a beacon of light in a city of sin. It is part of the mythology of exodus associated with the west (specifically the sun belt), but also acts as a fascinating self-contained microcosm for the nation at large, a single point at which some of the most significant cultural, religious, and political threads of America intersect.

Eric Metz: Earth Sciences

Mentor: Frankie Jackson, Patrick Druckenmiller -- Earth Sciences

A New Polycotyloid Specimen from the Bearpaw Shale of Montana

A new polycotyloid specimen from the Upper Cretaceous (Campanian-Maastrichtian) Bearpaw Formation of Northeastern Montana is described based on a partial, articulate skeleton. This specimen becomes only the second polycotyloid described from the Bearpaw Shale, the last occurrence of polycotyloids in North America. Preparation of this fossil specimen has revealed an ontologically mature adult skeleton that includes the left rear paddle, another partial paddle, pelvic bones, rib cage, and vertebral column, including nine cervical vertebrae. Ongoing sediment analysis hopes to provide critical dating information for such an exciting time in polycotyloid evolution.

Nicholas Miles: Liberal Studies, Environmental Studies

Mentor: Florence Dunkel -- Plant Sciences & Plant Pathology

Addressing grasshopper (*Melanopus differentialis*) herbivory, and the feasibility of developing biological/locally acquired applications' for deterrent

Two experiments' were completed, using the 'Holistic Process' to address a grasshopper issue at the Little Bighorn College Community Garden in Crow Agency, Montana. The first one utilized samples of swiss-chard and parsley from the community garden. One sample of swiss-chard was doused with 5ml of well water (control), while another was doused with 5ml of 'parsley slurry' (treatment); 5 male and 5 female grasshoppers were placed in an aquarium with the control and treatment for approximately 45 minutes. Observations' were made throughout the allocated experiment time, which indicate that rather than deter grasshoppers, parsley slurry is an attractant. Second experiment tests the food preference of grasshoppers, given five choices of raw plant material from the Little Bighorn College Community Garden. Swiss-chard, chrysanthemum flowers, chrysanthemum leaves', peppermint and parsley (15x12cm) are placed in an aquarium. 10 female and 10 male grasshoppers are dropped simultaneously onto parsley, and their food preference is documented over the following two days'. The study shows that when given raw parsley, grasshoppers favor it the least out of the five other choices. Such a result between the two studies indicates that grasshoppers cannot digest raw parsley due to parsley's physical structure.

Jake Morison: Physics

Mentor: Galina Malovichko -- Physics

Modification of LiNbO_3 Properties with Tetravalent Dopants

Lithium Niobate, LiNbO_3 is used extensively in the telecoms market. Dopants, which are intentionally introduced during the growth process, can significantly modify properties of the crystals. My project will be to investigate structure defects in LiNbO_3 crystals doped with tetravalent impurities like zirconium, Zr and tin, Sn. Until now the $\text{LiNbO}_3\text{:Zr}$ was rarely studied by the magnetic resonance and optical spectroscopy. Therefore, it is not known, what the charge state of Zr in LiNbO_3 crystals is, what ion (Li or Nb) it substitutes, and what the mechanism of the excess charge compensation is. I shall learn technique of magnetic resonance and optical spectroscopy, measure and compare spectra of the Electron Paramagnetic Resonance and optical absorption of nominally pure and doped crystals. So far, I have learned how to effectively operate the EPR machinery and collect measurements from samples. In addition to learning how to logically operate the machine parameters, I have taken in much of the theory behind the process. I plan on conducting more angular dependence studies of Lithium Niobate crystals. I will take measurements at both room temperatures and at low temperatures, achieved with liquid helium, in order to search for rare earth ion dopants., specifically

holmium, chromium, and manganese. Low temperature measurements are useful because many rare earth elements commonly appearing as dopants in the crystal only respond to the electron paramagnetic resonance at low temperatures. I will be conducting angular dependence to find the signals at the position perpendicular to the x, y, and z planes in order to learn about the crystal structure and locations of the dopants. All of this information will help to better understand the optical and acoustical characteristics resulting from dopants in the Lithium Niobate crystal. I plan on presenting a poster at the research celebration in April on my findings and analysis. The work will be carried out in the Magnetic Resonance Laboratory (Physics Department, MSU) under supervising Prof. G. Malovichko.

Connor Murnion: Cell Biology & Neuroscience

Mentor: Frances Lefcort, Amy Eibs -- Cell Biology & Neuroscience

Identification of genes regulated by IKBKAP: Investigating why neurons die in the disease Familial Dysautonomia

Familial Dysautonomia is a disease of the peripheral nervous system caused by a mutation of the IKBKAP gene on human chromosome nine. The goal of this research project is to determine what effect the knock-out of this gene has on transgenic model mice. In particular, it examines why proteins previously found to have altered concentrations in the mutant mice are present in different amounts compared to the control. To look at the expression of these genes, which include neuropeptide Y, parvalbumin, and substance P, the polymerase chain reaction was used to amplify these genes from reverse transcribed RNA isolated from both mutant and control mouse tissue. The PCR products were then run in agarose gel electrophoresis to determine expression levels. Due mostly to a lack of time, the project has yet to produce any conclusive results but work continues in order to obtain evidence concerning gene expression levels in the model mice.

Brook Murphy: Cell Biology & Neuroscience

Mentor: Roger Bradley, Dana Rashid -- Cell Biology & Neuroscience

Restoring Expression of SNAI2 Protein after Apoptosis of Xenopus laevis Embryos

In vertebrates, the neural crest comprises a population of stem cells that directly gives rise to the peripheral nervous system (PNS), most of the cartilage and bones of the face and skull, the adrenal medulla and also melanocytes. Research in Dr. Bradley's lab is focusing on NF-protocadherin (NFPC), a cell adhesion molecule required for neural tube and neural crest function, but its specific role still remains to be fully elucidated. Earlier research in Dr. Bradley's lab has shown that knocking out expression of NFPC inhibits neural crest formation and causes the cells to undergo apoptosis. Because the precise role is still not completely clear, research has focused on making this clear. Preliminary results show that when blocking expression of NFPC by adding an anti-NFPC morpholino, *snai2* (slug) is lost and cells undergo apoptosis. This study investigated the role of NFPC in maintaining the expression of *snai2* (slug), a transcription factor required for the migration and differentiation of the neural crest. Our objective was to find where rescuing apoptosis rescued the neural crest phenotype. Our hypothesis was that Bcl-xL (a Bcl-2 family anti-apoptotic gene) would rescue slug expression, which would restore the domain of neural crest cells. Our results demonstrated that NFPC is required for slug expression, and that rescuing the cell from apoptosis rescued slug expression, the neural crest phenotype and even extended its expression. This experiment, along with others in the lab, has shown that apoptosis is correlated strongly with the development of the neural crest, as inhibiting it increased the neural crest domain. This is intriguing as apoptosis is largely overlooked in this time of development at the moment. Future experiments will investigate this further as more data is needed. Also, if time allows, these experiments will also include investigating the roles of other apoptotic and anti-apoptotic genes, as each will likely have a specific temporospatial importance.

Kevin Murray: Chemistry & Biochemistry

Mentor: Robert Szilagyi -- Chemistry & Biochemistry

Electronic Structure Determination of [Fe]-hydrogenase model complexes

Hydrogenases are a class of metalloenzymes that catalyze the reversible oxidation of dihydrogen to protons. The mononuclear [Fe]-hydrogenases form a unique family of hydrogenase enzymes in that they function as hydrogen forming methylene-tetrahydromethanopterin dehydrogenases (Hmd). They catalyze the reversible reduction of N5,N10-methyltetrahydromethanopterin with H₂ to N5,N10-methylenetetrahydromethanopterin and a proton. In order to understand the electronic structure of the active site of this enzyme, which features a single low-spin iron center, we have studied a series of [Fe]-hydrogenase model complexes provided by a collaborator from Switzerland. X-ray absorption spectroscopy (XAS) data were taken at the S K- and Fe L-edges in order to investigate the electronic

structure of these compounds. The studies complexes allowed for a comparative analysis that provided us with how distinct structural elements of the complexes determine overall electronic structure. We utilize calibrated Density Functional Theory-based (DFT) calculations to aid the interpretation of our spectroscopic results. The XAS results allow us to determine the total S 3p and Fe 3d character of the unoccupied frontier orbitals and calculations will allow us to complete the orbital composition so that the total electronic structure is defined.

Gourav Krishna Nandi: Mathematical Sciences

Mentor: Russell Walker: Mathematical Sciences

Cantor's Theory of Fractional Dimension and Large Infinities

The aim of the study was to analyze the works of Georg Cantor, (1845 - 1918) which reveals an elegant perspective of the foundation of mathematics. Under the guidance of professor Russ Walker, the study was conducted in different phases. The first phase initiated with the analysis of the geometrical objects in fractal dimensions. We investigated the concept of fractal dimensions and applied it to Cantor set, Cantor square and other iterated functions. Following the first phase, we studied the patterns in fractional dimension in the Koch-Sierpinski triangle. The study on Koch triangle demonstrated a relation between the length of the removed portion of a Koch triangle and its dimension. The second phase also beheld the proof of Koch triangle's uniform Cauchy continuity. The third segment focused on Cantor function. Also known as a singular function and Devil's Staircase, further study constituted the proof of its continuity. The subsequent study will be focused on Cantor's transfinite numbers and the Continuum Hypothesis. This phase will also include the analysis about the existence of transcendental numbers. The study of Cantor's work on fractal dimensions and large infinities lies at the heart of the present day advanced Mathematics. This study will help me be to build a strong foundation for advanced Mathematics that I aim to pursue in course of time.

Courtney Peck: Physics

Mentor: Kevin Repasky -- Physics

Design, Construction, and Implementation of a Solar Spectrograph for the National Student Solar Spectrograph Competition

A solar spectrograph is an instrument that takes incoming sunlight over a majority of the electromagnetic spectrum and separates the light into its constituent frequency components, or spectrum. The components are then sent to a detector that measures intensity, which reveals the location of spectral properties of the light such as absorption and emission lines. The National Student Solar Spectrograph Competition (NSSSC) is a Montana Space Grant Consortium sponsored competition where undergraduate student teams from across the country design, build, and implement a ground-based solar spectrograph to perform any solar related task and demonstrate their spectrographs for the competition in May 2012 in Bozeman, MT. Each team is given a 2,000 dollar budget to build their spectrograph, which cannot be exceeded and all spectrographs must follow regulations in the NSSSC guidelines. Our team is designing the spectrograph to be capable of imaging the sun across the visible spectrum using spatial filters and a standard photo detector rather than a traditional charge-coupled device due to budget limitations. The spectrograph will analyze the spectrum of small sections of the sun to determine how the spectrum varies across solar features such as the corona, active regions, and quiet regions, and recompile the data into wavelength specific images of the sun. In addition to solar imaging, the spectrograph will also analyze atmospheric absorption of the solar spectrum by comparing the measured spectrum to the theoretical spectrum calculated from the blackbody equation.

Alyssa Peck: Mathematical Sciences

Mentor: Mark Greenwood -- Mathematical Sciences

Methods for exploring life course trajectories of MSGC significant award winners

Montana Space Grant Consortium, MSGC, is a NASA funded education and outreach program geared to promote Science, Technology, Engineering, and Mathematics (STEM fields) to the public. Since its inception in 1991, 107 fellowships and 371 scholarships have been awarded to students intending to pursue STEM related fields with special consideration given to underrepresented groups such as women and ethnic minorities. The assessment of programs such as the Montana Space Grant Consortium often involves tracking students' career paths in the years immediately following their funding. Those paths often follow complex trajectories through different work and school experiences, modeled as a variety of different discrete states, or categories. Methods have recently been developed for modeling these "life trajectories" that allow investigation into the influence of different students in defining those trajectories

and for explorations for the grouping of typical patterns of trajectories. This project will attempt to process the current MSGC data base into a useful format and assess the different methods available for this type of analysis. Because of limited information currently available, a simulated data set will be constructed to illustrate the use of the methods. The current data set has issues with missing observations and follow up information on students has only been collected since 2005. As a result of this and the intention of MSGC to continue collecting student data, this project will focus on the potential use of these methods for program assessment.

Jaclyn Peick: Cell Biology & Neuroscience

Mentor: Ann Bertagnolli, Lori Christenson -- Montana INBRE, Gallatin County Food Bank

Celiac Disease: Wheat's Role in our Lifestyles and The Cost of Going Gluten Free

Celiac disease (CD), an autoimmune disorder causing the destruction of microvilli in the small intestine when in the presence of gluten, has become significantly more prevalent over the last decade. CD is often undiagnosed, yet in the US, about 1 in 133 people are living with CD. Costly biopsies, blood tests, and genetic testing make it difficult for many patients to validate the diagnosis. This literature review describes recent studies involving CD, and primarily aims to aid those trying to manage CD with limited resources. Research focuses on the response of emergency food providers, and how limited resource individuals can eat gluten free. Ideas like, creating meals based on naturally gluten free ingredients to avoid the steep prices of specially processed gluten free foods or substituting rice, quinoa, corn, bean, nut, and soy products can provide cheaper alternatives. Food banks around the country have recognized the increasing need for gluten free products. A variety of educational materials were created to inform the community and suggest inexpensive ways to control symptoms. Educating the public, gluten free donations, as well as the continuation of research, all contribute to improving the lives of celiacs, particularly those experiencing financial pressure.

Natasha Pettinger -- Cell Biology & Neuroscience

Mentor: Bern Kohler -- Chemistry & Biochemistry

Charge Transfer Dynamics in Photosensitizer-Hydrogenase Systems

Solar energy is one of the most promising renewable energy sources in the world today. High costs of materials isolation and processing and relative inefficiencies of current solar technologies necessitate further research and progress in this field. It is imperative to develop cheap, clean, and efficient solar energy harvesting and storage technologies, which can potentially be achieved through the production of hydrogen gas. Researchers have been investigating the possibility of coupling a hydrogenase enzyme to a photosensitizer, most commonly photosystem I or II, in order to drive the synthesis of hydrogen gas. The advantage of using hydrogenases is they are inexpensive and easy to make. However, their catalytic sites become deactivated in the presence of oxygen or carbon monoxide, which poses a problem when coupled with hydrolysis. We are looking into coupling hydrogenases with different electron donors such as ruthenium complexes, chromophores, and chromoproteins, with the end goal of using protein capsids organized into thin films as an assembly framework. I will be investigating the charge transfer dynamics of these systems in order to identify potential candidates and arrangements for a photosensitizer-hydrogenase system.

Nathan Phillips: English

Mentor: Gretchen Minton -- English

Not True to Troilus, Nor False to Cressida: An Introduction to Shakespearean Textual Editing in Troilus and Cressida

Shakespeare's plays stand on a far more precarious footing than the general reading public realizes: meaning that the text of Hamlet one can pick up from the local bookstore never existed in its present form during Shakespeare's lifetime. The path a play takes from the Early Modern Period to today as it moves from conception to an edited edition is a particularly knotty one that takes the play through 400 years of scholarship and hundreds of pairs of hands. *Troilus and Cressida* is notoriously branded as one of those few plays in the Shakespearean canon deemed problematic, and without set genre. The play presents itself both textually and contextually in the form of a riddle; it is a comedy without the wedding, and a tragedy cheapened by its not-quite-tragic characters. *Troilus* is a play governed by innumerable "what ifs," and it is up to contemporary editors to make sense of these cruxes for the modern reader and student. I would like to discuss general practices (using *Troilus and Cressida* as my test case) in modern Shakespearean textual editing, and how they impact the text that ends up in the contemporary book buyer's hands

Stefan Piontek: Chemistry & Biochemistry

Mentor: Robert Walker -- Chemistry & Biochemistry

Chemical Film Formation at Liquid-Solid and Liquid-Vapor Interfaces: Correlating Film Organization with Molecular Structure

Molecular adsorption to solid/liquid interfaces plays an important role in processes as diverse as waste control in rivers and streams to efficient pharmaceuticals separation. Our recent studies have explored the effects of solute structure and solvent identity on adsorption of related solutes to silica/liquid interfaces. Steady state fluorescence measurements report intensities of coumarin solutes adsorbed to silica slides from solutions having concentrations < 30uM. The specific systems we have examined thus far include silica/methanol, silica/chloroform and silica/hexane and coumarin solutes having different types of hydrogen bonding abilities. Of particular interest are the roles played by hydrogen bond donating and accepting properties as well as steric considerations. Our results show that polarity, not hydrogen bonding accepting capabilities of the solvent allow the solutes to organize themselves on the silica surface. These results come from fluorescence measurements taken at the silica vapor interface and we are currently constructing a total internal reflection fluorimetry spectroscopy chamber to verify these results in situ. With these data we plan to examine how the original solid/vapor work correlates with in situ solid/liquid interfaces.

Nicquel Porch: Cell Biology & Neuroscience

Mentor: Wade Hill -- Nursing

Contrasting Alternative Medicine Availability in Western & Eastern Environments

From skepticism to admiration, traditional, naturopathic, and alternative medical practices receive mixed reviews from the American people. With a predominantly allopathically educated nation, many people are not aware of available alternatives to western medicine. This produces a monopoly of powers with allopathic physicians providing only one type of medicine: that of disease suppression. One barrier to the incorporation of alternative medical practices within western medicine may be that physicians in the United States have little opportunity within their training to examine practices that fall outside of their own traditions. Therefore, the purpose of this investigation was to examine how alternative medical practices are incorporated into medical school curricula in two different cultures, the US and Thailand, in order to contrast opportunities to bring more comprehensive health care to western societies. Structured interviews were conducted in Chiang Mai, Thailand with healthcare providers who were influential in the decision-making process to the format of medical schools. In the US, research on the availability for education on alternative practices was also performed in like manner. Overall, it appears that Thai allopathic medical schools structure their training and education very closely to that of western medical schools. There is a much greater availability for practicing alternative medicine on one's own (without an MD degree), however, but there are also several more elective courses on alternative therapies within attaining a medical degree. Significantly, it appears that the demand among Thai people is what differs the greatest, as they embrace and sometimes encourage alternative therapies alongside allopathic prescriptions. As a developing country, it is not surprising that Thailand's medical schools would adopt and promote developed western standards and procedures. It is encouraging, however, that many of the Thai people retain their view for holistic care and offer so many clinics and treatment options outside of the allopathic standards, as well as more electives within the MD degree. In the US, alternative therapies and holistic lifestyles seem to be slowly catching attention as health and food production deteriorate, but it does not seem to be happening within the allopathic medical schools.

Virginia Price - Physics

Mentor: Nathan Pust -- Electrical & Computer Engineering

IRIS Spectrograph Competition

The goal of this project is to design and build a spectrograph and carry out a ground-based spectroscopy experiment of our team's choosing. Each team will have the 2011-12 academic year to declare a science goal, design and build their instrument, collect and analyze data, and perform some type of educational outreach. Teams will congregate May 2012 in Montana to demonstrate their instrument and their findings in a competition-style format.

Colin Reutter: Physics

Mentor: Hugo Schmidt, Stephen Sofie -- Physics, Mechanical & Industrial Engineering

Analysis and mitigation of oxygen electrode delamination in solid electrolyzer cells

Hydrogen production using solid oxide electrolyzer cells (SOECs) suffers from rapid degradation issues. In order to understand these problems unique to electrolysis, more information on the conditions of SOEC failure is needed. A current model by Anil Virkar addressing degradation in SOECs based on non-equilibrium thermodynamics is summarized. The model indicates high pressures developing in the electrolyte under certain conditions may be the source of the oxygen electrode delamination reported in the literature. It is predicted that introducing some electronic conductivity into the electrolyte will mitigate this delamination. The process of fabricating solid oxide electrolyzer cells to verify the model begins with tape casting a Ni-based supporting anode for consistent performance across all cells. The electrolyte is deposited by spin-coating layers to vary the thickness. The progress on fabrication and the use of ceria in the electrolyte or a ceria-based interlayer as options to increase the electronic conductivity is addressed. Future work on alternative cathode materials is suggested.

David Rey: Earth Sciences

Mentor: David Mogk, Colin Shaw -- Earth Sciences

Quantitative analysis of reactive transport processes in potential carbon sequestration reservoir rocks

We are currently using STELLA modeling software to quantitatively analyze reactive transport processes in potential carbon sequestration reservoir rocks. Having been observed to naturally occur in some deep geologic reservoirs, carbon sequestration is now being viewed as a feasible option for long term CO₂ storage. Therefore it is necessary to develop an understanding of fluid rock interactions in potential reservoir units, and the effect of super critical CO₂ on potential geologic reservoirs. We initially produced simple models of fluid flow through porous or fractured media, and will subsequently consider the more complex impacts of fluid-rock interactions (e.g. dissolution and precipitation rates of recrystallized minerals; changes to state variables (pressure and temperature) as water-rock reactions evolve; affects of rock strength in response to changing physical conditions). We are particularly interested in the effects of dissolution vs. precipitation on a fracture controlled vs. pore-controlled sample. Specifically how permeability will evolve in these two systems under both dissolving and precipitating system conditions. Using validated models we are testing different pressure and temperature conditions to predict the systems equilibrium constants and solubility curves. Model creation will be facilitated by 3-D Nuclear Magnetic Resonance (NMR) images to determine the porosity of the core and fractures present. Experimental data will be used to assess the validity of future models.

Russell Ricker: Mathematical Sciences

Mentor: Albert Parker, Tomas Gedeon -- Mathematical Sciences

Creating Soft Clusterings of Data Via the Information Bottleneck Method

Information-based distortion methods have been used successfully to analyze the relationship between stimulus and reaction spaces. Distortion methods make few assumptions concerning the correspondence between the two spaces, providing maximally informative relationships between them. I used the Information Bottleneck technique to create soft clustering of a synthetic data set with 50 stimuli and 50 neural responses with a multivariate Gaussian (either with 4-blobs or 10-blobs) describing their hypothetical relationship. The algorithm utilized an annealing method to solve the high-dimensional non-linear problem, and was implemented using Matlab. As the annealing parameter increased, the solution to the problem underwent a series of phase transitions, or bifurcations, that eventually stabilized to a nearly deterministic clustering. By calculating the matrix of second derivatives (Hessian), we are able to determine when the bifurcations occur. By calculating the third and fourth derivatives we are able to determine whether the bifurcations are subcritical or supercritical. The existence of subcritical branching implies that several solutions not found by the method of annealing exist. Because the method of annealing is guaranteed to converge, the subcritical branch must turn at a later bifurcation and become optimal.

Shelby Rogala: History & Philosophy
Kristen Intemann -- History & Philosophy
The ethics of aid: Is voluntourism ever ethical?

Voluntourism is an industry in the aid world that sends tourists into developing nations in order to be agents of change. These volunteers, however, receive little to no training, are not culturally or linguistically educated, and rarely have work experience in community building. Many question whether such a system is inherently unethical, as the volunteers often benefit more than the communities they serve, sometimes at a price to the integrity of the area in need. This paper explores the realm of international voluntourism, addresses objections and ultimately concludes that voluntourism, though imperfect, is not by nature unethical. Further, it seeks to reconcile methods of aid with communities needs as well as the interests of the volunteers.

Bronwyn Rolph: Modern Languages & Literatures
Mentor: Ada Giusti -- Modern Languages & Literatures
English Teaching Program in Mali

Our team's research responds to the requests of an elementary school in Sanambele, a village in rural Mali. The English instructor of the school has requested tools to help him teach English, especially pronunciation and oral comprehension, which my USP addresses. Our team has done a lot of research on the Malian society in order to create projects that work well for the school and community. For teaching English, I needed to make tools with content that students who have never left their village could still identify with and enjoy. After examining the rich history of oral storytelling and Malian mythology, I decided to use early American myths and recorded them by multiple speakers in order to give oral examples that students in Sanambele can enjoy. The stories were also written and illustrated with many pictures in order to facilitate comprehension and catch their interest. To teach pronunciation, I evaluated several existing phonetics educational programs, and chose sections of these lessons that seem particularly pertinent to French-speakers. Workshops that explain how to use these projects have also been developed in order to give the instructor the ability to use these programs long after the implementers have left.

Rachel Ruggles: Cell Biology & Neuroscience
Mentor: Roger Bradley -- Cell Biology & Neuroscience
Rescuing NFPC defects in *Xenopus* Embryos

Neural Fold protocadherin (NFPC) is a type of cadherin required for cell adhesion and is required for ectodermal differentiation during embryonic development. One method to study the function of NFPC is to inhibit translation of it, thereby making a functional knockout. Morpholinos are often used in this process due to their ability to bind to mRNA and prevent protein translation. When NF-protocadherin is inhibited in *Xenopus laevis* embryos using anti-NF-protocadherin morpholino, defects in the neural tube are observed. To test the specificity of these defects, we plan to rescue these defects by ectopically expressing full length NFPC. Embryos will be injected with the morpholino together with an altered NF-protocadherin mRNA that the morpholino will not bind to. In one approach, the region of mRNA the morpholino binds to is modified by changing enough nucleotides to maintain the same protein sequence while introducing enough mismatch to prevent the morpholino from binding. In the second approach, a primer is engineered to begin translation of the mRNA downstream of the normal start site thereby eliminating the morpholino binding site. If we can successfully rescue the neural tube defects, we can prove the defects are specific to knocking down NFPC.

Jesse Ruzicka: Chemistry & Biochemistry
Mentor: Brian Bothner, Vamseedhar Rayaprolu -- Chemistry & Biochemistry
Measuring Virus Rigidity by QCM-D

The ability to study conformational changes of a virus can give us a glimpse of its intriguing structure, its infection cycle and more importantly its interactions with the host which enable it to cause the infection. These biophysical changes occur *in-vivo* due to different chemical environments and are of great interest. The effects of chemical changes such as; different pHs and salt concentrations can be studied *in-vitro* and can help us expand our knowledge about such virus particles. Many instruments and techniques are available for measuring such values. One instrument is the Quartz Crystal Microbalance with Dissipation Monitoring. The Q-Sense™ D300 instrument is capable of measuring both the fundamental frequency and the damping (dissipation) of the stored resonance energy of an excited quartz

crystal. The measurement of these values allows us to calculate the rigidity of virus particles. Flock House Virus (FHV) and Nudaurelia Capensis Omega Virus (NwV) were studied so that values of rigidity and insight to the virus' viscoelastic properties could be obtained.

Ryan Scanlon: Earth Sciences

Mentor: Mark Skidmore -- Earth Sciences

Stable Isotopic Investigatino of Basal Ice, Taylor Glacier Antarctica

Basal ice, debris-rich ice at the base of a glacier or ice sheet, contains particles of ground up material from the rocks and sediments the glacier flows over. The stable isotopic ratio of debris-rich ice can vary in response to the type of debris entrainment processes including direct freeze-on and basal shearing. This project will measure the stable isotope ratios of oxygen and hydrogen in melt water from debris-rich ice bands from basal ice from Taylor Glacier, Antarctica, in order to improve our understanding of basal ice formation. The 60 cm thick section (3 x 20 ice blocks) that is the focus of the study was collected in the 2007 field season as part of a research project headed by Dr. Mark Skidmore. These blocks contain debris-bands that are bracketed by clean ice layers above and below. The isotopic analysis will be conducted at the 1 cm resolution through the debris bands and in the clean ice to allow a beter understanding of the isotopic structure in laminated debris-rich ice. The isotopic data will be compared with geochemical gas chemistry data of the same ice sequence from Scott Montross' recently completed PhD theses. This analysis should lead to an improved understanding of the basal ice formation at Taylor Glacier, Antarctica.

George Schaible: Plant Sciences & Plant Pathology

Mentor: Gary Strobel -- Plant Sciences & Plant Pathology

Characterization of Novel Endophytic Isolate Or10-4 and Analysis of Increased Bio-Activity by Addition of Esters

Today there is thought to be over a million species of fungi to exist and approximately 75,000 of those have been scientifically identified, leaving an enormous amount of species still unidentified and under-researched. The work done in Dr. Gary Strobel's lab focuses on the collection of biologically diverse plant material for isolation and classification of fungal endophytic species. Research has shown that these species of endophytes contain novel characteristics that make them of high interest for further research and analysis. Or10-4 is an endophytic isolate from the Canadian hemlock that produces a valuable volatile organic compound (VOC), 6-Pentyl-2H-pyran-2-one, which can be used as an anti-pathogen for crop plants to be applied in large agricultural settings. Analysis of scanning electron microscope (SEM) pictures from spore structures have indicated that Or10-4 is a new species to be taxonomically classified calling for complete rDNA sequencing. Furthermore, tests done on Or10-4 with the addition of esters in bioactivity tests against pathogenic species has shown increased inhibition. The chemistry of the interaction between the esters and VOC's is still being analyzed.

Virginia Schmidt: Sociology & Anthropology

Mentor: Tamela Eitle -- Sociology & Anthropology

Language & Inequality in Post-Colonial African Nations

Understanding language as a form of power might help deconstruct the hierarchies that produced the stark political, economic, and social stratification within post-colonial nations (Huss & Lindgren, 2011). My study explores the relationship between language and national inequality in post-colonial African nations. I compiled data on 19 African post-colonial nations and tested for a correlation between national inequality - measured by each nation's average household income ratio (the highest 10% household income distribution for each nation divided by its lowest 10% household income distribution) - and language officiality. I divided nations into two groups based on language officiality data from the CIA World Factbook website: Category 1 nations consist of those that employ only the previous European colonizer's language as an official language; Category 2 nations are those that have both the previous colonizer's language and a national/local language as the nation's official languages. My difference of means test yielded a real difference in average national inequality between Category 1 and Category 2 countries, although the difference was not statistically significant. Category 1 countries have a slightly higher (real) mean household income ratio than countries in Category 2. Future research in this area might explore the relationship between national levels of inequality and language use in specific societal sectors such as government, business/commerce, media, and education.

Joshua Sinrud: Physics
Mentor: Hugo Schmidt -- Physics
Solid Oxide Fuel Cell Test Rig

Solid Oxide Fuel Cells (SOFCs) are a very promising alternative energy source. SOFCs have many advantages, especially their high fuel flexibility. As opposed to other fuel cell types, the SOFC can use a multitude of different fuels including pure hydrogen and methane. Because of the high commercial use of methane as a fuel, we decided to create our rig to be run off of methane. The purpose of the test rig is to run the fuel cells and gather data on the V(i) curve of the cell and how efficiently it runs. Because of the cell's high operating temperature (800 centigrade), heat resistant materials must be used to run the cell. In order to get the methane to the cell, it is run through a series of tubes connected to mass flow controllers that runs through a humidifier and finally comes in contact with the cell via an aluminum oxide tube that the cell is glued to. This poster will explain how the rig is put together and the startup and shutdown procedures. We hope to use the rig to run many fuel cells in the future and do a multitude of test on SOFCs.

Benjamin Smith: Chemistry & Biochemistry
Mentor: Bern Kohler -- Chemistry & Biochemistry
Cryogenic Studies of DNA Excimers and Phosphorescence Decays

Ultra-violet radiation from the sun has the consequence of causing DNA mutations in the human genome by forming a dimer between two adjacent thymine residues. This mutation has been linked to skin cancer and occur on a pico-second timescale, where kinetics and dynamics of the excited state are incredible fast. This project hopes to study single DNA nucleotides at cryogenic liquid nitrogen temperature, (77K) where excited state kinetics and dynamics are better resolved than at room temperature. The nucleotides have been shown to dissolve in an ethylene glycol solution and cool to form optically clear glasses. The optically clear glasses are used to collect absorption spectra of the nucleotides in a solid state and are critical to the research. As the nucleotides cool to the anamorphous glassy state, the nucleotides excited state interactions with the solvent are less appreciable than when in the room temperature liquid state. A spectrometer is being built to more accurately measure the change in absorption of the nucleotides as they cool from a liquid state to a glassy state. This study will increase the understanding of isolated nucleotides at cryogenic temperatures and offer information on the dynamics of the excited state of single DNA nucleotides.

Erin Smith: Chemistry & Biochemistry
Mentor: Michael Franklin -- Center for Biofilm Engineering
Alginate Epimerization by AlgG

Pseudomonas aeruginosa is a bacterium found in the respiratory tract of cystic fibrosis patients. This opportunistic pathogen thrives in the thick mucus layer formed in the lungs of people with chronic pulmonary infections. Under these conditions the mucoid strain of this bacterium, FRD1, is able to form a protective extracellular matrix making it resistant to antimicrobial treatments. The major component of this matrix is alginate, a secreted extracellular polysaccharide; in this strain alginate is composed of D-mannuronic acid residues and L-guluronic acid residues. Initially alginate is produced by the cell in a poly-mannuronic acid form. The protein AlgG epimerizes some of the mannuronic acid residues into guluronic acid residues. The entire structure of AlgG has been proposed and is the model used as the foundation for this research. The focus of this current project has been to characterize the functional region of AlgG. During this project single amino acid mutations have been made in regions of algG with a hypothesized function. These constructs have then been expressed in a strain of *P. aeruginosa* with and algG deletion to determine the effect of the mutation on alginate production. Assays of these different mutants will give a better understanding of which regions of AlgG play a role in this proteins function.

Kelly Spendlove: Mathematical Sciences
Mentor: Tomas Gedeon -- Mathematical Sciences
Predicting Critical Transitions in Complex Dynamical Systems

Complex dynamical systems, ranging from physiological diseases to financial markets and Earth's climate, often exhibit radical changes in their behavior following small changes in their parameters. In physiology, there are spontaneous system failures such as asthma attacks and epileptic seizures; in ecology, sudden collapses of wildlife populations. Data indicate Earth's climate has swung between a 'snowball' and 'tropical' Earth, occurring rapidly on a geologic scale. The

common theme in these systems is a drastic change in the behavior due to potentially imperceptible changes in the conditions or parameters. Even with robust mathematical models, predicting such critical transitions prior to their occurrence is notoriously difficult. Recently, a topological approach has been developed which coarsely characterizes the dynamics of these systems. Our research builds upon this framework, using machine learning algorithms in combination with rigorous theorems regarding the underlying dynamics to construct a database which detects and catalogs critical transitions. Exploiting state-of-the-art paradigms in parallel computing, we are making this database efficiently computable for increasingly complex systems.

**Please join the Hughes Scholars at the 2:00 oral session where we will share our science outreach experiences.

Hillary Stacey -- Chemistry & Biochemistry

Mentor: Charles (Bill) McLaughlin -- Chemistry & Biochemistry

Group Online E-chats as Learning Aides for Analytical Chemistry

As an online supplement to course work, online discussions (or E-chats) were set up for students to interact in groups. As most chemical research is performed in collaborative groups, students discussed (1) analytical chemistry in society, (2) writing a scientific paper subjected to peer review, and (3) analytical techniques not discussed in class, together and online in collaborative groups. Students' attitudes on the effectiveness of online assignments are surveyed and improvement of understanding of analytical chemistry is judged over the assignments. Student participation in these online assignments exceeded the expectations and supported the effectiveness of this tool.

Nathan Stansfield -- Earth Sciences

Mentor: Colin Shaw -- Earth Sciences

Microstructural Analysis of Quartz Samples from Bald Butte Porphyry

Dikes, veins, and a silica cap associated with the ca. 40 Ma Bald Butte Porphyry system in the Marysville mining district can be genetically correlated with an economic Molybdenum deposit. This study employs Electron Backscatter Diffraction (EBSD) and Computer Integrated Polarization Microscopy (CIP) to study microstructures that record processes that produced the ~200-m-diameter dense silica cap overlying the subsurface Bald Butte stock. Samples collected from the silica cap contain quartz stockwork veins that crosscut each other and almost completely replace the country rock. The Cap is primarily quartz in composition with minor phyllosilicates, feldspar (?), and fluorite (?). Isolated relicts of country rock can still be identified. Textures surrounding major grains may indicate conditions present after emplacement of the system. We are working to define the relationship between subgrain recrystallization textures and secondary crystal growth in voids within several samples. We also hope to employ Energy Dispersive Spectrometry (EDS) to acquire a chemical profile along a transect across these textures in order to document changes in fluid chemistry recorded by the growing crystals. This study has implications for understanding processes of silica replacement in epithermal mineral systems.

Kristi Stefani: Psychology

Mentor: Ian Handley -- Psychology

Just Don't Think! The Role of Unconscious Thought in Attitude Change

Contrary to intuition, individuals sometimes make better decisions about complex information (e.g., persuasive information about a topic) when they are distracted, as compared to not distracted, from consciously deliberating on the information. Such findings support the idea that unconscious thinking processes are capable of using information to output sound judgments. The current experiment investigated whether unconscious thinking processes are capable of using optimal information, rather than relying on suboptimal information, to develop attitudes about a given topic. In particular, assuming unconscious processes can discriminate between more and less useful information, we predict that unconscious thought will lead individuals to form attitudes based primarily off of the quality of arguments in a persuasive message compared to relatively tangential information such as the expertise of the message author.

Hannah Susorney: Earth Sciences

Mentor: Frankie Jackson, Colin Shaw -- Earth Sciences

Electron Backscatter Diffraction (EBSD) analysis of fossil turtle eggshell

Electron Backscatter Diffraction (EBSD) allows high-resolution analysis of the microstructure of fossilized turtle eggshell. EBSD is routinely used in materials science; however, it has only recently been applied to study fossil and modern eggshell. This technique was used to study the microstructure of fossilized turtle eggs from the Upper Cretaceous Kaiparowits Formation of Utah. The fossil sample was cut radially and micro-polished for mapping. The sample was cut radially and micro-polished for mapping and was first studied with cathodoluminescence, where diagenesis/replacement appeared to be focused within the pores. The crystal orientation and mineralogy (calcite vs. aragonite) of the eggshell were identified using the pixel data from EBSD mapping and displayed in maps and stereographic pole figures to show the preferred orientation and spatial arrangement of individual crystals. Details of the aragonite eggshell structure, including preferred orientation, misorientation between adjacent shell units, lattice distortions and subgrain structure, were then observed and quantified. This technique could be applied for morphological and diagenetic studies of fossilized and modern eggshell.

Jennifer Thornburg: English, 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 book manuscript. 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.

Hazal Ural: Chemistry & Biochemistry

Mentor: Robert Szilagyi -- Chemistry & Biochemistry

Copying Nature: Chemical Synthesis of a Possible Catalytic Compound for H₂ Generation

The catalytic active iron-sulfur cluster of FeFe-hydrogenase can product hydrogen gas close to 10,000 molecules of H₂ per second per enzyme molecule. None of the currently known synthetic iron-sulfur cluster can even come close to this reactivity. A recent computer modeling study indicated that there is a new compound that may be able to meet this record activity. I propose to make this compound. The innovative part of the work is the attachment of a unsaturated ligand (olefinic and/or allylic) to the Fe₂S₂(CO)₆ 'parent' compound. I will use infrared and visible/ultraviolet spectroscopic techniques to characterize the compounds I will make. Using analytical techniques I will determine the reduction potential and protonation constant of the new compounds and will compare to other iron-sulfur compounds. The proposed work will be carried out with the help of a graduate student and with the guidance of faculty mentor, who has already secured funding for material and supplies related expenses.

Hannah Wahlert, Katelyn Weber, Mackenzie Weber: Political Science, Mathematical Sciences, History

Mentor: Christina Hayes -- Mathematical Sciences

LGBT Resource Center Necessary

Efforts are underway here at MSU to establish a Lesbian, Gay, Bisexual, Transgender, Queer help center located on campus. According to Dr. Matt Caires, the LGBTQ community at MSU is one of the "most underserved" groups that attend the college. This resource center would solve that problem by providing a central, safe location for LGBTQ students to go. This project is a collaboration between three MSU students: Katelyn Weber, Mackenzie Weber, and Hannah Wahlert. As members of Tell 3 Montana, a grassroots LGBTQ awareness organization based here at MSU these

women are well versed in LGBTQ issues faced by MSU students. The project is split up into two parts: a sequence of social surveys, which will be headed up by Katelyn and Hannah, and a five-year action plan, which will be headed up by Mackenzie. The goals of this project are to determine whether MSU would support such a help center, what services such an office should provide, what a budget for it would look like, and how we can raise money to support the center. We intend to determine support from MSU and what the center should provide by designing and implementing several social surveys. We intend to determine the five-year action plan including funding by using the VOICE Center and Women's Center as business models.

Thomas Weas: Physics

Mentor: Ron Hellings -- Physics

Using 'Filterpolation' with LISA/OMEGA Satellites to detect Gravitational Waves

In order to verify Einstein's Theory of Relativity, direct evidence of Gravitational Waves (GW) need to be detected. The current solution is using grounded laser interferometers (such as LIGO) to detect shifts in the space-time fabric. Earth's conditions do not allow for the sensitivity needed to observe these small changes from noise. The next solution is to put larger interferometers in space (LISA and OMEGA) to eliminate noise. Once in space, the satellites will be able to detect GWs. However, there is currently no way to tell which direction the GW came from, just that it was detected. The way to solve this is to run the data through a low pass filter, relative to the barycenter of our solar system. In order to improve on collection speed, the data will be 'filterpolated' as it is collected, which is done by taking 2^n evenly spaced data samples that are then sent through the low pass filter.

Tom Weas: Physics

Mentor: Aleks Rebane -- Physics

Broad-band telescope for focussing femtosecond pulses in two photon absorption spectroscopy experiments

As the intensity of the laser pulses increase, the double photon absorption increases by a power of 2, which causes a problem when trying to measure over a large range of wavelengths. We have built a telescope system that would allow us to focus the laser as a function of wavelength by using two stepper motors that are controlled by a LabVIEW VI. We also address problems that involve diffraction from a gaussian beam vs. geometrical limits.

Katelyn Weber: Mathematical Sciences

Mentor: Lucy Marshall, Mark Greenwood -- Land Resources & Environmental Sciences, Mathematical Sciences

A Clustering Approach to Hydrological Predictions in Ungauged Basins

In an effort to improve hydrologic analysis in areas with limited data, the International Association of Hydrological Sciences (IAHS) formulated the Predictions in Ungauged Basins (PUB) initiative. Hydrologists seek to link catchments in such a way that basins where little to no data collection occurs can be related to catchments that are gauged. Various metrics and methods have been proposed to identify such relationships, in the hope that "surrogate" catchments might provide information for those catchments that are hydrologically similar. To examine the relationship between a hydrological model and certain hydrological metrics, we first run the Dynamically Dimensioned Search (DDS) Algorithm [Tolson and Shoemaker, 2007] to calibrate six model parameters for the Probability Distributed Model (PDM) [Moore, et. al, 2007]. We then use hierarchical clustering based on Ward's Algorithm to link catchments based on these six calibrated parameters. Clustering has been used in multiple recent hydrologic studies [Hastie, et. al, 2009 and Sawicz, et. al, 2011], but catchments are often clustered based on physical characteristics alone. Usually there is little evidence to suggest that such "surrogate" data approaches provide sufficiently similar model predictions. Beginning with model parameters and working backwards, we hope to establish if there is a relationship between the model inputs and physical characteristics for improved model predictions in the ungauged catchment. To analyze relationships, we use a perMANOVA test [Anderson, 2001] to determine if our clusters of physical metrics show significant delineation, which provides evidence to suggest that the surrogate procedure does, in fact, result in similar hydrological model behavior. Further, we perform perMANOVAs to determine which hydrological and physical descriptors show significant differences among clusters, and follow this up with a sequence of pairwise perMANOVAs between clusters. This leaves us with a complicated structure of clusters that are different based on certain metrics in the study.

Luke Wheeler: Chemistry & Biochemistry

Mentor: Trevor Douglas -- Chemistry & Biochemistry

Incorporation of HNP-1 into a Protein Cage Architecture Based on the Bacteriophage P22

Utilizing molecular biology techniques, a gene construct was created that encodes for a modified protein cage architecture based on the bacteriophage p22. This specific protein cage has a genetic fusion to the scaffolding protein (which is necessary for particle assembly) which results in the incorporation of the antibacterial and antifungal Human Alpha Defensin 1, also known as Human Neutrophil Peptide-1 (HNP-1) on the inside of the protein cage, with one HNP-1 attached to each subunit. This protein was expressed in E. coli expression cells (BL-21 line), isolated and purified. The identity of the modified protein cage architecture was confirmed using a combination of mass spectrometry, SDS PAGE, dynamic light scattering, multi-angle light scattering and agarose gel electrophoresis. Preliminary bioactivity assays using aspergillus fumigatus indicate that the protein construct does not have antifungal activity and instead increases the metabolic rate of treated fungi. This, coupled with the high yield of protein isolated from e. coli, indicates that the containment of the antibacterial peptide within the P22 protein cage results in the shielding of exposed organisms from the cytotoxic activity of the enclosed HNP-1.

Hannah Wilson: History

Mentor: Frankie Jackson -- Earth Sciences

Comparison of Two Methods Used to Calculate Water Vapor Conductance in Modern and Fossilized Eggshell

Comparison of water vapor conductance (GH20) values in eggs of extinct taxa to those of extant birds and reptiles to those of extinct taxa provides a useful tool for interpreting nesting environment in the fossil record. However, measuring water vapor conductance rates in fossil eggs requires different methods than those used for studying extant eggs. In extant species, GH20, is obtained by placing a fresh egg in a desiccator and calculating the weight loss of the egg, divided by the difference in water vapor pressure across the eggshell. In fossil eggs, analysis of pore area from eggshell thin sections allows calculations of GH20. This method, however, has not been compared to the gravimetric methods used in studies of modern eggs, and their comparability remains unknown. In this study, I will apply the thin section method typically used for fossil eggshell to calculate GH20 for eggs of five extant taxa. I will then compare these results to values reported in the literature for the same eggs, using the gravimetric method. This study will determine comparability of methods, thus allowing for more accurate interpretations of nesting behavior in extinct species.

Lindsey Wolfe: Cell Biology & Neuroscience

Mentor: Frances Lefcort -- Cell Biology & Neuroscience

A Mouse Model for Familial Dysautonomia

Familial Dysautonomia (FD) is a genetic disorder of the autonomic nervous system caused by a mutation in the gene IKBKAP on chromosome 9. This mutation leads to a decrease in expression of the I κ B kinase complex associated protein (IKAP) and has detrimental effects on the development and function of autonomic and sensory neurons. FD is an autosomal recessive trait found mostly in Ashkenazi Jews, with approximately 1 in 27 being carriers of the trait. There is currently no cure for FD and half of all affected individuals die before they reach 40 years of age. To explore the disorder we have engineered a line of mice that express a conditional knockout of the IKBKAP gene in cells containing alpha-tubulin, a component of neurons. We are interested in analyzing the effect of this mutation on the nervous tissues as well as organ systems. Our methodology involves cryosectioning mutant and control mice tissues and using immunohistochemistry to stain for cells of interest. By examining the microanatomy displayed in this disease, we are able to further understand how this genetic mutation leads to the symptoms of FD and gain insight on which preventative measures and medications will have the best results in increasing the quality and length of life of FD patients.

Thomas Wright: Chemistry & Biochemistry

Mentor: Martin Teintze -- Chemistry & Biochemistry

Mechanism of Antibacterial Guanides Specifically Against MRSA USA300

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 a pathogen that has become resistant to antibiotics such as penicillins, cephalosporins, and monolactams. The Teintze lab has synthesized many

guanide, biguanide and phenylguanide compounds designed to block the CXCR4 chemokine receptor necessary for HIV to bind to mammalian cells. Some of these compounds also turned out to be active against various bacteria. Along with Staph, the lab has tested the compounds against *Acinetobacter baumannii*, *Enterococcus faecalis*, *Escherichia coli*, *Burkholderia cepacia*, and *Pseudomonas aeruginosa*. The compounds have some structural similarity to known bis-biguanides used as antibacterials (chlorhexidine and alexidine), but may inhibit bacterial growth by different mechanisms. The goal of this project has been to determine the minimum inhibitory concentration (MIC) of THAM trisguanide and THAM trisphenylguanide on MRSA and investigate the changes in the proteome of treated cells to help elucidate the mechanism of action. The MIC allows reasonable comparison between the compounds and known antibacterial drugs. The proteins of treated and untreated bacteria are studied by 2D gel analysis, which separates proteins based on isoelectric point and size. The treated and untreated 2D gels were then compared and many differences were found.

Esther Yoon: Cell Biology & Neuroscience

Mentor: Laura Larsson -- Nursing

Perceptions of Digital Signage among Health Department Clients

Traditionally, education interventions have been delivered by healthcare personnel. In the Montana Radon Study, digital signage technology (DST) is being evaluated for its effectiveness in delivering health information while clients wait for their appointment. The objective is to make better use of the client's time in the waiting room and un-burden the client-provider relationship. The purpose of this nested, cross-sectional study was to measure the attitudes and perceptions of waiting room clients to the DST. Survey data was collected over nine-weeks in the winter of 2011-2012 from three health department waiting rooms in Gallatin and Flathead Counties. Participants (n = 110) voluntarily responded to eight questions and were given a pack of sugar-free gum as a token of appreciation. The study was approved by the Montana State University Institutional Review Board. Out of 110 surveys, 92 replied that the system was moderately informative, very informative, or extremely informative. Also, 65 said that they would prefer a mixture of entertainment and health care information. Through this study, the opinion of the public of DST was heard and more can be done to inform clients of health related topics.

Amanda Zellar: Ecology

Mentor: Rebecca Mattix -- Immunology & Infectious Diseases

Treatment of Foot Disease in Captive Asian Elephants in Northern Thailand

Foot disease is a major concern in captive elephants in the United States and a significant cause of disability and death. It is estimated that half of all captive elephants in North America and Europe have had foot disease at some time in their lives (Csuti 9). The causes of many foot ailments are not well understood, but the most common etiologies cited for foot disease include lack of exercise, improper nutrition, inadequate trimming and grooming of feet or hard, rough or damp enclosure substrates (Csuti 1). Though many traditional Western medical and surgical treatments are used to manage different forms of foot disease, mahouts in Thailand and other native range countries, have used traditional Eastern medicine consisting local plants for centuries (Csuti 81-4). There has been a lack of detailed published information on current elephant foot veterinary medicine treatments in Thailand or other countries in the region (Fowler 447). The aim of this study was to document methods of preventing and treating foot disease in captive Asian elephants currently being employed in northern Thailand to inform future research. A qualitative approach was taken using the standpoint of descriptive phenomenology and direct observation to examine current methods of prevention and treatment of foot disease in captive Asian elephants in Northern Thailand. Three veterinarians experienced in elephant health care were interviewed to determine current standards of elephant foot disease management in Northern Thailand. Direct observation of elephant care by veterinarians, mahouts, and keepers was carried out at two elephant facilities in Chiang Mai province, and focused on specific quantitative and qualitative variables implicated in elephant foot health including: diet nutritional composition, total housing area, and housing substrate. From the responses of veterinarians in this study, foot disease is not a major health concern, there appears to be a difference in the prevalence of foot disease in captive Asian elephants in northern Thailand and those previously reported in the United States and Europe (Csuti 9), there is not an emphasis on prevention of foot disease, and when foot diseases are seen by veterinarians, there is a strong presence of both traditional and herbal medicine in elephant health care.

Linjie Zou: Mathematical Sciences

Mentor: Mark Greenwood, David Yopp -- Mathematical Sciences

Statistical Methods for Measuring the Impact of Mastery Learning in College Algebra

An intervention involving a unique modification of mastery learning was implemented in Fall 2011 in College Algebra at Montana State University-Bozeman. It was expected that the mastery learning would increase student ability on a variety of topics taught in the course. Item Response Theory Models can be used to estimate ability scores from tests made up of items from final exams from Fall 2011 and Fall 2010 (the comparison semester). Graded Partial Credit Models (GPCM) are an extension of IRT used when partial credit is given when scoring items. The application of GPCM to the College Algebra final is discussed. The ability scores from the GPCM are then analyzed using a Mixed Model to account for differences between sections. Results suggest higher ability in the semester after implementation of mastery learning and minimal differences between sections.

COLLEGE OF NURSING

Annelise Baker: Nursing

Mentor: Edward Dratz, Jared Bowden -- Chemistry & Biochemistry

A Screening Method of Hydrophobic Binding Capacity for Human Serum Albumin

The objective of the research is to assess the binding capacity of human serum albumin (HSA) in people with metabolic syndrome and type 2 diabetes (T2D), compared to healthy controls. The initial method uses the ability of the fluorescent compound 1-anilinonaphthalene-8-sulfonic acid (ANS) to be taken up on binding sites on HSA, where its fluorescence increases greatly when it is bound. The initial finding is that the plasma from a person with metabolic syndrome or T2D, when normalized for concentrations of HSA and ANS, will fluoresce significantly less than when compared to that of a person considered healthy. This is hypothesized to be due to some other molecule being bound to the HSA where ANS would normally bind. Metabolic syndrome is a precursor of T2D; searching samples from individuals in this pre-diabetic state should allow discovery of accurate predictive markers for T2D. This screening process could give a good indication of possible T2D and therefore the necessity of changing lifestyle or diet to prevent development of T2D and will help identify the currently unknown compounds that are partially filling the binding sites in HSA in the subjects.

Larissa Donahue: Nursing

Mentor: Ann Bertagnolli, Kris Juliar, Renee Harris -- Montana INBRE, Montana Office of Rural Health/AHEC

An Evaluative Approach to Strengthening the Nursing Workforce

Work focused on assisting nurse leaders in Montana to implement the recommendations of the landmark IOM "Future of Nursing" report. Two of the seven IOM goals were the focus of this research: first that nurses be equipped to lead change and second, that barriers to full scope of practice for nursing professionals be removed. A literature survey of the years 2002 to 2012 was performed on CINAHL, PubMed, and MedLine databases with the search terms "nursing," "leadership," and "barrier." The goal was to assess current impediments to nurses performing and thriving in leadership roles both on and off unit floors. Additionally, a survey was distributed to the directors of nursing in Montana asking for greatest concerns pertaining to nurses transitioning into their facilities. Initial results from both surveys indicate that nurses need more training in skills such as time management, prioritizing, delegation, and organization before they can begin to advance leadership matters. Allowing full scope of practice for nurses requires reform in national and local law and change in the mindset about nursing. Both the literature review and the survey indicated that managerial and legal obstacles must be removed before clear vision for nursing change can be implemented and effected.

Whitney Ann Gilkerson: Nursing

Mentor: Sandra Kuntz -- Nursing

Partnership for Pediatric Environmental Health on the Flathead Reservation

Background: This project contributes to work underway by the Partnership for Pediatric Environmental Health (PPEH), a research team investigating potential exposure to environmental toxins and the disproportionately high infant mortality rates among Montana Native communities. Purpose: This project will bring previously identified environmental themes from focus groups, conducted by Milissa Grandchamp, a recent MSU graduate student, back to community members for further analysis and insight. Methods: A literature review was conducted to examine project methods and themes identified within the Grandchamp thesis. Then, using a community-based participatory research approach, interviews will be conducted through an expert elicitation interview process. Lastly, a qualitative approach will then be used to assess the results of these interviews. Results: The literature review revealed several ways of adapting the community-based participatory research process to better fit within Native American communities as well as describing various benefits of this approach. Exposure to environmental tobacco smoke, drugs/alcohol and methylmercury, as identified themes, were explored to reveal proposed interventions from several indigenous focus groups. Conclusion: Community-based participatory research is an effective method for addressing environmental health needs in Native American populations. The results from the literature review will continue to guide the project as it moves forward.

Rachel Huleatt: Nursing

Mentor: Wade Hill -- Nursing

Asthma and Air Quality in Northern Thailand

Background: The prevalence of asthma is rising worldwide. Common environmental triggers of asthma include dust, chemicals in the air, and tobacco smoke. Because environmental factors play a large part in triggering asthma symptoms the quality of air is important. Northern Thailand contains both agricultural and urban areas and Thailand is considered a developing country. The specific aims of this research were to describe the epidemiological characteristics of asthma in northern Thailand and to describe the state of air quality in northern Thailand. Methods: This project used a multi-method approach to address project aims beginning with an interview from the perspective of descriptive phenomenology to identify trends of asthma, air quality in northern Thailand, and available data sources, followed by library research and inquiry into available surveillance data. Findings: In northern Thailand three contribution factors effect air quality: source, meteorological, and geographical. Air quality in northern Thailand appears to be influenced by open burnings, traffic, and industry. Traffic and industry's contribution to poor air quality appear least significant, but air quality does seem to vary by season. Data in Thailand appears to be lacking regarding asthma treatment, surveillance, and the potential linkages between disease and air quality. Implications: Comprehensive surveillance data on the epidemiology of asthma in northern Thailand is currently lacking because data is not collected yearly. In order to draw better conclusions on the current prevalence of asthma in northern Thailand further information is required. Future work includes collecting yearly data on asthma and other health problems in Thailand as well as studying the impact environmental factors have on such illnesses.

Emma Murter: Nursing

Mentor: Eric Boyd -- Chemistry & Biochemistry

Microbial Diversity Associated with Bioherms Inhabiting the Hypersaline Environment of the Great Salt Lake

Great Salt Lake (GSL) is the fourth largest terminal lake in the world and harbors a diverse biological community, owing to the unique combination of minerals and chemicals resulting from evaporative processes. Bioherms, or layered formations of calcareous minerals typically formed by cyanobacteria, have been identified in the deeper part of the GSL and have been estimated to ~170 mi². Moreover, bioherm structures have been observed in both the North arm (NA) and South arms (SA) of GSL where chemical and salinity differences exist. Pyrotag-based sequencing of archaeal, bacterial, and eukaryal rRNA genes was used to compare the composition and structure of the microbial communities associated with bioherms from the NA and SA, as well as the community inhabiting the water column present at both environments. The results indicate that the bioherm-associated communities are distinct, with that of the NA exhibiting less diversity than that from the SA. This finding is consistent with elevated salinity associated with the NA, which would presumably select for a lower diversity. Moreover, neither the water column communities or the bioherms from

NA or SA harbored significant populations of cyanobacteria, suggesting that other taxa are likely responsible for the formation of bioherms in GSL ecosystem.

UNIVERSITY COLLEGE

Christopher Carter: Directed Interdisciplinary Studies

Mentor: Ann Bertagnoli -- University Honors Program

Understanding Emerging Stressors and Adaptations in Generational Ranching Operations through Participant Visual Ethnography

Drawing on two years of ethnographic fieldwork with sheep ranching families in Sweet Grass county Montana this research explores emerging stressors and adaptations influencing the decision making process of rural emigration. While this research focuses on a uniquely Montana way of life, urbanization, migration and subsequent loss of rural identity are phenomena that are beginning to be recognized and studied through qualitative methodologies. Through this research I have sought to collaboratively understand, why people choose to stay, why some leave, and the forces at play influencing this process. In doing so I utilize a combination of unique methodologies including Photovoice, Community Based Participatory Research and Participatory Visual Ethnography, as they emerged as the most appropriate means of understanding this community. During fieldwork issues of generational property and social capital transfer, new skilled migrant labor, land management and agricultural subsidy for small scale ranches surfaced as themes that speak directly to debates of food security, urbanization and agrarian identity in the American West. As rural emigration affects societies and economies beyond this Montana community, this USP funded research suggests an integration of participatory and qualitative research methods into the understanding, planning and policy making of sustainable futures in agriculture and society.

Katherine Chambers: University Studies

Mentor: Ann de Onis -- Education

The Irish Experience of War

My research project will consist of investigating the differences and similarities between the Irish and American experiences of war. Having been raised in a society that has been fighting a war in another country for almost my entire life, I want to explore the other side of invasion by investigating how the Irish fought against English imperialism. I also wish to research how this imperialism eventually led to the Irish Civil War, and compare it with the experiences of the American Civil War. I wish to see the places and artifacts of the battles, witness the effects the war had on the Irish people, and understand how it must feel to be oppressed, a feeling that cannot be communicated through the pages of a book. Therefore I will conduct preparatory research throughout the spring semester of 2012, and finish my project by actually traveling to Ireland in May upon conclusion of the spring semester. During weekly meetings with my mentor, Dr. Ann de Onis, we will discuss texts and I will complete assignments to complement my research. This ongoing focus will help prepare me for my trip to Ireland. As an Irish-American myself, there would be no greater educational experience than to visit the country where my ancestors fought for the basic freedoms I enjoy today. I hope that after completing my project, I will have gained a greater understanding of the deleterious effects war has on every individual involved; furthermore, I hope to be able to share this message with others and do my small part to be an ambassador for peace.

ALPHABETICAL LISTING OF STUDENTS

Student, Mentor, Project	Session	Poster #	Abst. Page #
Mark Abbey-Lambertz, Megan Layhee: Land Resources & Environmental Sciences Robert Peterson, Andrew Ray, Adam Sepulveda -- Land Resources & Environmental Sciences, Northern Rocky Mountain Science Center <i>Suppressing invasive bullfrogs with carbon dioxide</i>	am	80	29
Dylan Abraham, Jesse Shirley, Sarah Mondl: Computer Science, Computer Engineering Hunter Lloyd -- Computer Science <i>RoboSub</i>	pm	41	44
Hadeel Alniemi: Cell Biology & Neuroscience Martin Lawrence, Brian Eilers -- Chemistry & Biochemistry <i>Examining A109 Protein in Sulfolobus Turreted Icosahedral Virus from Yellowstone National Park</i>	am	70	62
Lydia Anderson: Ecology David Sands -- Plant Sciences & Plant Pathology <i>Sustainable biocontrol of Striga (witchweed) in Kenya using an enhanced biocontrol fungus</i>	am	56	62
Erik Anderson: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Winterization and Upgrade of Remote Weather Station</i>	am	22	44
Hannah Arm: Mechanical & Industrial Engineering Sarah Codd, Joe Seymour, Jennifer Brown -- Mechanical & Industrial Engineering, Chemical & Biological Engineering <i>Temperature Control System for Supercritical Flow of Brine and CO2</i>	am	46	45
Samuel Atkins, Dylan Strike: Cell Biology & Neuroscience, Sustainable Foods & Bioenergy Jaime Jelenchick Jacobsen -- University Honors Program <i>Bozeman Eats: A Documentary Film Surveying Food in the Gallatin Valley</i>	Sustainability Topical	10:00am SUB 235	63
Collin Avery: Film & Photography Alexis Pike -- Film & Photography <i>Remain Calm</i>	pm	Framed Art 3	33
Collin Avery: Film & Photography Alexis Pike -- Film & Photography <i>Down this River</i>	pm	Framed Art 3	33
Kayla Babbitt: Mechanical & Industrial Engineering Stephen Sofie -- Mechanical & Industrial Engineering <i>Design and Development of a Seebeck Coefficient Measurement System</i>	am	27	45
Annelise Baker: Nursing Edward Dratz, Jared Bowden -- Chemistry & Biochemistry <i>A Screening Method of Hydrophobic Binding Capacity for Human Serum Albumin</i>	pm	29	97
Patrick Bakken: Film & Photography Jon Long -- Film & Photography <i>Discovering Family Lineage</i>	pm	50	33
Kevin Bangen: Mechanical & Industrial Engineering Chris Jenkins -- Mechanical & Industrial Engineering <i>Membrane Tearing</i>	am	21	45
Daniel Barta: Earth Sciences David Varricchio -- Earth Sciences <i>A Cladistic Approach to Understanding Dinosaur Egg Diversity and the Evolution of Reproductive Traits Within Dinosauria: Preliminary Results</i>	am	100	63
Jonah Barta: Liberal Studies Leah Schmalzbauer, Nancy Mahoney -- Sociology & Anthropology <i>Socio-Cultural and Economic Implications of EWB-MSU Development Projects In Khwisero, Kenya</i>	pm	92	63

Student, Mentor, Project	Session	Poster #	Abst. Page #
Anna Bartkowiak: Health & Human Development Adina Smith -- Health & Human Development <i>Graduate Counseling Students' Growth</i>	am	1	23
Brandon Beck: Psychology Keith Hutchison -- Psychology <i>Subliminal Stroop</i>	am	85	64
Wesley Beougher: Chemistry & Biochemistry Cate Burgess -- Chemistry & Biochemistry <i>Determining the Structure and Function of AcxR Dependent Sigma54 Regulation of Acetone Carboxylase Expression</i>	am	79	64
Ethan Berg, Sean Stettner: Cell Biology & Neuroscience, Bioengineering Steve Hamner -- Microbiology <i>Microbial Source Tracking of Escherichia coli in the Little Big Horn River, Montana</i>	am	31	64
Bridget Bergin: Mechanical & Industrial Engineering Sarah Codd -- Mechanical & Industrial Engineering <i>NMR Technologies for Monitoring Biological and Geochemical Processes in the Subsurface</i>	am	25	45
Samuel Bernhard: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Analysis of GAL3 and Lactose functionalized PAMAM Binding by EPR</i>	am	119	65
Tor Bertin: Ecology David Willey -- Ecology <i>Modeling carnivore sign data: A case study with the carnivore guild in a ranch in eastern Montana</i>	am	99	65
Heather Blanchard: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>Molecular Partitioning Between Aqueous and Hydrophobic Environments</i>	pm	100	65
Christie Blaskovich: Chemistry & Biochemistry Laura Mentch, Ann Bertagnolli -- BridgerCare, Montana INBRE <i>Evaluation of Misconceptions about Unplanned Pregnancy and Contraception Among 20-29 year old Women</i>	am	111	65
Christie Blaskovich: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Evaluation of Humanitarian Organizations in France</i>	pm	109	66
Alissa Bleem: Chemical & Biological Engineering Ross Carlson, Hans Bernstein -- Chemical & Biological Engineering <i>The Design and Characterization of Artificial Biofilms: Microbial Catalyst Platforms Based on Photo-Autotrophic Syntrophy</i>	am	50	46
Amy Bloemendal: Health & Human Development John Seifert -- Health & Human Development <i>Blood glucose/lactate responses from ingesting high fructose corn syrup and sucrose beverages</i>	am	5	22
Thomas Bogen: Land Resources & Environmental Sciences Rich Macur -- Center for Biofilm Engineering <i>Towards standardized methods for the analysis of algal lipids: Total lipid content</i>	pm	12	29
Mark Boyd: Agricultural Economics & Economics William Dyer, Barbara Keith -- Plant Sciences & Plant Pathology, Land Resources & Environmental Sciences <i>GST Study in Wild Oats</i>	am	34	29
Justin Brewer: Cell Biology & Neuroscience Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience, Immunology & Infectious Diseases <i>Isolation and Cloning of zic Genes in Chick</i>	am	10	66
Tyler Bridges: Earth Sciences David Varricchio -- Earth Sciences <i>Microtaphonomy of Modern Deer Phalanges</i>	pm	57	66

Student, Mentor, Project	Session	Poster #	Abst. Page #
Dewey Brooke: Chemistry & Biochemistry Brian Bothner, Mavis Agbandje-McKenna -- Chemistry & Biochemistry, Biochemistry & Molecular Biology (University of Florida) <i>Analysis of phospholipase activity in adeno-associated virus particles by liquid-chromatography/mass-spectrometry</i>	am	112	67
Dan Buettner: Film & Photography Christina Anderson -- Film & Photography <i>Less Than 983: Small Towns of Montana</i>	am	61	34
Dan Buettner: Film & Photography Ian van Coller -- Film & Photography <i>Out of Sight, Out of Mind</i>	am	62	34
Dan Buettner: Film & Photography Christina Anderson -- Film & Photography <i>Junk Mail</i>	am	63	34
Douglas Burns: Cell Biology & Neuroscience Roger Bradley -- Cell Biology & Neuroscience <i>Relative Onset of NFPC in Xenopus Development</i>	pm	114	67
Elizabeth Byron, Alex Wittorff: Invited Guest, Byron HS Mari Eggers, Sue Broadway -- Microbiology <i>Inorganic Nutrient Variability in Prairie Potholes</i>	am	41	67
Samuel Carlson: Land Resources & Environmental Sciences Brian McGlynn -- Land Resources & Environmental Sciences <i>Quantifying Watershed Storage Dynamics using long duration high frequency measurements of Precipitation, Runoff, and Evapotranspiration</i>	am	104-105	30
Nathan Carroll: Earth Sciences Ilse Mari-Lee, David Varricchio -- University Honors Program, Earth Sciences <i>Pterosaurs as a Teaching Tool</i>	am	91	68
Christopher Carter: Directed Interdisciplinary Studies Ann Bertagnolli -- University Honors Program <i>Understanding Emerging Stressors and Adaptations in Generational Ranching Operations through Participant Visual Ethnography</i>	Exhibit	SUB 232	99
Katherine Chambers: University Studies Ann de Onis -- Education <i>The Irish Experience of War</i>	pm	31	99
Juniper Chapman: English Marvin Lansverk, Doug Young -- English, Agricultural Economics <i>From the Father of Economics to Freakonomics: A Literary Study of Economic Texts and their Socioeconomic Contexts</i>	am	60	68
Krishna Chattergoon: Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>High-speed focus control MEMS deformable mirror with controlled air damping</i>	pm	104	46
Yasmin Chaudhry: Civil Engineering Joel Cahoon -- Civil Engineering <i>Hydraulic Rating of Functional Fish Barriers</i>	pm	37	46
Kelly Christensen: Microbiology Wade Hill -- Nursing <i>A Cross-Cultural Comparison of Perinatal HIV Transmission In the United States and Thailand</i>	am	69	68
Erin Clark: Psychology Bethany Letiecq -- Health & Human Development <i>Perceptions of civil unions, the benefits of marriage, and the legalities of relationship recognition</i>	pm	9	69
Cameron Clevidence: Ecology Christopher Guy -- Ecology <i>Dietary Assessment of Yellowstone Cutthroat Trout in Yellowstone Lake, Yellowstone National Park</i>	am	98	69

Student, Mentor, Project	Session	Poster #	Abst. Page #
Shane Close: Psychology Ian Handley -- Psychology <i>Hydration on Psychological Processes</i>	McNair Topical	10:00am Ballroom C	69
Warren Colomb: Physics William Randall Babbitt -- Physics <i>Beam Conditioning via Output Coupler and Spatial Filter</i>	pm	105	70
David Connor, Kendra McGahan: Health & Human Development John Seifert -- Health & Human Development <i>The Influence of Pre-Exercise Solid and Liquid Caloric Ingestion on Blood Glucose and Lactate</i>	pm	111	22
Jesse Cook: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Lactose-functionalized PAMAM Dendrimer Effects on Cancer cell Aggregation</i>	am	54	70
Gwendolyn Courtney: Film & Photography Ian van Coller -- Film & Photography <i>Going Grey</i>	pm	91	34
Andrew Crawford: Mechanical & Industrial Engineering David Klumpar, Ehson Mosleh, David Racek -- Space Science and Engineering Laboratory <i>Multiple Spacecraft Adaptability for Small Satellite Ground Operations</i>	am	13	47
Charles Crellin: Cell Biology & Neuroscience Ann Bertagnolli, Buck Taylor -- Montana INBRE, Community Health Partners <i>Healthy Montana Kids</i>	pm	7	70
Natasha Cronsell: Health & Human Development Amy Cory -- Health & Human Development <i>Parent Perspectives on Opportunities for Healthy Physical Activity and Recreation for Young Children in Bozeman</i>	am	11	41
Michelle Dallas: Film & Photography Ian van Coller, Christina Anderson, Alexis Pike -- Film & Photography <i>Memories</i>	am	88	35
Jacob Danczyk: Mechanical & Industrial Engineering Hugo Schmidt -- Physics <i>Characterization of Anode Nickel Coarsening in Solid Oxide Fuel Cells through Impedance Spectroscopy</i>	pm	54	47
Nicholas Danielson: Art Dean Adams -- Art <i>Wild Clay Research</i>	pm	62	35
Larissa Donahue: Nursing Ann Bertagnolli, Kris Juliar, Renee Harris -- Montana INBRE, Montana Office of Rural Health/AHEC <i>An Evaluative Approach to Strengthening the Nursing Workforce</i>	pm	53	97
Casey Donovan: Mathematical Sciences Lukas Geyer -- Mathematical Sciences <i>Multifractal Analysis of Heart Beat Interval Time Series</i>	pm	27	70
Jordan Dood: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Infrared Study of Exciton Migration in Single and Double Stranded DNA</i>	pm	87	71
Krista Drummond: Electrical & Computer Engineering Wataru Nakagawa -- Electrical & Computer Engineering <i>Development and Optimization of Surface Plasmon-Polariton Based Sensing System</i>	pm	4	47
Troy Duker: History & Philosophy Lynda Sexson -- History, Philosophy & Religious Studies <i>The Mosaic Archetype</i>	McNair Topical	9:20am Ballroom C	71
Megan Dunbar: Film & Photography Alexis Pike -- Film & Photography <i>Your Place and Mine</i>	am	116	35
William Dupree: Physics Lisa Davis -- Mathematical Sciences <i>When a Traffic Light Turns Green, a Study of Traffic Flow Using Partial Differential Equations</i>	pm	26	71

Student, Mentor, Project	Session	Poster #	Abst. Page #
Amanda Durch: Chemical & Biological Engineering Garth James -- Center for Biofilm Engineering <i>Three-Species Chronic Wound Model: Targeting Specific Species with Antibiotics</i>	am	55	48
Alisa Dvarishkis: Cell Biology & Neuroscience Steven Stowers -- Cell Biology & Neuroscience <i>Somatosensory Neural Circuit Mapping</i>	pm	5	71
Yanet Eudave: Health & Human Development Bethany Letiecq -- Health & Human Development <i>Coping and Mental Health among Documented and Undocumented Mexican Migrants in a New Frontier Settlement</i>	McNair Topical	9:40am Ballroom C	42
Jude Eziashi: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Chromium Volatility: Assessment of Quantifying Techniques</i>	am	48	48
Amber Ferris: Psychology Jessi Smith, Keith Hutchison -- Psychology <i>Stop Interfering! Understanding how Stereotype Threat reduces Working Memory Capacity by using the Dual Processes Model.</i>	am	65	24
Christopher Fisher: Agricultural Economics & Economics Dominic Parker -- Agricultural Economics & Economics <i>Resource Endowments and Economic Development in Central Africa</i>	pm	20	72
Cassidy Fisher: Mechanical & Industrial Engineering Douglas Cairns -- Mechanical & Industrial Engineering <i>The Effects of Defects in Wind Turbine Blade Manufacturing</i>	pm	19	48
Trudi Fisher: English Doug Downs -- English <i>Hooks are for fishing: Preparing students for writing across their curriculum</i>	am	51	71
Patrick Flaherty: Mechanical & Industrial Engineering Joe Eldring -- Mechanical & Industrial Engineering <i>Snowboard Manufacturing Press</i>	pm	96	49
Elizabeth Flesch: Ecology Robert Garrott -- Ecology <i>Population trends of bighorn sheep and mountain goats in the Greater Yellowstone Area</i>	am	97	72
Angie Ford: English Doug Downs -- English <i>College Retention Initiatives at a High School Level: When Undergraduate Students Lead Summer Writing Camps</i>	Humanities Topical	11:10am SUB 233	73
Blaine Fritz: Cell Biology & Neuroscience Darla Goeres -- Center for Biofilm Engineering <i>Evaluation of 3M Petrifilm as an equivalent alternative to drop-plating on agar plates in a biofilm system</i>	am	44	73
Sophia Froelich: Cell Biology & Neuroscience Brian Bothner, Joshua Heinemann -- Chemistry & Biochemistry <i>Oxidative Stress and the Metabolism of <i>Sulfolobus solfataricus</i></i>	am	42	73
Madison Gabig: Architecture Gregory Young -- Music <i>Musi-Tecture: Using Correlations between Music and Architecture to Explore New Creative Processes and Inspiration</i>	pm	49	35
Edward Gall: Liberal Studies Leah Schmalzbauer -- Sociology & Anthropology <i>Studying Abroad In South America: Ethnographic Images and Short Films</i>	am	14	73
Joe Geil: Art Dean Adams -- Art <i>Wild clay research</i>	pm	61	36
Ares Geovanos: Chemical & Biological Engineering Edward Dratz -- Chemistry & Biochemistry <i>Electrokinetic protein extraction from polyacrylamide gels with in-line microfluidic digestion and integrated mass-spectral analysis</i>	am	78	49

Student, Mentor, Project	Session	Poster #	Abst. Page #
Whitney Ann Gilkerson: Nursing Sandra Kuntz -- Nursing <i>Partnership for Pediatric Environmental Health on the Flathead Reservation</i>	pm	28	98
Patricia Glatz: Mechanical & Industrial Engineering Ed Adams -- Civil Engineering <i>Modeling Snow Temperature in Complex Topography</i>	am	39	49
Mark Gockenbach: Physics Bennett Link -- Physics <i>The Equation of State of Neutron Stars</i>	am	103	74
Candace Goodman: Chemistry & Biochemistry Mary Cloninger, Greg Gillispie -- Chemistry & Biochemistry, Fluorescence Innovations Inc. <i>Aggregation Characterization of Lectin Interactions with Sugar-Functionalized Dendrimers</i>	pm	97	24
Brett Green: Physics John Neumeier -- Physics <i>Superconductivity in Alkali-doped Dibenzopentacene</i>	am	30	74
Brett Green: Physics Hugo Schmidt -- Physics <i>Characterization of Strontium-doped Lanthanum Manganite Solid Oxide Fuel Cell Cathodes</i>	am	29	74
Eileen Guthrie: Earth Sciences Colin Shaw -- Earth Sciences <i>Syntectonic microstructures record local strain on the Montana Transverse Zone</i>	pm	67	75
Erin Hafila: Civil Engineering Otto Stein -- Civil Engineering <i>Nitrogen Removal via Ammonium Adsorption to Gravel Sized Particles in Constructed Wetlands</i>	pm	95	50
David Halat: Chemistry & Biochemistry Rob Walker -- Chemistry & Biochemistry <i>Studies of Solid Oxide Fuel Cells (SOFCs) and SOFC Materials with High-Temperature Raman Spectroscopy</i>	am	9	75
Matthew Handley: Electrical & Computer Engineering Dave Klumpar, Ehsan Mosleh -- Space Science & Engineering Laboratory <i>Using Solar Panel Data to Model In-Orbit Spacecraft Dynamics</i>	am	7	50
Eric Hansen: Civil Engineering Mike Berry -- Civil Engineering <i>Mechanical Properties of Portland Cement Concrete with Reclaimed Asphalt Pavement Aggregate</i>	am	77	24
Charles Hart: Ecology Michael Ivie -- Plant Sciences & Plant Pathology <i>A Faunal Treatment of the Cerambycidae of Montana</i>	am	32	75
Lena Heuscher: Physics Joseph Shaw -- Electrical Engineering <i>Gallatin Valley Winds</i>	am	102	76
Parker Hilton: Film & Photography Ian van Coller -- Film & Photography <i>The Jersey Shore</i>	am	90	36
Samantha Hinckley: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Effective Art Enhancement of MMAMA.net</i>	pm	110	76
Eric Hjelvik: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Determination of Thin Film Thickness</i>	am	49	50
Jessica Huggans: Psychology Ian Handley -- Psychology <i>Bottoms Up! Affects of Intoxication on the Unconscious Thought Process</i>	pm	112	76
Rachel Huleatt: Nursing Wade Hill -- Nursing <i>Asthma and Air Quality in Northern Thailand</i>	pm	15	98

Student, Mentor, Project	Session	Poster #	Abst. Page #
Meghan Huntoon: Psychology Jessi Smith -- Psychology <i>I'm Incredible!: Consequences of Violating the Modesty Norm</i>	am	6	25
Carla Hutson: English Christa Merzdorf -- Cell Biology & Neuroscience <i>Are the "wings" of zic1 expression a part of the pre-migratory neural crest?</i>	am	16	76
Steven Hystad: Plant Sciences & Plant Pathology Dave Sands -- Plant Sciences & Plant Pathology <i>Metabolic Suppression of Water Hyacinth (Eichornia crassipes) Utilizing Amino Acid over-producing mutants of Fusarium oxysporum as a Biocontrol Agent</i>	pm	72	30
Jeff Ibey: Computer Science Clemente Izurieta -- Computer Engineering <i>Micro-Compressor</i>	pm	48	51
William Isbell: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Calibration of Weather Station Instruments and Heat Island Effects</i>	pm	88	51
Forrest Jarvi, Aaron Whittenburg: Sociology & Anthropology Michael Neeley -- Sociology & Anthropology <i>A Comparison of Broken and Complete Bladelets from TBAS 102, a Natufian Site in West-Central Jordan</i>	am	40	77
Kala Jauquet: Health & Human Development Mary Miles -- Health & Human Development <i>Cultural and Economic Factors Affecting Diet and Nutrition in Children in Khwisero, Kenya</i>	am	68	42
Ian Jefferies: Psychology Ian Handley -- Psychology <i>The Placebo Effect: The Result of Biased Information Acquisition?</i>	am	8	77
Milenka Jirasko: Architecture Maire O'Neill -- Architecture <i>Surfaces of Auschwitz</i>	Exhibit	Cheever Hall Lower Gallery	36
Chait Johar: Mechanical & Industrial Engineering Barton Scott -- History, Philosophy & Religious Studies <i>Study of Indonesia as a Paragon of Tolerance in Religion using ISKCON as a Test Case</i>	Humanities Topical	10:10am SUB 233	51
Sarah Johnson: Civil Engineering Otto Stein -- Civil Engineering <i>Soil Redox Potential in Constructed Wetlands for Wastewater Treatment</i>	Sustainability Topical	10:00am SUB 235	51
Ethan Keeler: Electrical & Computer Engineering Wataru Nakagawa, David Dickensheets -- Electrical & Computer Engineering <i>Near-Infrared Polarization Optics using Nanostructured Silicon</i>	Optical Science Topical	5:20pm Ballroom C	52
Amanda Kelley: Chemistry & Biochemistry Martin Teintze -- Chemistry & Biochemistry <i>Guanides as X4 HIV Inhibitors, Antibiotics and Inhibitors of Cancer Metastasis</i>	am	43	77
Jordan Kennedy: Mechanical & Industrial Engineering Jennifer Brown -- Chemical & Biological Engineering <i>Rheological Characterization of Alginate Gel</i>	am	73	52
Gal Keren-Aviram: Chemistry & Biochemistry Edward Dratz -- Chemistry & Biochemistry <i>Human Brain Proteomics in the Systems Biology of Epilepsy Project (SBEP)</i>	pm	73	25
Kyler Kingston: Chemistry & Biochemistry Christa Merzdorf, Elena Kalinina-Turner -- Cell Biology & Neuroscience <i>Role of Zic Family of Transcription Factors in Early Neural Development</i>	pm	6	78
William Kirk: Physics Hugo Schmidt -- Physics <i>Characterization of Cathode Polarization</i>	pm	34	78
Amber Kleven: English Lisa Eckert, Robert Petrone -- English <i>Yearbooks as a Force in Representing and Developing Adolescence</i>	Humanities Topical	11:30am SUB 233	25

Student, Mentor, Project	Session	Poster #	Abst. Page #
Craig Kozeluh, Taisha McWilliams: Cell Biology & Neuroscience Steven Stowers -- Cell Biology & Neuroscience <i>Optogenetic Circuit Mapping In Drosophila Larvae</i>	pm	113	78
Gregory Krantz: Molecular Biosciences Matthew Fields -- Center for Biofilm Engineering <i>Field Scanning Electron Microscopy and Growth Modelling of a Desulfovibrio alaskansis G20 Biofilm</i>	pm	44	28
Christopher Kratz: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Zinc-Air Technology: A Proposal for Clean and Sustainable Energy Research</i>	pm	36	52
Elizabeth Kruk: Earth Sciences Frankie Jackson, Colin Shaw, David Varricchio -- Earth Sciences <i>Applications of Electron Backscatter Diffraction on Fossilized Dinosaur and Modern Eggshell</i>	am	93	79
Katharine Kujawa: Psychology Julie Wieseler - Psychology (University of Colorado, Boulder) <i>Dorsal root ganglion activation in below-level pain - 602</i>	pm	66	79
Erika Lacy: Cell Biology & Neuroscience Mensur Dlakic -- Microbiology <i>Fluorescent Probes for Detecting Protein Interactions in Bacteria</i>	am	2	79
Abigail Lair: Business Agnieszka Kwapisz -- Business <i>Factors Influencing Adult Full Day Ski Ticket Prices in the U.S.</i>	pm	22	40
Eric Lake: Mathematical Sciences Kris Ellingsen -- University Honors <i>Rebirth</i>	Humanities Topical	10:50am SUB 233	79
Kara Landolfi, Leanna Hansen: Health & Human Development, Cell Biology and Neuroscience Alison Harmon -- Health & Human Development <i>Evaluation of the Impact of Food Insecurity Education</i>	pm	30	42
Benjamin Larson: Architecture Bill Clinton -- Architecture <i>Stav-Kirke [Norwegian Stave Churches]</i>	Exhibit	Cheever Hall Lower Gallery	37
Heather Lee: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Publication and Distributions of the English-language translation of Bocar N'Diayes's Contribution à la connaissance des us et coutumes du Mali (On the Habits and Customs of Mali)</i>	pm	106	80
Cheyenne Lesky: Chemistry & Biochemistry Ann Bertagnolli, Darcy Hunter -- Montana INBRE, Montana WIC <i>Improving Client Turnout at WIC through Text Communication</i>	am	28	80
Reid Loessberg: Music Rob Maher, Kristi McGarity -- Electrical & Computer Engineering, Music Technology <i>Acoustic Analysis of Campus Classrooms: How Do Acoustics Effect a Learning Space?</i>	am	47	37
Gavin Lommatsch: Electrical & Computer Engineering Joe Shaw -- Electrical & Computer Engineering <i>Airborne Thermal Imaging for Wildlife Surveys</i>	pm	69	53
Natasza Lorentz: Cell Biology & Neuroscience Wade Hill -- Nursing <i>Access to Healthcare in Chiang Mai, Thailand</i>	pm	14	80
Tiphani Lynn: Cell Biology & Neuroscience Charles Gray -- Cell Biology & Neuroscience <i>Characterization of Gamma Frequency Synchronized Oscillations in Macaque Visual Cortex</i>	pm	116	81
Hamilton Lynn, Liz Hummelt: Sustainable Food & Bioenergy, Land Rehabilitation Catherine Zabinski -- Land Resources & Environmental Sciences <i>Determining Nutrient Availability in Gallatin Valley Organic Systems Through Comprehensive Soil Testing</i>	pm	101-102	43

Student, Mentor, Project	Session	Poster #	Abst. Page #
Aidan Lynn-Klimenko: Film & Photography Ian van Coller -- Film & Photography <i>Mas o Menos</i>	pm	Framed Art 2	40
John MacDonald: Chemistry & Biochemistry Phillip Sullivan -- Chemistry & Biochemistry <i>Characterizing Photoswitches to Mimic Nerve Cell Repolarization</i>	pm	55	81
Paige Madison: Sociology & Anthropology Michael Reidy -- History & Philosophy <i>How Neandertal Conceptions were Built by Nineteenth-century European Scientists</i>	pm	51	81
James Mauch: Earth Sciences Jim Schmitt -- Earth Sciences <i>Characterizing and interpreting the morphology of fan-shaped depositional landforms along the Madison Range front, SW Montana</i>	am	109	81
Wyatt Maw, Alex Miller: Film & Photography Paul Monaco -- Film & Photography <i>Silence</i>	pm	127	37
Michael McCambridge: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Silicon Carbide Oxidation and Environmental Barrier Coating Investigation</i>	pm	47	53
Michael McLoughlin: Microbiology Ed Schmidt -- Immunology and Infectious Diseases <i>The Development of Hepatocellular Carcinoma in Thioredoxin Reductase 1 Deficient Liver Cells</i>	pm	74	82
Kiera McNelis: Chemical & Biological Engineering Otto Stein -- Chemical & Biological Engineering <i>Investigating Impacts of Human Urine as a Fertilizer in Khwisero, Kenya</i>	pm	39	53
Taisha McWilliams, Craig Kozeluh: Cell Biology & Neuroscience Steve Stowers -- Cell Biology & Neuroscience <i>Optogenetic Circuit Mapping In Drosophila Larvae</i>	am	113	82
Kyle Mehrens: Earth Sciences Adam Sigler -- Land Resources & Environmental Sciences <i>Nitrate-N concentrations and their impact on water quality throughout Gallatin Valley</i>	am	76	82
Jill Melcher: English Lynda Sexson -- History, Philosophy, & Religious Studies <i>Teaching World Religion in the West Through Western Religious Imagery</i>	am	89	83
Ivy Merriot: American Studies Sara Mast, Terry Beaubois, Jeanne Moe -- Arts & Architecture, Sociology & Anthropology <i>The Big Horn Medicine Wheel: Native Science Research in Astronomical Place-Based Pedagogies</i>	pm	60	25
Hunter Metcalf: Business Agnieszka Kwapisz -- Business <i>Factors Influencing Student Retention in Higher Education</i>	am	83	41
Eric Metz: Earth Sciences Frankie Jackson, Patrick Druckenmiller -- Earth Sciences <i>A New Polycotylid Specimen from the Bearpaw Shale of Montana</i>	pm	71	83
Gary Michelfelder: Earth Sciences Todd Feeley -- Earth Sciences <i>Observations On The Origin Of Across-Strike Geochemical Variations In Quaternary Silicic Lava Flows From The Andean Central Volcanic Zone: Comparison Of Data From Individual Eruptive Centers</i>	am	108	26
Alexandr Mikhailov: Physics Aleksandr Rebane, Mikhail Drobijev -- Physics <i>Validity of Two-Level Approximation for Two-Photon Absorption in the Lowest Electronic Transition of Dipolar Molecules</i>	Optical Science Topical	4:40pm Ballroom C	26
Nicholas Miles: Liberal Studies, Environmental Studies Florence Dunkel -- Plant Sciences & Plant Pathology <i>Addressing grasshopper (<i>Melanopus differentialis</i>) herbivory, and the feasibility of developing biological/locally acquired applications' for deterrent</i>	am	115	83

Student, Mentor, Project	Session	Poster #	Abst. Page #
Alexander Miller, Wyatt Maw: Film & Photography Dennis Aig, Paul Monaco -- Film & Photography <i>Silence; Senior Film</i>	pm	127	37
Sarah Mondl, Jesse Shirley, Dylan Abraham: Electrical & Computer Engineering, Computer Science Hunter Lloyd -- Computer Science <i>Computer Vision in Underwater Navigation Systems</i>	pm	41	54
Maxwell Moran: Land Resources & Environmental Sciences Rich Macur, Mark Kozubal -- Center for Biofilm Engineering, Land Resources & Environmental Sciences <i>Biofuel Production Using an Acidophilic Fungus</i>	pm	68	30
Jake Morison: Physics Galina Malovichko -- Physics <i>Modification of LiNbO3 Properties with Tetravalent Dopants</i>	pm	94	83
Dayla Morris: Chemical & Biological Engineering Robin Gerlach, Ellen Lauchnor, Adrienne Phillips -- Center for Biofilm Engineering, Environmental Engineering <i>Optimization and Kinetics of Ureolysis by Sporosarcina pasteurii</i>	Sustainability Topical	10:00am SUB 235	54
Tessa Mosdal, Bronwyn Rolph, Christie Blaskovich, Samantha Hinckley: Civil Engineering, Modern Languages & Literatures, Art Ada Giusti -- Modern Languages & Literatures <i>Computer Education in Sanambele, Mali</i>	pm	108	54
Connor Murnion: Cell Biology & Neuroscience Frances Lefcort, Amy Eibs -- Cell Biology & Neuroscience <i>Identification of genes regulated by IKBKAP: Investigating why neurons die in the disease Familial Dysautonomia</i>	am	71	84
Brook Murphy: Cell Biology & Neuroscience Roger Bradley, Dana Rashid -- Cell Biology & Neuroscience <i>Restoring Expression of SNAI2 Protein after Apoptosis of Xenopus laevis Embryos</i>	pm	43	84
Kevin Murray: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Electronic Structure Determination of [Fe]-hydrogenase model complexes</i>	pm	64	84
Emma Murter: Nursing Eric Boyd -- Chemistry & Biochemistry <i>Microbial Diversity Associated with Bioherms Inhabiting the Hypersaline Environment of the Great Salt Lake</i>	pm	2	98
Gourav Krishna Nandi: Mathematical Sciences Russell Walker: Mathematical Sciences <i>Cantor's Theory of Fractional Dimension and Large Infinities</i>	pm	56	85
Ashley Nettles: Film & Photography Ian van Coller -- Film & Photography <i>Bringing Back My Father</i>	pm	Framed Art 1	38
Hannah Newhouse: Chemical & Biological Engineering Brent Peyton -- Chemical & Biological Engineering <i>Optimization of Lipid Accumulation in Green Algae Using a Photobioreactor and Connections between Algal DNA</i>	am	26	55
Sarah Novotney: Health & Human Development Wade Hill -- Nursing <i>A Cross-Cultural Comparison of Standards of Care for Anterior Cruciate Ligament (ACL) Injury</i>	am	57	43
Kyle Oliver: Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>Stress engineering for free-standing SU-8 2002 thin film devices</i>	pm	3	55
Jankiben Patel: Plant Sciences & Plant Pathology Chaofu Lu -- Plant Sciences & Plant Pathology <i>Generation of a T-DNA Mutagenized Camelina Population</i>	am	18	31

Student, Mentor, Project	Session	Poster #	Abst. Page #
Alyssa Peck: Mathematical Sciences Mark Greenwood -- Mathematical Sciences <i>Methods for exploring life course trajectories of MSGC significant award winners</i>	pm	18	85
Courtney Peck: Physics Kevin Repasky -- Physics <i>Design, Construction, and Implementation of a Solar Spectrograph for the National Student Solar Spectrograph Competition</i>	pm	17	85
Jaclyn Peick: Cell Biology & Neuroscience Ann Bertagnolli, Lori Christenson -- Montana INBRE, Gallatin County Food Bank <i>Celiac Disease: Wheat's Role in our Lifestyles and The Cost of Going Gluten Free</i>	am	72	86
Melis Penic: Chemical & Biological Engineering Michael Franklin -- Microbiology <i>Visualization and Characterization of the Pseudomonas aeruginosa Biofilm Matrix with Fluorescent Staining</i>	am	17	55
Natasha Pettinger -- Cell Biology & Neuroscience Bern Kohler -- Chemistry & Biochemistry <i>Charge Transfer Dynamics in Photosensitizer-Hydrogenase Systems</i>	am	35	86
Nathan Phillips: English Gretchen Minton -- English <i>Not True to Troilus, Nor False to Cressid: An Introduction to Shakespearean Textual Editing in Troilus and Cressida</i>	Humanities Topical	10:30am SUB 233	86
Stefan Piontek: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>Chemical Film Formation at Liquid-Solid and Liquid-Vapor Interfaces: Correlating Film Organization with Molecular Structure</i>	pm	99	87
Rajit Podder -- Electrical & Computer Engineering David Dickensheets -- Electrical & Computer Engineering <i>Zoom lenses based on variable power optics</i>	pm	40	55
Nicquel Porch: Cell Biology & Neuroscience Wade Hill -- Nursing <i>Contrasting Alternative Medicine Availability in Western & Eastern Environments</i>	pm	32	87
Collin Preftakes -- Land Resources & Environmental Sciences Robert Peterson -- Land Resources and Environmental Sciences <i>Bystander exposure to ultra-low-volume insecticide applications used for adult mosquito management</i>	pm	11	31
Virginia Price - Physics Nathan Pust -- Electrical & Computer Engineering <i>IRIS Spectrograph Competition</i>	am	36	87
Jeremiah Prummer: Business Graham Austin -- Business <i>B2C Communication & Permission Marketing</i>	am	84	41
Paul Quigley: Film & Photography Gianna Savoie -- Film & Photography <i>No Limitations</i>	am	59	38
Jamie Raznoff: Plant Sciences & Plant Pathology William Hoch, Norm Weeden -- Plant Sciences & Plant Pathology <i>Development of a Simple Sequence Repeat (SSR) Genetic Map in Ornamental Viburnum</i>	pm	58	31
Brian Redman: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Testing a Low-cost All-Sky Infrared Cloud Imager</i>	Optical Science Topical	5:40pm Ballroom C	56
Colin Reutter: Physics Hugo Schmidt, Stephen Sofie -- Physics, Mechanical & Industrial Engineering <i>Analysis and mitigation of oxygen electrode delamination in solid electrolyzer cells</i>	Sustainability Topical	10:00am SUB 235	88
David Rey: Earth Sciences David Mogk, Colin Shaw -- Earth Sciences <i>Quantitative analysis of reactive transport processes in potential carbon sequestration reservoir rocks</i>	am	38	88

Student, Mentor, Project	Session	Poster #	Abst. Page #
Russell Ricker: Mathematical Sciences Albert Parker, Tomas Gedeon -- Mathematical Sciences <i>Creating Soft Clusterings of Data Via the Information Bottleneck Method</i>	pm	93	88
Erin Rinehart: Health & Human Development Ann Bertagnolli, Lynn Hellenga -- Montana INBRE, Montana Nutrition and Physical Activity Program <i>Montana Public Worksite Breastfeeding Support</i>	pm	52	43
Sarah Riordan: Architecture Ralph Johnson -- Architecture <i>Energy Saving Possibilities in local Medical Clinics throughout the Gallatin Valley</i>	pm	13	38
Andrew Rivers: Psychology Ian Handley -- Psychology <i>An Inkblot for Unconscious Thought: Examination of Nonconscious Implicit Attitude Change</i>	am	64	27
Melissa Robertson: Microbiology Marcella McClure -- Microbiology <i>Are Significant Differences in Retroid Content Discernable Between Individuals?</i>	pm	1	26
Robert Rodgers: Art Dean Adams -- Art <i>The Business of Art</i>	am	118	38
Shelby Rogala: History & Philosophy Kristen Intemann -- History & Philosophy <i>The ethics of aid: Is voluntouring ever ethical?</i>	am	53	89
Felicia Rogers -- Film & Photography Paul Monaco -- Film & Photography <i>Paranormal Detectives</i>	pm	8	39
Bronwyn Rolph: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>English Teaching Program in Mali</i>	pm	107	89
Adam Rothman: Chemical & Biological Engineering James Connolly, Robin Gerlach -- Center for Biofilm Engineering <i>Modeling Kinetics of Ureolytic Bacteria in Flow Systems</i>	pm	103	56
Gregory Ruegsegger: Health & Human Development Mary Miles -- Health & Human Development <i>Effects of eccentric muscle contraction and a high- or low-glycemic diet on inflammation</i>	am	66	44
Rachel Ruggles: Cell Biology & Neuroscience Roger Bradley -- Cell Biology & Neuroscience <i>Rescuing NFPC defects in Xenopus Embryos</i>	am	12	89
Jesse Ruzicka: Chemistry & Biochemistry Brian Bothner, Vamseedhar Rayaprolu -- Chemistry & Biochemistry <i>Measuring Virus Rigidity by QCM-D</i>	pm	42	89
Skylar Rydberg: Electrical & Computer Engineering Wataru Nakagawa, David Dickensheets -- Electrical & Computer Engineering <i>Fabrication of Optical Nanostructures Using HSQ Masks</i>	Optical Science Topical	5:00pm Ballroom C	56
Ryan Scanlon: Earth Sciences Mark Skidmore -- Earth Sciences <i>Stable Isotopic Investigatino of Basal Ice, Taylor Glacier Antarctica</i>	am	37	90
George Schaible: Plant Sciences & Plant Pathology Gary Strobel -- Plant Sciences & Plant Pathology <i>Characterization of Novel Endophytic Isolate Or10-4 and Analysis of Increased Bio-Activity by Addition of Esters</i>	am	33	90
Matthew Schmidt: Land Resources & Environmental Sciences Rich Macur -- Land Resources & Environmental Sciences <i>Alkaliphilic Microalgae for Biofuel Production: Scaling-up to 50 Liter Bag Bioreactors</i>	pm	21	32
Virginia Schmidt: Sociology & Anthropology Tamela Eitle -- Sociology & Anthropology <i>Language & Inequality in Post-Colonial African Nations</i>	am	15	90

Student, Mentor, Project	Session	Poster #	Abst. Page #
Amber Schmit: Chemical & Biological Engineering Christine Foreman, Heidi Smith, Betsey Pitts -- Land Resources & Environmental Sciences, Center for Biofilm Engineering <i>Microbial isolates from Antarctica</i>	Sustainability Topical	10:00am SUB 235	57
Benjamin Schwarz: Chemistry & Biochemistry Trevor Douglas -- Chemistry and Biochemistry <i>Enzyme encapsulation in the P22 viral capsid as a platform for biological nanoreactors</i>	pm	24	27
Jyoti Sharma: Mechanical & Industrial Engineering Laura Stanley -- Mechanical & Industrial Engineering <i>Modeling the validity and transfer of eye-scanning patterns for hazard perception from virtual reality training environments to reality</i>	am	95	57
Matthew Sherick: Chemical & Biological Engineering Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Analysis of Homogeneous and Inhomogeneous Gelation of Alginate Derived from Pseudomonas aeruginosa</i>	am	23	57
Jesse Shirley, Dylan Abraham, Sarah Mondl: Computer Science, Computer Engineering Hunter Lloyd -- Computer Science <i>AUV - Automated Unmanned Vehicle for the RoboSub 2012 competition</i>	pm	41	58
Joshua Sinrud: Physics Hugo Schmidt -- Physics <i>Solid Oxide Fuel Cell Test Rig</i>	pm	35	91
Benjamin Smith: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Cryogenic Studies of DNA Excimers and Phosphorescence Decays</i>	pm	65	91
Erin Smith: Chemistry & Biochemistry Michael Franklin -- Center for Biofilm Engineering <i>Alginate Epimerization by AlgG</i>	am	4	91
Sam Sorensen: Computer Science Clem Izurieta, Brock LaMeres, Wataru Nakigawa -- Computer Science, Electrical & Computer Engineering <i>Smart Power Strip</i>	pm	90	58
Kelly Spendlove: Mathematical Sciences Tomas Gedeon -- Mathematical Sciences <i>Predicting Critical Transitions in Complex Dynamical Systems</i>	am	3	91
Terri Spray -- Film & Photography Alexis Pike -- Film & Photography <i>Elderly of Gallatin Valley</i>	am	Framed Art 1	39
Terri Spray: Film & Photography Christina Anderson -- Film & Photography <i>Still a Family</i>	am	Framed Art 1	39
Hillary Stacey -- Chemistry & Biochemistry Charles (Bill) McLaughlin -- Chemistry & Biochemistry <i>Group Online E-chats as Learning Aides for Analytical Chemistry</i>	am	82	92
Nathan Stansfield -- Earth Sciences Colin Shaw -- Earth Sciences <i>Microstructural Analysis of Quartz Samples from Bald Butte Porphyry</i>	am	92	92
Kristi Stefani: Psychology Ian Handley -- Psychology <i>Just Don't Think! The Role of Unconscious Thought in Attitude Change</i>	am	67	92
Justin Stewart: Film & Photography Ian van Coller -- Film & Photography <i>Khwisero</i>	pm	16	39
Joshua Stringam: Chemical & Biological Engineering Robin Gerlach, Ellen Lauchnor, Adrienne Phillips -- Center for Biofilm Engineering, Environmental Engineering <i>Continued development of an injection strategy for homogenous calcium carbonate distribution by Sporosarcina pasteurii</i>	am	74	58

Student, Mentor, Project	Session	Poster #	Abst. Page #
Eric Strubeck: Health & Human Development John Seifert -- Health & Human Development <i>Hydration Perceptions, Hydration Practices and Reaction Times of Fighter and Helicopter Pilots</i>	am	86	23
Hannah Susorney: Earth Sciences Frankie Jackson, Colin Shaw -- Earth Sciences <i>Electron Backscatter Diffraction (EBSD) analysis of fossil turtle eggshell</i>	pm	59	93
Dustin Talbert: Architecture Ralph Johnson -- Architecture <i>Reevaluating the Efficiency and Function of Regional Storage Units, a New Approach to Storage</i>	Sustainability Topical	10:00am SUB 235	40
Jennifer Thornburg: English, Liberal Studies Jerome Coffey -- English <i>The Dream of the Road</i>	am	52	93
Jordan Thornton: Art Sara Mast, Rollin Beamish -- Art <i>My Skeletons Prefer the Kitchen</i>	am	117	40
Jean-Paul Toussaint: Chemical & Biological Engineering Ross Carlson, Florence Mus -- Chemical & Biological Engineering <i>Metabolic analysis of lipid accumulation in a microalga</i>	am	24	58
Hazal Ural: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Copying Nature: Chemical Synthesis of a Possible Catalytic Compound for H2 Generation</i>	am	19	93
Hannah Wahlert, Katelyn Weber, Mackenzie Weber: Political Science, Mathematical Sciences, History Christina Hayes -- Mathematical Sciences <i>LGBT Resource Center Necessary</i>	pm	10	93
Logan Warberg, Seth Berardinelli, Alison Figueira -- Computer Science Hunter Lloyd -- Computer Science <i>Lunabotics Computer System Analysis</i>	pm	129	59
Katherine Warthen: Chemical & Biological Engineering Ellen Lauchnor, Robin Gerlach -- Center for Biofilm Engineering <i>The Effectiveness of Various Herbal Kidney Medications</i>	am	75	59
Tom Weas: Physics Aleks Rebane -- Physics <i>Broad-band telescope for focussing femtosecond pulses in two photon absorption spectroscopy experiments</i>	Optical Science Topical	4:00pm Ballroom C	94
Thomas Weas: Physics Ron Hellings -- Physics <i>Using 'Filterpolation' with LISA/OMEGA Satellites to detect Gravitational Waves</i>	pm	89	94
Elizabeth (Betsy) Webb: Education Art Bangert -- Education <i>What is Good and What is Right: Ethics in Montana Municipal Government</i>	am	81	23
Katelyn Weber: Mathematical Sciences Lucy Marshall, Mark Greenwood -- Land Resources & Environmental Sciences, Mathematical Sciences <i>A Clustering Approach to Hydrological Predictions in Ungauged Basins</i>	am	106	94
Chelsie Wharton: Mechanical & Industrial Engineering Jennifer Brown, Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Rheological and Rheo-NMR Studies of Biopolymer and Polymer Solutions and Gels</i>	pm	46	59
Luke Wheeler: Chemistry & Biochemistry Trevor Douglas -- Chemistry & Biochemistry <i>Incorporation of HNP-1 into a Protein Cage Architecture Based on the Bacteriophage P22</i>	pm	117	95
Christopher White: Chemical & Biological Engineering Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Detection of Oil Under Sea Ice Using NMR Technology</i>	am	107	60

Student, Mentor, Project	Session	Poster #	Abst. Page #
Laura Whitmore: Land Resources & Environmental Sciences William Inskeep, Mark Kozubal -- Land Resources & Environmental Sciences <i>Autotrophic Carbon Fixation in Crenarchaeota from Yellowstone National Park</i>	pm	38	32
Geoffrey Wicks: Physics Aleksander Rebane, Mikhail Drobijev -- Physics <i>A New Femtosecond Nonlinear Transmission Experiment for Accurate Determination of Intrinsic Two Photon Absorption Spectra of Non-Fluorescent Chromophores</i>	Optical Science Topical	4:20pm Ballroom C	27
Wade Wilkison: Mechanical & Industrial Engineering Ronald June -- Mechanical & Industrial Engineering <i>Characterization of Initial Flight Path by Optical Applications and Sensor Technology</i>	pm	25	60
Hannah Wilson: History Frankie Jackson -- Earth Sciences <i>Comparison of Two Methods Used to Calculate Water Vapor Conductance in Modern and Fossilized Eggshell</i>	am	58	95
Alix Wittmayer: Agricultural Economics & Economics Anton Bekkerman -- Agricultural Economics & Economics <i>Identifying the Relationship Between Feed Intake and Bull Health: A Data-driven Analysis</i>	pm	23	32
Lindsey Wolfe: Cell Biology & Neuroscience Frances Lefcort -- Cell Biology & Neuroscience <i>A Mouse Model for Familial Dysautonomia</i>	pm	63	95
Thomas Wright: Chemistry & Biochemistry Martin Teintze -- Chemistry & Biochemistry <i>Mechanism of Antibacterial Guanides Specifically Against MRSA USA300</i>	pm	33	95
Daigo Yamamura: Earth Sciences James Schmitt -- Earth Sciences <i>Sandstone diagenesis as a proxy indicator of pore fluid geochemistry: implications for fossilization of vertebrate skeletal material in the Hell Creek Formation (Upper Cretaceous), Eastern Montana</i>	pm	70	27
Esther Yoon: Cell Biology & Neuroscience Laura Larsson -- Nursing <i>Perceptions of Digital Signage among Health Department Clients</i>	am	87	96
Elise Young: Animal & Range Sciences David Sands -- Plant Sciences & Plant Pathology <i>Linking common factors in the phenomenon of protein clumping observed in several diseases</i>	pm	98	33
Kaysha Young: Mechanical & Industrial Engineering Laura Stanley -- Mechanical & Industrial Engineering <i>Hands Free Texting While Driving - Is It Safer than Conventional Texting While Driving?</i>	am	96	61
Hauwa Yusuf: Computer Science Clemente Izurieta -- Computer Science <i>EAS: Efficient and Accurate Statistics</i>	am	20	61
Luke Zanella: Mechanical & Industrial Engineering Robb Larson -- Mechanical & Industrial Engineering <i>Avalanche Airbag Deployment System</i>	am	114	62
Anna Zelaya: Microbiology Matthew Fields -- Molecular Biosciences <i>Microbial community analyses between groundwater and sediments injected with nitrate for biostimulation of chromium reduction at Hanford Site</i>	pm	115	28
Amanda Zellar: Ecology Rebecca Mattix -- Immunology & Infectious Diseases <i>Treatment of Foot Disease in Captive Asian Elephants in Northern Thailand</i>	am	94	96
Linjie Zou: Mathematical Sciences Mark Greenwood, David Yopp -- Mathematical Sciences <i>Statistical Methods for Measuring the Impact of Mastery Learning in College Algebra</i>	pm	45	97
Brent Zundel: Civil Engineering Bridget Kevane -- Modern Languages & Literatures <i>San Juan El Espino Road Crossing</i>	am	45	61