

2013 MSU Student Research Celebration

Montana State University

*Celebrating Research & Creativity
in All Academic Disciplines*



April 18, 2013

The Undergraduate Scholars Program Acknowledges the Following Sponsors and Partners for their Ongoing Support of Student Research:

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Special Thanks to the Office of the Provost, the Graduate School, and the Montana INBRE Program for their assistance and sponsorship of today's event.



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Conference Map

Topical Sessions—SUB Room 235

Thursday, April 18

TRIO – MCNAIR SCHOLARS PROGRAM (MSP)- 9:00-10:30PM

McNair Scholars are paired with faculty mentors to conduct meaningful research during the summer. The MSP is a nationally recognized and federally funded program that prepares underrepresented undergraduate students for success in attaining their bachelor's degrees, acceptance in graduate school and pursuit of earning doctoral degrees.

9-9:15 – James Cwick, Microbiology (Jovanka Voyich-Kane, Michele Hardy)

The Effect of Glycyrrhizin and its Derivative 18β-Glycyrrhetic Acid on Clinically Prominent Bacteria

9:20-9:35- Halley Heintz, Art (Dede Taylor)

Spanish Baroque Fusion Paintings

9:40-9:55 – William Dupree, Physics (Bennet Link)

Hydro Static Equilibrium, the study of the Lane Emden and TOV Equations

10-10:15 – Dominique David, Earth Sciences English (Wayne Stein, Lisa Lone Fight)

Indigenous Science Knowledge Inherent in Native Language Place Names

10:15-10:30 – Justin Brewer, Cell Biology & Neuroscience (Christa Merzdorf, Dan Van Antwerp)

Isolation and Cloning of zic Genes from Chick

HUGHES SCHOLARS SCIENCE OUTREACH- 11:00AM-12:30PM

Successful scientists in the 21st Century are using multi-faceted approaches to sharing science in general and their research in particular with diverse audiences. Hughes Scholars will present their experiences designing and delivering outreach projects to local and online populations.

11:00-Arrika LaSalle, Chemical Engineering (Ed Dratz)

Mad Scientists Palooza

11:15-Erika Whitney, Plant Biology (Matthew Fields)

Alternative Energy Options: An Online Series

11:30-Katie Rowe, Biotechnology – Animal Systems (Jovanka Voyich)

Investigating Infectious Diseases in People and Pets

11:45-Alissa Bleem, Chemical Engineering (Ross Carlson)

Biofilm Explorers: Sampling Bacteria in the Classroom

12:00-Lindsey Wolfe, Cell Biology & Neuroscience (Frances Lefcort)

Curious? A Science 'zine for the People

12:15-Kasey Holland, Cell Biology & Neuroscience (Ed Schmidt)

"I'll Take Healthy Lifestyles for \$1000"

Topical Sessions—SUB Ballroom C

Thursday, April 18

DOING SOCIOLOGY: STUDENT WORK IN SOCIOLOGICAL THEORY AND PRACTICE-9:00-10:30AM

In this session, MSU Sociology students will present their original and exciting sociological research in the areas of sexuality and Christianity, gender and higher education, media and the 2012 presidential election, gender and heteronormativity in local print advertising, and gender in the gym.

9-9:15: Lindsay Murdock, Sociology & Anthropology (Danielle Hidalgo)

The Female President: The Redefinition of Gender Roles in Higher Education

9:15-9:30: Colin Gaiser, Sociology & Anthropology (Danielle Hidalgo)

The Post-Debate Information Waltz: Online media interpretations and distortions of the 2012 presidential debates

9:30-9:45: Susan Andrus, Sociology & Anthropology (Danielle Hidalgo)

Children are for Women and Sports are for Men: Gender and Heteronormativity in Local Print Advertising

9:45-10:00: Belinda Buck, Sociology & Anthropology (Danielle Hidalgo)

Christianity and Sexuality: A study of how to "do Christianity" in an Evangelical Church

10-10:15: Kristen Ingman, Sociology & Anthropology (Danielle Hidalgo)

Gender in the Gym: Exploring the Ways Gender Inequality Manifests Itself in the Taylor Fitness Center and in Popular Fitness Magazines

10:15-10:30: Q&A

CULTURAL INTERFACES: THE RHETORICAL FORCE OF LANGUAGE & MACHINES—2:00-3:30PM

Speakers investigate a number of ways in which everyday, practically invisible, completely ubiquitous linguistic and technological operations--turning on a Kindle, asking questions, adopting a shared language--carry rhetorical force that shapes culture.

2:00 – Angie Ford / Erica Jansma, English (Doug Downs)

An Inquiry of Distance: From Old Media to New Media

2:20 – Jesse Powell, English (Doug Downs)

The Elementary Emergence of Rhetoric within Questions

2:40 – Joe Thiel, Liberal Studies and Chemical Engineering (Doug Downs)

Rhetoric and the Organization: Perspectives on Rhetorical Institutionalism

3:00 – Sarah Sproul, History & Philosophy (Doug Downs)

Where the "Rest of the Story" starts

UNCERTAIN BOUNDARIES: LINES OF FICTION AND FACT IN LITERATURE AND CULTURE—4:00-5:30PM

This session combines five student posters with moderated panel discussion, all focusing on the boundary between fact and fiction, or autobiography and creative embellishment, in mythic, literary, theoretical, and pop-culture texts.

4:00 – Felicia Hamilton, English (Linda Karell)

Fictionality and Factuality: Where is the Line?

4:20 – Chandra Barber, English (Linda Karell)

A Convoluted Examination of a Historical Construction-Helen

4:40 – Charity Shumaker, English (Linda Karell)

Fairy Tales and The Construction of The Feminine Identity

5:00 – Marisa O'Sullivan, English (Linda Karell)

Female Insanity in Literature

Morning Poster Presentations

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

Student, Mentor, Project	Poster #	Abstract Page #
Kenneth Gaskill: Animal & Range Sciences Tom Geary -- Fort Keogh Ag Experiment Station <i>Bovine In Vitro Fertilization and Embryo Development using Nano-particle Depleted Spermatozoa</i>	1	43
David Aderholdt: Cell Biology & Neuroscience Christa Merzdorf -- Cell Biology & Neuroscience <i>Evaluation of the interaction of Zic1's interaction with Beta-Catenin in Xenopus Laevis embryos</i>	2	68
James Cwick: Microbiology Jovanka Voyich-Kane, Michele Hardy -- Immunology & Infectious Diseases <i>The Effect of Glycyrrhizin and its Derivative 18β -Glycyrrhetic Acid on Clinically Prominent Bacteria</i>	3	71
Amy Graham: Immunology & Infectious Diseases Joshua Obar -- Immunology & Infectious Diseases <i>Infection and activation of mast cells by influenza A virus enhances viral-induced pathology</i>	4	26
Carly Grant: Microbiology Joshua Obar -- Immunology & Infectious Diseases <i>Induction of highly protective CD8+ T cells by Listeria monocytogenes</i>	5	77
Emily Gravens: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Synthesis and Characterization of Fe-S Particle Clusters in Clay</i>	6	77
Vanessa Murray: Chemistry & Biochemistry Timothy Minton -- Chemistry & Biochemistry <i>Hyperthermal Scattering of Atomic Oxygen and Argon from a Hot Carbon Surface</i>	7	39
Allison Nesseth: Nursing Laura Larsson -- Nursing <i>Industry Thoughts on Radon Resistant Construction Practices in Montana</i>	8	103
Matthew Williams: Cell Biology & Neuroscience Laura Larsson -- Nursing <i>Testing Internal Consistency of an Instrument for Measuring Knowledge, Risk-Perception, Risk Framing, Self-Efficacy, and Intentions In Relation To Dental Sealants on the Blackfeet Reservation</i>	9	101
Catherine Gilligan: Cell Biology & Neuroscience Laura Mentch -- Bridgercare <i>Assessment of MSU Student Knowledge of STIs and Local Resources</i>	10	76
Rachael Johnson: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Urbanization and Government Health Spending</i>	11	82
Jake Weimer: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>The Pricing of Timberland: Economic and Ecological Implications</i>	12	98

Student, Mentor, Project	Poster #	Abstract Page #
S. Kathleen Fogg: Ecology Billie Kerans, Ryan Lamb -- Ecology <i>Effects of M. cerebralis on the competitive ability of T. tubifex</i>	13	75
Christian Heck: Cell Biology & Neuroscience David Varricchio, Frankie Jackson -- Earth Sciences <i>Evaluating deformation in Spheroolithus dinosaur eggs from Zhejiang, China</i>	14	79
Daniel Ross: Earth Sciences David Lageson -- Earth Sciences <i>Structural Geology of the North Half of the Swift Reservoir Culmination</i>	15	40
David Riesland: Electrical & Computer Engineering Joseph Shaw, Nathan Pust, Paul Nugent -- Electrical & Computer Engineering <i>Developing a multi-wavelength optical aurora detector</i>	16	62
Gavin Lommatsch: Electrical & Computer Engineering Nathan Pust, Joseph Shaw -- Electrical & Computer Engineering <i>Characterizing Light Polarization in the Near Infrared</i>	17	57
Jake Parker: Physics Charles Kankelborg -- Physics <i>Radiometric Calibration of the MOSES Rocket Payload</i>	18	88
Alex Adams: Mechanical & Industrial Engineering David Miller, Christopher Jenkins, Kevin Amende -- Mechanical & Industrial Engineering <i>Characterization and Optimization of Rotational Friction Welding for Small Stainless Steel Tubes</i>	19	31
Utkarsh Goel, Ajay Miyyapura: Computer Science Mike Wittie, Qing Yang -- Computer Science <i>MITATE: Mobile Internet Testbed for Application Traffic Experimentation</i>	20	32
Ian Macdonald, Rob Mackin: Cell Biology & Neuroscience Steve Stowers -- Cell Biology & Neuroscience <i>Optimization of GRASP</i>	21	84
Tiphani Lynn: Cell Biology & Neuroscience Rafal Angryk, Charles Gray -- Computer Science, Cell Biology & Neuroscience <i>Finding repeated patterns in time series data: applications to the study of neural oscillations</i>	22	38
Kelsey March: Cell Biology & Neuroscience Thomas Hughes -- Cell Biology & Neuroscience <i>Light: The New Drug</i>	23	85
Katherine Kent: Chemical & Biological Engineering Jennifer Brown -- Chemical & Biological Engineering <i>Rheological Response of Dilute and Semi-dilute Polymer-particle Dispersions</i>	24	56
McLain Leonard: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Performance Of Electroless Nickel Plating On 441 Stainless Steel For SOFC Interconnect Applications</i>	25	57
Griffin Ruehl: Chemical & Biological Engineering Stephen Sofie -- Mechanical & Industrial Engineering <i>Synthesis of multivalent perovskite and scheelite structures for use as solid oxide fuel cell anodes</i>	26	62
Noelle Carpenter: Agricultural Economics & Economics Carly Urban, Mark Anderson -- Agricultural Economics & Economics <i>The Effects of Alcohol Taxes in Montana on State GDP Per Capita</i>	27	70

Student, Mentor, Project	Poster #	Abstract Page #
Rebekah Mohr: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Racial Bias in Lending Markets</i>	28	86
Elizabeth Redman: Health & Human Development Alison Harmon, Carmen Byker, Tony Hartshorn -- Health & Human Development, Land Resources & Environmental Sciences <i>On-campus composting: A pilot study</i>	29	30
Saurab Sainju: Cell Biology & Neuroscience Mike Vogel -- MSU Extension <i>Healthy Kids Make Healthy Homes</i>	30	91
Aaron Jutila, Donald Zignego: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Physiologically stiff agarose as a 3D culture environment for primary human chondrocytes</i>	31	33
Anish Babu Bharata: Computer Science Mike Wittie, Qing Yang -- Computer Science <i>IP2DC: Making Sense of Replica Selection Tools</i>	32	31
Jude Eziashi: Chemical & Biological Engineering Paul Gannon, Roberta Amendola -- Chemical & Biological Engineering <i>Measuring Cr volatility from ferritic stainless steels: Novel and conventional methods compared</i>	33	53
Bradley Towey: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Quantification of S mixing of dithiocarbamate ligands in transition metal complexes</i>	34	40
Jacob Simon: Physics Hugo Schmidt -- Physics <i>Exploration of Lithium Coated Yttrium Doped Barium Zirconate as Material for Solid Oxide Fuel Cells</i>	35	93
Derek Reimanis: Computer Science Clemente Izurieta -- Computer Science <i>Developing the Input/Output Module of a Multi-Disciplinary System Modeling Framework</i>	36	34
Jackson Knoll: Physics Charles Kankelborg -- Physics <i>Optical Testing of Concave Diffraction Gratings for MOSES</i>	37	83
Halley Heintz: Art Dede Taylor -- Art <i>Spanish Baroque Fusion Paintings</i>	38	47
Isabel Milkovich: English Gretchen Minton -- English <i>Javert's Revenge: Ethical Suicide in Les Misérables</i>	39	86
Parker Dunn: English Gretchen Minton -- English <i>Performance History of Shakespeare's "Much Ado About Nothing" and its Influence on Critical Thought</i>	40	73
Michael Fast Buffalo Horse: Education Jioanna Carjuzaa -- Education <i>Montana's Native American Tribes and Language Revitalization</i>	41	51
Michael Wilson: History & Philosophy Holly Grether, Linda Sexon -- History & Philosophy <i>Out of the Iron Furnace: The introduction of the Yaweh Cult into Israel by the inhabitants of Egypt's Arabah mining colonies</i>	42	100

Student, Mentor, Project	Poster #	Abstract Page #
Virginia Price: Physics Charles Kankelborg, Philip Judge -- Physics <i>Calibration and testing of an EUV hollow cathode light source</i>	43	90
Brennan Ireland: Physics Nico Yunes -- Physics <i>Numerical Computation of on Resonance EMRI Black Holes</i>	44	82
James Pallardy: Mechanical & Industrial Engineering Doug Cairns -- Mechanical & Industrial Engineering <i>Composite Wind Turbine Blade Flaw Characterization</i>	45	60
Paul Castle: Cell Biology & Neuroscience John Miller, Brian Bothner -- Cell Biology & Neuroscience, Chemistry & Biochemistry <i>Determining the Concentration of Ethylene Thiourea in Various Local and Regional Beers</i>	46	70
Christopher White: Chemical & Biological Engineering Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Self Diffusion Coefficient Model Development of HPMCAS Polymer Solutions and Gels with PGSE NMR</i>	47	65
Stephan 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>	48	89
Brooks Marshall: Chemistry & Biochemistry Timothy Minton, George Schatz -- Chemistry & BiochemistryNorthwestern University <i>Reactions of Oxygen with Small Carbon Clusters</i>	49	38
Donald Zignego, Aaron Jutila: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Strain-field evaluation in 3D physiologically-stiff agarose hydrogels using confocal microscopy</i>	50	35
Yida Fang: Civil Engineering Xianming Shi -- Western Transportation Institute <i>Best Practices to Protect DOT Equipment from the Corrosive Effect of Chemical Deicers</i>	51	54
Priyanka Kudalkar: Land Resources & Environmental Sciences John Priscu -- Land Resources & Environmental Sciences <i>Role of Fungi and Cyanobacteria in Nutrient Cycling in the Ice Ecosystem and its Functions</i>	52	26
Rachael Luhr: Computer Science Clemente Izurieta -- Computer Science <i>Visualizing the Flow of Multiple Currencies in Flux Networks</i>	53	58
Amanda Crandall: Psychology Wesley Lynch -- Psychology <i>Early predictors of Obesity: A Retrospective Analysis of College-Age Students</i>	54	37
Andrew Rivers: Psychology Ian Handley, Keith Hutchison, Michelle Meade -- Psychology <i>Shifting Goals for Unconscious Thinkers: Reevaluation as Theoretical Test of Unconscious Thought Theory</i>	55	40
Jacob Remington: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Probing the Structural Dynamics of Single Stranded DNA Labeled with 2-Aminopurine Using Simulated Annealing to Analyze Time-Resolved Fluorescence Measurements</i>	56	90

Student, Mentor, Project	Poster #	Abstract Page #
Todd Pedersen: Chemical & Biological Engineering Brent Peyton, Rob Gardner -- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Analysis of TAG accumulation with the use of alternative grades of bicarbonate and alternative bicarbonate salts.</i>	57	61
Matthew Olson: Chemical & Biological Engineering Ron June -- Mechanical & Industrial Engineering <i>Improved Quantification of Cartilage Degeneration in Osteoarthritis</i>	58	59
Marnee Rand: Political Science David Parker -- Political Science <i>IRS Intimidation and Deep Water Horizon: How Contingent Oversight Theory Explains the Politics of Congressional Investigations</i>	59	90
Abigail Ita: Film & Photography Nancy Mahoney, Theo Lipfert -- Sociology & Anthropology, Film & Photography <i>Curation Crisis</i>	60	48
Heidi Windauer: Cell Biology & Neuroscience Renee Harris -- Montana Office of Rural Health <i>Efficacy of Complete Street Policy in Rural Montana Communities</i>	61	100
Eric Dietrich, Varsha Rao: Civil Engineering Anne Camper, John Doyle, Mari Eggers, Tami Old Coyote -- Center for Biofilm Engineering, Crow Environmental Health Steering Committee, Little Big Horn College <i>Service Learning to Address Drinking Water Quality through Community-Based Participatory Research on the Crow Reservation</i>	62	67
Varsha Rao: Chemical & Biological Engineering Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Molecular Weight Characterization of Alginate Solutions</i>	63	61
Courtney Holland: Cell Biology & Neuroscience Phillip Sullivan -- Chemistry & Biochemistry <i>Comparison of Organic Photochromic Compounds' properties and BSA interaction</i>	64	80
Julian Thorne: Cell Biology & Neuroscience Frances Lefcort, Michael Babcock -- Cell Biology & Neuroscience, Psychology <i>Novel Object Recognition in IKAP Deficient Mice</i>	65	96
Fermin Guerra: Immunology & Infectious Diseases Jovanka Voyich-Kane -- Immunology & Infectious Diseases <i>Interferon-gamma Production and Bactericidal Activity of Human Polymorphonuclear Neutrophils Exposed to S. aureus</i>	66	26
Katelyn Weber: Mathematical Sciences Lisa Davis, Tomas Gedeon -- Mathematical Sciences <i>Simulation and validation of a continuum model for bio-polymerization processes</i>	67	98
Josh Sinrud: Physics Hugo Schmidt -- Physics <i>Characterization of SOFC LSM cathodes using EIS</i>	68	93
William Pauli: Plant Sciences & Plant Pathology Thomas Blake -- Plant Sciences & Plant Pathology <i>Large, Multiyear Field Trials Identify Novel Barley Alleles</i>	69	26
George Schaible: Plant Sciences & Plant Pathology Gary Strobel -- Plant Sciences & Plant Pathology <i>Gene mining for the 1,8-Cineole synthase enzyme in the biosynthetic pathway of cineole production within the fungal species Annulohyphoxylon sp.</i>	70	46

Student, Mentor, Project	Poster #	Abstract Page #
Tanner Moe: Sociology & Anthropology Tamela Eitle, David Eitle -- Sociology & Anthropology <i>Parental Bond, Gender and Adolescent Coping Skills</i>	71	86
Chelsey Pengra: Sociology & Anthropology Tamela Eitle, David Eitle -- Sociology & Anthropology <i>Parental Bonding and Teen Polysubstance Use</i>	72	88
Eric Halverson: Cell Biology & Neuroscience Amy Cory -- Greater Gallatin United Way <i>Constructing a Community Resource Guide for Families in Gallatin Valley</i>	73	79
Robert Wilke: Political Science Ada Giusti -- Modern Languages & Literatures <i>The Capabilities Approach and Development in the High Atlas of Morocco</i>	74	99
Bronwyn Rolph: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Moroccan Literature and Stories</i>	75	91
Amanda Richards: Microbiology Michael Franklin -- Microbiology <i>Fluorescent Imaging of Pseudomonas aeruginosa Biofilms</i>	76	90
Arrika LaSalle: Chemical & Biological Engineering Edward Dratz, Duane Mooney, Mike Davenport -- Chemistry & Biochemistry <i>Automated Protein Extraction and Analysis</i>	77	57
Katie Rowe: Immunology & Infectious Diseases Jovanka Voyich-Kane, Tyler Nygaard, Shannon Moreaux -- Immunology & Infectious Diseases, Animal & Range Sciences <i>Characterization of Staphylococcus aureus Virulence Factors isolated in Equine Populations</i>	78	45
Jesse Ruzicka: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>The Effect of Surfactants on Lipid Membrane Structure and Stability</i>	79	91
Benjamin Smith: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Kinetic Study of 2-Aminopurine at 77 K in Cryogenic Glass</i>	80	94
Donald Wright: Chemistry & Biochemistry Joan Broderick -- Chemistry & Biochemistry <i>Site-Directed Mutagenesis and Characterization of HydF</i>	81	101
Justin Brewer: Cell Biology & Neuroscience Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience <i>Isolation and Cloning of zic Genes from Chick</i>	82	69
Jakob Kammeraad: Plant Sciences & Plant Pathology Chaofu Lu -- Plant Sciences & Plant Pathology <i>Characterization of Camelina sativa T-DNA mutants</i>	83	44
Kasey Holland: Cell Biology & Neuroscience Ed Schmidt, Emily Talago -- Immunology & Infectious Disease <i>Hepatocyte Lineage and Liver Regeneration</i>	84	81
Erika Whitney: Plant Sciences & Plant Pathology Matthew Fields -- Microbiology <i>Isolation and Characterization of a Novel, Benthic Diatom for Potential Bio-oil Production from Yellowstone National Park</i>	85	46
Tia Sharp: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Creating Basic English and French Lessons and Conversation Plans</i>	86	93

Student, Mentor, Project	Poster #	Abstract Page #
Shannon Holmes: Psychology Ada Giusti, Louise Ryder -- Modern Languages & Literatures, Psychology <i>Mental Health Support Nongovernmental Organizations in Morocco and the United States</i>	87	81
Tara Will: Cell Biology & Neuroscience Darcy Hunter -- Gallatin Valley WIC <i>Managing Efficiency and Cost Effective Marketing: The Key to Public Health Program Involvement</i>	88	100
Audrey Schadt: Cell Biology & Neuroscience Renee Harris, Julia Middleton -- Montana Office of Rural Health <i>Worksite Wellness in Montana Critical Access Hospitals: Importance and Implementation</i>	89	92
Kevin Hall: Sociology & Anthropology Tamela Eitle -- Sociology & Anthropology <i>Association of Depressive Symptomology and Adolescent Sexual Behavior</i>	90	78
Donald Liles: Education Carrie Myers -- Education <i>Heuristics in the Role of Self-Regulated Learning</i>	91	30
Kim Yates: Education Michael Brody -- Education <i>Connecting Kids To Nature: A Multi-case Study of Garden Based Learning in Southwest Montana</i>	92	31
Chris Lustgraaf: Psychology Jessi Smith -- Psychology <i>Evolution and the Social Environment: Which is the Greater Influence on Liking?</i>	93	38
Lauren Jackson: Business Perry Solheim -- Business <i>Perceptions of Accountants as Seen Through Media</i>	94	29
Robert Warwood: Physics Joey Key -- Physics <i>Keep the Dream Alive</i>	95	97
Geoffrey Wicks: Physics Aleksander Rebane, Mikhail Drobizhev -- Physics <i>A systematic evaluation of dipole moment generation in heavy-atom substituted chromophores through the use of two photon absorption</i>	96	41
Tom Rose: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Mouse/Rat Knee Static Loading Test Apparatus</i>	97	34
Elliot Gray: Physics Dana Longcope -- Physics <i>Magnetic Helicity and Plasma Energy in Solar Corona</i>	98	77
Blaine Ferris: Electrical & Computer Engineering Todd Kaiser -- Electrical & Computer Engineering <i>Flexible Radiation Monitoring Strip with Particle Identification for use in a Wearable Sensor Network</i>	99	54
Kyle Allemeier, Jacob Danczyk: Physics, Mechanical Engineering Hugo Schmidt, Paul Rugheimer -- Physics <i>Growing Barium Zirconate Films by Pulsed Laser Deposition for use in Low Temperature Solid Oxide Fuel Cells</i>	100	68
Mike Roddewig: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Infrared cloud imager measurements at Barrow, Alaska</i>	101	34

Student, Mentor, Project	Poster #	Abstract Page #
Elizabeth Forbes: Physics Joseph Shaw, Nathan Pust -- Electrical & Computer Engineering <i>Effects of Wildfire Smoke on the Optical Polarization of Skylight</i>	102	75
Erin McDonald: Electrical & Computer Engineering Hashem Nehrir -- Electrical & Computer Engineering <i>Electricity Use in Rural Kenya and the Economic Potential for Alternative Energy Source Implementation</i>	103	58
Jordan Dood: Chemistry & Biochemistry Bern Kohler, Jinquan Chen, Tom Zhang -- Chemistry & Biochemistry <i>Protonation and Ion Binding of Adenosine Oligomers</i>	104	73
Jesse Cook: Chemistry & Biochemistry Mary Cloniger -- Chemistry & Biochemistry <i>Effects of Lactose Functionalized PAMAM Dendrimers on Cancer Cell Aggregation</i>	105	71
Kathleen Chamberlin: Business Phenocia Bauerle -- Office of Diversity Awareness <i>Improving Campus Inclusivity: An Assessment of Minority Student Needs</i>	116	50
Ashley Powell: Agricultural Education Shanon Arnold -- Agricultural Education <i>Adapting Leadership Theories to Develop Agriculture and Natural Resources Adult Leadership Programs</i>	117	27
Matt Queen: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Electronic Structure of [Ni(II)S₄] Complexes from S K-edge X-ray Absorption Spectroscopy</i>	122	40
Katie Burbank: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Comprehensive Evaluation of Uranyl Coordination Chemistry with a Quinol-type Cofactor</i>	123	36
Cody West: Cell Biology & Neuroscience Roger Bradley , Dana Rashid -- Cell Biology & Neuroscience <i>Neural Fold Protocadherin Role in Early Vertebrate Development</i>	124	99
Elisa Boyd: Plant Sciences & Plant Pathology Jennifer Britton -- Plant Sciences & Plant Pathology <i>The Tenor of Heritage Tree Programs: Policy and Perception in the Rocky Mountain/Interior Plains Province</i>	125	--
Jordan Larsen: Film & Photography Jenny Hatchadorian -- Film & Photography <i>So Sad To Say</i>	126	48
Logan Warberg, Alison Figueira: Computer Science Hunter Lloyd -- Computer Science <i>Computer System Review and Design for NASA Lunabotics 2013</i>	127	65
Calin Mauch: Film & Photography Ian van Coller -- Film & Photography <i>The Big Open</i>	Framed Art A	48
Cameron Clevidence: Ecology Alexis Pike -- Film & Photography <i>Ecological Winter</i>	Framed Art B	71
Danielle Mullens: Film & Photography Christina Anderson -- Film & Photography <i>Thin Masquerade</i>	Framed Art C	48

Afternoon Poster Presentations

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

Student, Mentor, Project	Poster #	Abstract Page #
Eben Howard, Clint Cooper: Computer Science Mike Wittie, Qing Yang, Stephen Swinford -- Computer Science, Sociology & Anthropology <i>Cascading Impact of Lag on User Experience in Multiplayer Games</i>	1	33
Daniel Wagar: Computer Science Clemente Izurieta -- Computer Science <i>Machine Translation Software for Undocumented Languages</i>	2	64
William Dupree: Physics Lisa Davis -- Mathematical Sciences <i>When a Traffic Light Turns Green: A study of Traffic Flow Using Partial Differential Equations</i>	3	74
William Dupree: Physics Bennet Link -- Physics <i>Hydro Static Equilibrium, the study of the Lane Emden and TOV Equations</i>	4	74
Derek Gengenbacher: Computer Science Clemente Izurieta -- Computer Science <i>The Struggle For Success In Fantasy Baseball Is Over</i>	5	55
Edward Gillig: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Dendrimers: Functionalization and Toxicity</i>	6	76
Michelle Thomas: Chemistry & Biochemistry Martin Lawrence -- Chemistry & Biochemistry <i>Structural Studies of CRISPR/Cas Proteins of M. tuberculosis</i>	7	96
Emma Garcia: Chemical & Biological Engineering Michelle Flenniken -- Plant Sciences & Plant Pathology <i>Viruses as Biomarkers for Honeybee Health</i>	8	54
Sarah Riorda: Architecture Ralph Johnson -- Architecture <i>Research on Wastewater Systems in the Gallatin Valley and a proposed Living Machine Alternative</i>	9	49
Andrew Stulz, Tyson Abel, Byron Groh: Architecture Ralph Johnson -- Architecture <i>Design Prospectus for the Reuse of the Aboandoned Safeway Building</i>	10	50
Gunduz Sinem Kocabas, Cansu Gumus: Land Resources & Environmental Sciences Cathy Zabinski -- Land Resources & Environmental Sciences <i>Comparison of Wind Energy in Turkey and Montana</i>	11	44
Thomas Gladbach: Architecture Thomas Wood -- Architecture <i>Lifecycle Embodied Energy Analysis and Reduction Strategies for Residential Housing in the Rocky Mountain Region</i>	12	47

Student, Mentor, Project	Poster #	Abstract Page #
Tony Junghans: Chemistry & Biochemistry Michele Hardy -- Immunology & Infectious Diseases <i>Purification and Characterization of Rotavirus NSP1</i>	13	82
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Ben LaFrance: Chemistry & Biochemistry Trevor Douglas -- Chemistry & Biochemistry <i>Hierarchical Assembly of Protein Cage Nanoparticles: A P22 Super-Lattice</i>	15	84
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2013 STUDENT RESEARCH CELEBRATION

GRADUATE ABSTRACTS

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COLLEGE OF AGRICULTURE

Nikki Bailey: Agricultural Education

Mentor: Shannon Arnold -- Agricultural Education

Educating the Future of Agriculture: A Focus Group Analysis of the Programing Needs and Preferences of Montana Young and Beginning Farmers and Ranchers

The average age of farmers and ranchers is rising and each year there are fewer young and beginning farmers and ranchers (YBFR). Therefore, educators must provide information and programs that address the needs of YBFR. This study assessed the educational needs and preferences of YBFR in Montana, to develop programing recommendations. Focus groups were utilized to gather data on the needs, programing preferences, and delivery formats from a purposive sample of YBFR. A grounded theory was developed using constant comparison analysis. YBFR identified business management skills, legal knowledge, communication skills, and skills associated with technologies as educational needs. Barriers such as distance, time, and lack of awareness prevented educational event attendance. Programs were considered successful if they provided networking opportunities, relevant content, and a positive, interactive environment. YBFR utilized different delivery formats ranging from email to face-to-face conferences; preference was placed on longer duration events featuring a variety of information. Agriculture educators and programmers need to decrease the barriers and increase the positive elements associated with educational programs. Educational needs of YBFR must be addressed in environments that foster interaction and networking. Agriculture organizations need to collaborate to create comprehensive, impactful programs focused on developing the skills and knowledge of YBFR.

Matthew Calverley: Immunology & Infectious Diseases

Mentor: Allen Harmsen -- Immunology & Infectious Diseases

The Facultative Intracellular Pathogen *Cryptococcus neoformans* is Susceptible to in vivo Clearance by Alveolar Macrophages

Cryptococcus is a yeast commonly found in soil, decaying wood and bird excreta. Normally characterized as an opportunistic human infection, cryptococcosis is a leading cause of meningitis and death in HIV/AIDS patients in Sub-Saharan Africa. Recent *Cryptococcus gattii* outbreaks within healthy, immunocompetent populations in the Pacific Northwest are calling this characterization into question. Recent studies support the ability of *Cryptococcus* to replicate intracellularly, particularly in macrophages, leading to classification as a facultative intracellular pathogen. However, in vivo analysis of this capacity for intracellular replication in the context of a disease model for pulmonary infection has been lacking. Here we employ a GFP expressing strain of *Cryptococcus neoformans* and present novel dye labeling strategies to assess whether intracellular replication is productive in a mouse model of pulmonary cryptococcosis. We show that, while limited intracellular replication occurs, cryptococcal clearance by alveolar macrophages within the first forty-eight hours of pulmonary infection predominates. *Cryptococcus* may correctly be characterized as a facultative intracellular pathogen; however, alveolar macrophages possess the capacity to clear this pathogen, keeping early infection in check. Our finding, showing the importance of the alveolar macrophage in early cryptococcal clearance, opens the possibility of novel treatment strategies for a clinically important human pathogen.

Amy Graham: Immunology & Infectious Diseases

Mentor: Joshua Obar -- Immunology & Infectious Diseases

Infection and activation of mast cells by influenza A virus enhances viral-induced pathology

Influenza A virus (IAV) is a seasonal respiratory pathogen that results in severe lung pathology. The role of mast cells has been under explored during severe pulmonary viral infections. We found that both A/WSN/33 (WSN) and A/PR/8/34 (PR8) influenza viruses cause significant immunopathology in C57BL/6 mice, but only WSN-induced pathology was mast cell dependent. Using in vitro-derived bone marrow cultured mast cells (BMCMC), we found that WSN, but not PR8, directly activated BMCMC to produce histamine, leukotrienes, inflammatory cytokines, and anti-viral chemokines. Moreover, human H1N1, H3N2, and influenza B virus isolates could activate both murine BMCMC and the human mast cell line HMC-1 in vitro. BMCMC activation required infection of mast cells by IAV, which was dependent on the viral hemagglutinin. Cytokine and chemokine production from BMCMC occurs in a RIG-I/MAVS-dependent fashion which required the de novo production of vRNA; conversely, degranulation occurs through a RIG-I/MAVS-independent mechanism. Reconstitution of mast cell deficient mice with RIG-I^{-/-} BMCMC generated lung pathology similar to wild type BMCMC, suggesting that mast cell degranulation, rather than production of cytokines, causes WSN induced lung pathology. Thus, we have identified a unique inflammatory cascade which could be therapeutically targeted to limit morbidity following infection with influenza virus.

Fermin Guerra: Immunology & Infectious Diseases

Mentor: Jovanka Voyich-Kane -- Immunology & Infectious Diseases

Interferon-gamma Production and Bactericidal Activity of Human Polymorphonuclear Neutrophils Exposed to *S. aureus*

Polymorphonuclear neutrophils (PMNs) are phagocytic cells normally found in the blood stream able to migrate to sites of inflammation through chemotaxis. A previous study in our lab, using a mouse model of staphylococcal peritonitis, demonstrated that PMNs were the predominant source of interferon-gamma production which was induced by the SaeR/S two-component system in *Staphylococcus aureus*. Innate anti-bacterial mechanisms against *S. aureus* were diminished by interferon-gamma production in PMNs. In this current study, we investigated bactericidal activity of human PMNs exposed to conditioned serum against *S. aureus*. Furthermore, flow cytometry was used to analyze interferon-gamma production in human PMNs exposed to *S. aureus* and the induction effect of the SaeR/S two-component system. Preliminary results suggest that conditioned serum increases bacterial survival against PMNs. Interferon-gamma expression was observed in PMNs in a donor and SaeR/S two-component system dependent manner.

Priyanka Kudalkar: Land Resources & Environmental Sciences

Mentor: John Priscu -- Land Resources & Environmental Sciences

Role of Fungi and Cyanobacteria in Nutrient Cycling in the Ice Ecosystem and its Functions

The permanently ice covered lakes of Antarctica harbor a diverse group of microbes that live in unique liquid water habitats. My research focuses on the functional role of Fungi in the permanent ice covers of lakes in the McMurdo Dry Valleys. Laboratory cultures, obtained from ice cores taken from selected lakes, will be tested for growth characteristics under various temperature and nutrient regimes and in the presence of cyanobacteria isolated from the same environment. We will also use genomic methods to screen for functional genes and to identify novel fungal types unique to this region of Antarctica. Results from the study will be the first to address the structure and function of fungi in these subzero habitats and the potential for eukaryotic life to exist in icy worlds beyond Earth.

William Pauli: Plant Sciences & Plant Pathology

Mentor: Thomas Blake -- Plant Sciences & Plant Pathology

Large, Multiyear Field Trials Identify Novel Barley Alleles

Barley (*Hordeum vulgare* L) represents one of the earliest domesticated crops of man and today is the fourth largest crop in terms of area and biomass harvested worldwide (<http://faostat.fao.org>). Barley also represents one of Montana's key agricultural products. Using next generation genomic technologies, we undertook an expansive field study to identify genes and genomic regions that control key traits in this crop. We used a 3,072 SNP array to

genotype a panel of over 3,000 barley lines that represent the current genetic variation in barley breeding programs from across the nation. These 3,000 lines were also extensively phenotyped at MSU's Arthur Post Research Farm over a period of four years. Using advanced mixed model analyses, we conducted genome wide association studies to elucidate the genetic architecture of six agronomic traits that are vital in barley production. Our analyses identified over 50 quantitative trait loci that significantly impact morphological as well quality traits in barley. Using this information, we are able to increase the genetic gain in our breeding program by incorporating desirable alleles for these traits. This study represents one of the most comprehensive analyses conducted in small grains and will lead to economic gain for producers in the state.

Ashley Powell: Agricultural Education

Mentor: Shanon Arnold -- Agricultural Education

Adapting Leadership Theories to Develop Agriculture and Natural Resources Adult Leadership Programs

Built upon the need for practical leadership skills and advanced knowledge of complex topics, REAL Montana was created for adult professionals in the agriculture and natural resources industry in Montana. Twenty agricultural and natural resources professionals will be chosen to participate in a ten seminar, two year leadership program organized through Montana State University Extension. Content framework was constructed based on the Ethical Capacity Development Model (Johnson, 2009) and the Leadership Identity Development method of self-efficacy (Komives, Longersbeam, Mainella, Osteen, & Owen, 2009). Participants will engage in multiple feedback-intensive activities and evaluations (McCauley & Van, eds., 2004). Results will be used to measure the progressive learning of participants to achieve an active, evolving program design. Participants will complete the program with advanced level knowledge of multiple topics within the agriculture and natural resources industry, gain practical experience with leadership theories, and be better equipped to face ethical challenges within their workplace.

Acknowledgements: Janelle Booth (Staff) - Political Science

Ashley Powell: Agricultural Education

Mentor: Carl Igo -- Agricultural Education

An Examination of Self-Perceived Temperament Styles and Its Relation to the Retention of First-Time, Full-Time Freshmen in a College of Agriculture

The purpose of this quantitative study is to investigate the potential for a significant explanatory relationship between self-perceived temperament styles and retention to the second fall semester of first-time, full-time freshmen in the College of Agriculture at [state] University. Through purposive sampling techniques, participants were chosen due to their enrollment in the [university] course, their academic standing as first-time, full-time freshmen, and having completed both the Beginning College Survey of Student Engagement (BCSSE) during the 2012 summer orientation and Real Colors temperament assessment in the fall 2012 or spring 2013 semester. Participant's BCSSE and ACT scores, GPA, and temperament will be collected and grouped by semester of enrollment in [university] course. Both inferential and descriptive statistical procedures will be used to analyze the data. Results from this study will be critical in expanding our knowledge of College of Agriculture students by unveiling a new component for effective interventions that can be implemented for both college and university-wide retention plans. [State] University College of Agriculture faculty and staff, specifically, will have an additional identifier of students whom are likely to complete a collegiate program and seek employment in the agriculture industry.

Katie Tierney: Animal & Range Sciences

Mentor: Bret Olson, Jeffrey Mosley, Andrea Litt -- Animal & Range Sciences, Ecology

Effects of training on cattle grazing spotted knapweed and Canada thistle.

Plant species that are invading North America are changing and degrading ecosystems. Noxious weeds such as spotted knapweed (*Centaurea stoebe* L.) and Canada thistle (*Cirsium arvense* (L.) Scop.), replace native grasses and forbs on America's rangelands. Conventional control methods are often not cost-effective and are limited by regulatory guidelines. Using livestock as a tool to manage invasive species offers an alternative with fewer restrictions, is potentially more cost-effective, is less labor intensive, and may limit the spread and regeneration of weed populations. The objectives of this study were to determine: 1) if cattle trained to consume weeds in 2004

retained their training in 2011, and 2) if calves and yearlings of the 2004 trained cattle consume more spotted knapweed and Canada thistle than untrained cows. Trained cattle did not spend more time grazing spotted knapweed or Canada thistle than untrained cattle. Calves and yearlings from trained cattle did not spend more time grazing spotted knapweed or Canada thistle than those from untrained cattle. Trained cattle did not retain their training, and thus did not pass a preference onto their offspring. Training cattle did not result in greater time spent grazing weeds; however, regardless of training cattle will graze spotted knapweed.

Shavonn Whiten: Land Resources & Environmental Sciences

Mentor: Robert Peterson -- Land Resources & Environmental Sciences

The Influence of Temperature on the Susceptibility of *Aedes aegypti* and *Drosophila melanogaster* to the Insecticide Permethrin

Previous studies show that temperature directly affects the toxicity of insecticides to insects. Organophosphates exhibit a positive correlation between ambient temperature and mortality for many insect species. Carbamates exhibit a slightly negative correlation between ambient temperature and mortality. In contrast, pyrethroids are known to exhibit a distinctly negative correlation between increasing ambient temperature and mortality for many insect species. However, this relationship has not been systematically studied for adult mosquitoes. Therefore, we are examining the influence of temperature on the susceptibility of adult *Aedes aegypti* and adult *Drosophila melanogaster* when exposed to the pyrethroid insecticide, permethrin. Results from this study will also detail the median lethal concentration, LC50, for adult *Ae. aegypti* when exposed to eight concentrations of permethrin (0.00098 – 0.00982 $\mu\text{g}/\text{cm}^2$) for four hours. If mosquito populations are expanding in space and time because of increased temperatures due to global warming, and at the same time they cannot be managed as effectively with pyrethroids, then this may pose considerable risk to public health.

Oliwia Zurek: Immunology & Infectious Diseases

Mentor: Jovanka Voyich-Kane -- Immunology & Infectious Diseases

What, Where and How: The Influence of the Innate Immune System on *Staphylococcus aureus* Virulence

The ability of *Staphylococcus aureus* to colonize and infect a variety of host tissues is dependent on the pathogen's ability to sense and respond to different host environments. *S. aureus* accomplishes this task using gene-regulatory systems that control expression of virulence and immunomodulatory factors. While the SaeR/S two-component system is a major regulator of *S. aureus* virulence, the influence of the host environment on SaeR/S-regulated genes remains incompletely defined. Using QuantiGene 2.0 transcriptional assays, we examined the expression of genes with the SaeR binding site in USA300 exposed to human and mouse neutrophils, host-derived peptides and during subcutaneous skin infection. We found that only some of the saeR/S-targets, as opposed to the entire SaeR/S virulon, were activated within five and ten minutes of interacting with human neutrophils as well as alpha-defensins. Furthermore, mouse neutrophils promoted transcription of saeR/S-targets despite lacking alpha-defensins and the murine skin environment elicited a distinctive expression profile of saeR/S-targets. These findings indicate that SaeR/S-mediated transcription is unique to specific host stimuli. By implementing isogenic saeR/S and agr knockout strains, we also determined that saeR/S is the major regulator of virulence factors while agr has moderate influence on transcription of the saeR/S-targets during the initial host interactions.

Acknowledgements: Tyler Nygaard (Postdoctoral Fellow), Robert Watkins, Kyler Pallister (Research Associate) - Immunology & Infectious Diseases

COLLEGE OF BUSINESS

Lauren Jackson: Business

Mentor: Perry Solheim -- Business

Perceptions of Accountants as Seen Through Media

Accountants provide a service to the public by assisting in translating financial data into usable information. Examples of this include taxes, financial statements, or SEC filings. The public's faith in Accountants' interpretations and reports is essential for any business decisions to be made confidently. The SEC and AICPA have both made efforts, through legislation and outreach, to make accountants more creditable and professional. In this paper we use popular media from 1950 to 2012 to observe any changes in the public's attitude toward accountants, and if this change could be due to important regulations and events. Our analysis suggests that regulations and events affect the public's attitude toward accountants. There are trends to suggest that fraud and other scandals affect the perception of accountants in a negative way, increasing the number of incompetent accountants portrayed in the media and decreasing the number of students that study accounting in college. A positive effect due to AICPA and SEC regulations is less evident.

COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

Lindsey Jackson, Catherine Johnson: Education

Mentor: Carrie Myers, Marilyn Lockhart -- Education

Teaching and Taking: Lessons learned about online classes from a developing instructor and student perspective

This poster showcases several tips and tricks on teaching an online class including: creation of an online persona for online classes; how to connect and develop relationships with online students; and how to plan new assessment techniques at various times throughout online courses. An effective online persona, or the personality of an instructor as they interact with students online, can enhance a course and motivate students to meet their full potential. The presenters also include communication methods and ways to connect with students on an individual level. Why wait until the end to understand your opportunities for improvement and areas of strength? Ongoing assessment throughout an online course can greatly improve the online community, student success and experience, and heighten instructor development. A pre-assessment on students likes, dislikes, comfort level with technology and previous number of online classes will help to inform knowledge of the student population. Inspiration for this session comes from a developing instructor's and graduate student's experiences and real-life examples of tips and tricks learned from Boettcher's "The Online Teaching Survival Guide: Simple and Practical Pedagogical Tips." An adaptation of Brookfield's Critical Incident Questionnaire for online learning will be included. References are made to recent research on effective online course practice (Xu Jagers, 2013).

Danica Jamison, Christina McRae-Holland: Health & Human Development, Agricultural Education

Mentor: Carmen Byker, Alison Harmon -- Health & Human Development

The 4-H Sustainability Project: Youth Discovering, Engaging, and Learning about Food Systems Sustainability

The focus of this project was to develop a 4-H/Extension curriculum and program designed to help youth discover, engage with, and learn about food systems sustainability. Educators are alert to the need for youth and families to better understand the interconnected web of food systems sustainability in the face of pressing concerns such as food safety, the obesity epidemic and other diet related health problems, agricultural pollution, food access, unethical conditions for workers and animals, and climate change. Extension offers hundreds of 4-H projects for youth in Montana, but this project is the first to pull together 15 chapters on topics such as foodshed mapping, agroecology, biointensive vegetable production, sustainable meat production, food waste, composting, food consumption communities, food preservation, energy balance, niche marketing, water, recycling, and climate

mitigation/climate adaptation. In classic 4-H “learning-by-doing” style, the program’s hands-on activities are designed to engage youth beyond the classroom. Research and writing for the project was conducted by 55 MSU undergraduate students, two graduate students, and two faculty mentors through a collaborative project called “Campus to Community” (C2C) in which campus-based students and faculty worked with field-based Extension faculty to pilot the workshops with an afterschool program in the community.

Donald Liles: Education

Mentor: Carrie Myers -- Education

Heuristics in the Role of Self-Regulated Learning

Pintrich (1994) asserts the characteristics of Self-Regulation Learning (SRL) strategies to be a process which involves the regulation of three general aspects of college student learning/behavior: motivation, affect and cognition. In this mixed-methods study, a teacher-directed Classroom Assessment Technique (CAT) specifically examines how the SRL concept and construct could be “operationalized” within a learning strategy by introducing a heuristic for students to develop or improve study habits, organization and motivation. The overall research question asked in this study is, “Does the introduction of tailored classroom heuristics, applied toward achieving specific assignments, appeal to some students?” A two-part heuristic, designed to encourage thought, to organize and guide the student during a specified research assignment, was provided to twelve (12) undergraduate students. Assessment results support overall positive student learning outcomes when using teacher-directed scaffolding strategies and heuristics as a means to encourage and develop self-regulated learning among first-year college students. Furthermore, the results suggest that the SRL heuristic contributed positively to four major areas of student academic learning: (a) confidence, (b) time management, (c) motivation, and (d) self-awareness. Together these findings suggest that introduction of heuristics into the learning process may encourage or enhance student self-regulatory learning among undergraduate students.

Elizabeth Redman: Health & Human Development

Mentor: Alison Harmon, Carmen Byker, Tony Hartshorn -- Health & Human Development, LRES

On-campus composting: A pilot study

Implementing sustainability initiatives on college campuses has become an important part of institutional change today. Although many universities are taking advantage of the benefits of waste diversion through an outside party, few have developed on-site composting programs. Montana State University implemented a pilot program in the spring of 2013 using the anaerobic composting method called Bokashi. The following paper addresses the methodology, key partnerships, and challenges to implementing an on-campus system. The author interpreted the data to determine the potential cost savings of an expanded system and summarizes the potential interdisciplinary learning opportunities an on campus composting system would provide.

Tammy Stewart: Education

Mentor: Carrie Myers, Scott Myers -- Education, Sociology & Anthropology

Evaluation of Teaching and Pedagogical Strategies in Higher Education: Do Institutional Policies Influence Faculty Practices?

What motivates faculty to adopt effective and student-centered pedagogy? Research to date identifies three consistent factors: culture, faculty demographics, and broad institutional characteristics (Cox et al., 2011; Nelson Laird et al. 2011; Umbach, 2006, 2007). What is less clear is if institutional policies regarding the assessment of teaching influence the use of effective faculty pedagogy. Only a few studies exist that examine the association between teaching practices and the ways in which institutions assess and evaluate teaching and learning. This study posits a straightforward question: Are there associations between different methods of institutionally-mandated evaluations of teaching and the pedagogical practices of higher education faculty? We use recent debates about accountability to inform this question, and then test it with Institutional and Faculty data from the 2004 National Study of Postsecondary Survey. We find strong evidence that the methods used by institutions to evaluate teaching are significantly associated with the extent to which faculty use effective pedagogy in their undergraduate courses. Yet, the use of student outcomes as a method to evaluate teaching appears to be

unrelated to the incorporation of effective pedagogy. The pattern of results differs significantly between tenured and non-tenured faculty but not by Carnegie classification.

Kim Yates: Education

Mentor: Michael Brody -- Education

Connecting Kids To Nature: A Multi-case Study of Garden Based Learning in Southwest Montana

Many children today spend little time outdoors exploring the natural world and a great deal of time inside viewing the television or playing video games. This new condition of childhood has many negative ramifications, such as poor social development, childhood obesity, and a lack of feeling connected to the environment. One instructional tool being used by some schools to address these rising concerns is a school garden. School gardens can provide an opportunity for students to experience learning in a real-world application, outside of the classroom walls. This qualitative multi-case study explores three school gardens in Southwest Montana and tells each of their unique stories.

COLLEGE OF ENGINEERING

Alex Adams: Mechanical & Industrial Engineering

Mentor: David Miller, Christopher Jenkins, Kevin Amende -- Mechanical & Industrial Engineering

Characterization and Optimization of Rotational Friction Welding for Small Stainless Steel Tubes

Rotational friction welding is a common joining process used to join cylindrical metal components. Typically, one piece is rotated and a secondary piece is held rigid. The two samples are forced together, and friction generates enough heat to create a weld. This process was analyzed for 304 Stainless Steel. The specimens were hollow tubes with dimensions 1/8" outer diameter and .055 inch inner diameter. Each sample was three quarter inches long. Key parameters to the process included rotational speed, applied force, temperature, duration, and material upset. The goal was to obtain a leak-free weld upon completion. Also, the weld needed to withstand stresses resulting from pressures of 400 psi. Furthermore, the integrity of the through hole of the tube was a consideration. Optimal working parameters will be presented. The weld microstructure was then compared to other stainless steel welds to draw further conclusions on weld quality. A finite element analysis was performed to analyze buckling characteristics of the process. This analysis resulted in a critical length of specimen. This length was considered in order to avoid a buckling failure in the welding process. Experimental methodology, optimal parameters, and strength testing results will all be presented in the following report.

Anish Babu Bharata: Computer Science

Mentor: Mike Wittie, Qing Yang -- Computer Science

IP2DC: Making Sense of Replica Selection Tools

Cloud-based applications being developed for consumer electronics market (tablets, Smart TVs) struggle to deliver the same level of responsiveness as standalone Software, leading to user frustration and slow adoption. Often the network that separates user end-hosts from server back-end is to blame. To limit the impact of poor network performance on message delay, or lag, back-end logic and application data are deployed across geographically distributed servers and user requests are directed to the closest one. Such nearby servers deliver content more quickly thanks to a faster expansion of TCP congestion window and more rapid retransmissions over low round-trip time (RTT) paths. The challenge to realizing these benefits is the accurate selection of a server closest to a user, or a group of communicating users. Direct latency probing, for example using ping, is accurate, but time consuming and does not scale. Tools, such as CloudGPS, can reduce the number of user measurements, but require cooperation between ISPs and cloud providers. Content distribution networks (CDNs) rely on DNS redirection, though when a user's DNS server is not nearby, for example in the case of public DNS infrastructure, the likelihood

of selecting a nearby server is low. To provide guidance to application developers in choosing a predictive tool for server selection, we have undertaken a comparative evaluation of matchmaking tools. Specifically we are interested in their coverage of the IP space and their accuracy in determining the closest public cloud datacenter to a given IP, relative to direct probing. Our early results, presented in this poster, show a high level of discrepancy between the available tools and motivate further measurement as well as the need to develop techniques for more accurate server replica selection.

Utkarsh Goel, Ajay Miyyapura: Computer Science

Mentor: Mike Wittie, Qing Yang -- Computer Science

MITATE: Mobile Internet Testbed for Application Traffic Experimentation

A growing number of mobile applications support near realtime user interactions through multiplayer games, video chat, or augmented reality. The usability of these applications depends on low latency network service to deliver user requests between mobile devices and cloud datacenters, on which backend logic is deployed, in a timely manner. Since many important aspects of mobile network performance across time and coverage areas are poorly understood, developers lack the means to predict whether communication protocols they design will meet user expectations, or lead to user frustration and slower application adoption. To design communication protocols that keep user request delay low across a range of network conditions, application developers need to know not only network performance characteristics, but also specific network configuration and provisioning details that affect packet delay. Consequently, we propose not another network measurement study, but a platform for mobile network experimentation. We aim to enable application designers to experiment with different transactional traffic to refine or customize their communication protocols, for specific carriers, geographic-areas, and network conditions. This functionality would enable developers to answer questions such as: "Will changing message-size result in packet-fragmentation?" or "Which CDN provides fastest downloads through a particular mobile service provider's network peering points?"

Acknowledgements: Ajay Miyyapuram - Computer Science

Adam Gunderson: Electrical & Computer Engineering

Mentor: David Klumpar, Larry Springer -- Physics

Simultaneous multi-point space weather measurements using the low cost EDSN CubeSat constellation

The ability to simultaneously monitor spatial and temporal variations in penetrating radiation above the atmosphere is important for understanding both the near Earth radiation environment and as input for developing more accurate space weather models. Due to the high variability of the ionosphere and radiation belts, producing such a data product must be done using high density multi-point measurements. The most recent solar and space physics decadal survey states that these measurement densities have the potential to be provided by CubeSat constellations. The primary scientific purpose of the Edison Demonstration of Smallsat Networks (EDSN) mission is to demonstrate that capability by launching and deploying a fleet of eight CubeSats into a loose formation approximately 500 km above Earth. The Energetic Particle Integrating Space Environment Monitor (EPISEM) payload on EDSN will characterize the radiation environment in low-earth orbit (LEO) by measuring the location and intensity of energetic charged particles simultaneously over a geographically dispersed area. This is made possible because the EPISEM samples are acquired from across the dispersed constellation of eight EDSN spacecraft. This paper describes the fabrication approach of this miniaturized radiation detection instrument and operational considerations unique to constellation missions of this class. Collection timelines and data return models will be provided for the initial 60 day lifetime and a possible extended mission. The EPISEM payload was specifically designed for CubeSats; leveraging heritage from the payload operating aboard Montana State University's Hiscock Radiation Belt Explorer (HRBE), launched in October 2011. The EDSN project is based at NASA's Ames Research Center, Moffett Field, California, and is funded by the Small Spacecraft Technology Program (SSTP) in NASA's Office of the Chief Technologist (OCT) at NASA Headquarters, Washington. The EDSN satellites are planned to fly late 2013 as secondaries on a DoD Operationally Responsive Space (ORS) mission that will launch into space from Kauai, Hawaii on a Super Strypi launch vehicle. The EPISEM payload was designed, built, tested, and delivered to NASA Ames by the Space Science and Engineering Laboratory at Montana State University.

Acknowledgements: Matthew Handley, Andrew Crawford - Computer Engineering, Mechanical Engineering

Eben Howard, Clint Cooper: Computer Science

Mentor: Mike Wittie, Qing Yang, Stephen Swinford -- Computer Science, Sociology & Anthropology
Cascading Impact of Lag on User Experience in Multiplayer Games

Playing cooperative multiplayer games should be fun for everyone involved and part of having fun in games is being able to perform well, be immersed, and stay engaged. These indicators of enjoyment are part of a user's Quality of Experience (QoE), a measure which includes additional metrics such as attention levels and ability to succeed. Industry application development and current research both operate with the assumption that for any given individual in a group, that individual's QoE is affected only by their own network condition and not the network conditions of the other group members. We show that this assumption is incorrect. Our research shows that the QoE of all group members is impacted by a single member's lag (communication delay or loss caused by poor network conditions).

Aaron Jutila, Donald Zignego: Mechanical & Industrial Engineering

Mentor: Ron June -- Mechanical & Industrial Engineering

Physiologically stiff agarose as a 3D culture environment for primary human chondrocytes

The objective of this study was to create a physiologically stiff environment for 3D cell culture that maintains chondrocyte viability. Methods: Agarose stiffness was characterized from repeated mechanical tests for a range of agarose gel concentrations (3, 3.5, 4, 4.5, and 5 % w/v). Cell viability assays were performed using confocal microscopy on the cell-seeded hydrogels at 24 and 72 hours. Stress-relaxation tests yielded dynamic and equilibrium stiffness values ranging from 30-90 kPa and 17-50 kPa respectively. 3% agarose approximated diseased pericellular matrix and 5% agarose was in the range of healthy pericellular matrix. These values compare well with previously reported micro-pipette and atomic force measurements of stiffness for the human pericellular matrix. Cell viability in physiologically-stiff agarose was ~99% after twenty-four hour encapsulation, and >95% after 72 hour encapsulation. Conclusions: Having the capability to maintain cell viability in a physiologically stiff material provides a methodological foundation for investigation of the mechanisms by which chondrocytes and other cells respond to mechanical stimuli.

Acknowledgements: Donald Zignego - Applied Mechanics

Al Rashid: Mechanical & Industrial Engineering

Mentor: Ron June, Ahsan Mian -- Mechanical & Industrial Engineering

Fabrication, Calibration and Testing of Capacitive Type Pressure Sensor for Real time Measurement of Knee Pressure Distribution of Rodents

Rodents are commonly used in bio-medical and bio-mechanical research because of their genetic and biological characteristics closely resemble those of humans. Rodents have similar knee joint structures to human beings, and are commonly used as models for human osteoarthritis. Bio-mechanical factors influencing the patterns of pressure distribution within the joint are very important in the pathogenesis of osteoarthritis at the knee joints. The pattern of pressure distribution of the femoral condyles of weight bearing knee joints is therefore of great interest. A flexible PDMS (Polydimethylsiloxane) based pressure sensor is to be designed for this purpose with capacitive sensor array embedded inside the structure. The sensor structure comprises of a 4x16 arrays of sensors embedded inside the PDMS structure with air pocket and insulation layers to provide a suitable dielectric medium to have better capacitive sensitivity. The readout circuitry consists of multiplexing in the form of column and row decoders to measure capacitance cell by cell to the desired location, which will be a major challenge along with noise reduction, flexing of the structure under load and calibration of the sensor.

Derek Reimanis: Computer Science

Mentor: Clemente Izurieta -- Computer Science

Developing the Input/Output Module of a Multi-Disciplinary System Modeling Framework

Network Exchange Objects (NEO) is a simulation framework under development at MSU. NEO facilitates the development of simulation models that describe the behavior of complex systems- specifically the flux and storage of multiple interactive “currencies” (e.g., energy, economic capitol, genes, carbon, nutrients, or any other resource of interest, depending on the system) through systems represented as networks. The NEO Input/Output (NEOIO) module provides an interface to support a standard format for data input and data output in NEO. Herein, the development of the NEOIO module in accordance with the Rational Unified Process is documented. The use of agile design methodologies was employed, which supports abstract planning techniques to facilitate changing requirements. The use of these methods assisted in the design of a versatile, robust NEOIO module.

Mike Roddewig: Electrical & Computer Engineering

Mentor: Joseph Shaw -- Electrical & Computer Engineering

Infrared cloud imager measurements at Barrow, Alaska

The Infrared Cloud Imager (ICI) measures spatial and temporal cloud statistics, along with cloud optical depth up to a value of approximately 3. Because this instrument measures wide-angle, long-wave infrared images, the result is a continuous day-night data stream that overcomes the difficulties of visible-wavelength imagers for nighttime and high-latitude winter clouds. The ICI is deployed as part of an Intensive Operating Period at the North Slope of Alaska site in Barrow, Alaska, extending from July 2012 into August 2013. Obtaining cloud statistics from the Arctic is important because current climate models predict that climate change will occur earliest and most severely in high latitudes. This poster will describe the instrument and show examples of data obtained in Barrow during this year-long deployment.

Tom Rose: Mechanical & Industrial Engineering

Mentor: Ron June -- Mechanical & Industrial Engineering

Mouse/Rat Knee Static Loading Test Apparatus

The driving problem behind the motivation to create this machine was the need to develop a method to test the pressure distribution within a mouse knee. Given that this problem had yet to be approached no current test apparatus exists for this purpose. First preliminary measurements of young mouse knees and mature rat knees were taken to give a general range of required. Design of the machine began with an outline of desired degrees of freedom allowing the knee as natural of movement as possible. Fixtures were devised, and a tower apparatus that holds the knee in place while knee is statically-loaded. Applying the load is done via mechanical gravity-driven apparatus. Several hurdles were overcome during testing, which included how to interface the biological knee to the mechanical system, how to measure the pressure distribution of extremely small areas, and the calibration of both the load application as well as the fuji film pressure paper. Testing culminated in results showing general pressure distribution through the knee and the variation of distribution with varying flexion angles. The static knee loading machine is successful in its ability to test the pressure distribution through a mouse knee.

Justin Spengler: Chemical & Biological Engineering

Mentor: Ross Carlson -- Center for Biofilm Engineering

Community-level metabolic network analysis of a cross-fed consortia

A consortium of bacteria often outperforms monocultures in terms of productivity, due to the optimization of resource usages by the multiple organisms. By expressing cellular fluxes quantitatively as elementary flux modes (mathematically-defined pathways) with balanced metabolic stoichiometry, any physiological state can be expressed as a linear combination of these basic flux distributions. Elementary flux mode analysis was performed on an *Escherichia coli* model previously described by Carlson (2009). Glucose and oxygen-efficient elementary flux modes which produced the most biomass and produced organic acid byproducts acetate, succinate, or lactate exclusively were studied as competitive modes for a primary producer strain. A second round of metabolic network analysis was performed on models which represented byproduct scavenger strategy strains. Modes were

enumerated for three strains which each could use only acetate, succinate, or lactate as the reduced carbon source. These scavenger models were combined with the primary producing models via linking the exchange of metabolites using a methodology termed mode-squared analysis. The results of the interacting consortia were compared with the monoculture model to examine the synthesis of biomass. Results of this experiment will lead to greater understanding of the ecological complexity of microbial communities as they adapt to environmental conditions and stresses.

Colin Young: Electrical & Computer Engineering

Mentor: Hashem Nehrir -- Electrical & Computer Engineering

Design and Development of a Solar Photovoltaic Power Generation System for Educational Purposes at Montana State University

The power lab at MSU has been used to create better understanding of electrical power generation systems and motor drives. A solar photovoltaic (PV) simulator, referred to as the Solar PV Experimental Station, has been developed using a grant from MSGC to educate undergraduate electrical engineering students on solar PV generation, which will be an integral part of the future smart grid. This simulator uses a 1000 Watt HPS light to simulate the sun, and it will allow students to experiment with many electrical properties of the PV panel in doors. In the poster presentation, we will present the design and development of the solar PV system, and we will give its electrical characteristics including: current-voltage relationship, loading, light intensity, angle of incidence of solar irradiance, and operating temperature.

Acknowledgements: Josh Thelen - Electrical Engineering

Donald Zignego, Aaron Jutila: Mechanical & Industrial Engineering

Mentor: Ron June -- Mechanical & Industrial Engineering

Strain-field evaluation in 3D physiologically-stiff agarose hydrogels using confocal microscopy

The objective of this study was to evaluate the spatial variability in strain fields for 3D agarose hydrogel gels. Fluorescent microspheres were encapsulated in type VII-low-gelling-temperature agarose, cast, and compressed uniaxially during confocal imaging. Gel concentrations tested were 3%, 3.5%, 4%, 4.5%, and 5% (w/v) with n=3 replicates for each concentration. Strain was then calculated based on bead position. Strain values were calculated at six unique locations to verify strain homogeneity in each gel. Strain values in the direction of loading were uniform for each gel tested. Shear and transverse strains were ~0.0% for each gel. The minimal variability in strain fields between different spatial locations in each gel implies spatial homogeneity. These results provide the methodological foundation for future studies investigating how chondrocytes respond to mechanical cues. Using this system, we can now apply a uniform strain stimulus which may minimize biological variability toward dissecting mechanisms of mechanotransduction.

COLLEGE OF LETTERS AND SCIENCE

Tatsuya Akiyama, Katrina Jackson: Microbiology

Mentor: Mensur Dlakic -- Microbiology

Trimolecular Fluorescence Complementation (TriFC) for in vivo detection of RNA-protein interactions

Bimolecular Fluorescence Complementation (BiFC) is based on the fluorescent signal recovery from non-fluorescent protein fragments fused to interacting proteins. Trimolecular Fluorescence Complementation (TriFC) is a modified version of BiFC, where one of the non-fluorescent fragments is fused to the bacteriophage MS2 coat protein (also an RNA-binding protein), and the other non-fluorescent fragment is fused to the putative RNA-binding protein of interest. Fluorescent signal is generated only when both proteins are bound to their adjacent RNA targets, which brings non-fluorescent fragments in close proximity. We describe here the creation of Gateway® vectors with all required components in place, except for the RNA-binding protein of interest that can be cloned easily by homologous recombination in vitro. A separate group of vectors that contain MS2 coat protein binding site also has multiple cloning sites to insert recognition sequences of putative RNA-binding proteins. The whole system is modular and enables easy manipulation of RNA-binding proteins and their recognition sequences. Gateway® recombination system was used to clone known RNA-binding protein genes, CasE, Csy4, and IMP1, as well as their binding sites and mutated controls. Our modular TriFC constructs will be useful for in vivo detection of RNA-protein interactions in *E. coli* and other prokaryotes.

Rhonda Barton: Chemistry & Biochemistry

Mentor: Robert Szilagyi -- Chemistry & Biochemistry

Electronic Structural Information for Phosphorous Compounds and Complexes from X-ray Absorption Near-Edge Spectroscopy

Phosphorus is widely observed in complexes throughout industry, biology and in organometallic chemistry with formal oxidation states from -III to +V. A spectrochemical series of phosphorus compounds was developed including phosphines, phosphine oxides, phosphates and phosphorus halides of the +III and +V level to probe effective oxidation changes (see figure). Changing -R groups from aliphatic to aromatic systems in phosphines, switching oxygen for sulfur in phosphine oxides, and increasing the number of substituents on the phosphorus center will result in a change of the electronic structure and of the oxidation state of phosphorus. Using X-ray absorption spectroscopy, the XANES region of the P K-edge spectra provides information about effective oxidation state and P-X/P=X chemical bonds. Comparisons will be presented between XAS spectral features and data from more conventional spectroscopic techniques, such as ³¹P NMR, UV/vis, and IR. Coordination of the P-ligands to transition metals with unoccupied d-orbitals results in pre-edge features that can be used to obtain quantitative information about the amount of L-to-M donation, as well as M-to-L backdonation. Examples with Pd, Co, and Rh coordination complexes will be discussed. P K-edge data were collected at the Canadian Light Source, beamline SXRMB and the Stanford Synchrotron Radiation Lightsource, beamline 6-2.

Katie Burbank: Chemistry & Biochemistry

Mentor: Robert Szilagyi

Comprehensive Evaluation of Uranyl Coordination Chemistry with a Quinol-type Cofactor

A computational model that can accurately describe the interaction of the bioavailable form of high-valent uranium(VI) (uranyl or [UO₂]²⁺) with biomolecules is a powerful tool for providing atomic-scale quantum chemical description for a diverse set of experimental data. In this work, the performance of density functionals and basis sets, solvation models were evaluated in modeling [UO₂]²⁺ interactions with quinol-type cofactors of bacterial alcohol dehydrogenase. We combined the most relevant experimental data for [UO₂]²⁺ coordination chemistry and quinol-type biological cofactors in order to develop a computational model that balances both accuracy and cost and carried out independent systematic methodology evaluations for the organic cofactor (pyrroloquinoline quinone, PQQ) and separately for the solvated form of [UO₂]²⁺ ([UO₂(H₂O)₅]²⁺). We utilized crystallographic structural information and intramolecular distances from X-ray absorption spectroscopic measurements, protonation constants, reduction potentials, and electronic absorption spectra. It was found that the combination

of B3LYP/TZVP functional and basis set with the incorporation of both a first explicit shell and outer implicit solvation shells to be a good compromise in computational cost and accuracy for modeling both UO₂²⁺ and its interactions with quinol-type cofactors.

Amanda Crandall: Psychology

Mentor: Wesley Lynch -- Psychology

Early Predictors of Obesity: A Retrospective Analysis of College-Age Students

Extensive research has shown childhood socioeconomic status to be predictive of adult obesity, in that those growing up with fewer resources have a higher risk of adult obesity. The Cumulative Stress Theory attempts to explain this as a confluence of different stressors associated with childhood poverty, which create a situation of chronic stress. Chronic stress is related to obesity through the consumption of high fat and high sugar foods as a coping mechanism. This study intends to investigate the predictive value of chronic stress during childhood for adult obesity as compared to that of other childhood predictors that have been shown, including childhood food insecurity, limited resources in low-income neighborhoods, Participation in the SNAP program, and health disparities at birth. This study uses a retrospective survey to examine these childhood circumstances and height and weight data among students over-sampled for childhood poverty. Elucidating the qualities of childhood poverty that specifically predict adult obesity will add to the growing evidence on how best to prevent this condition.

Margaret Eggers, Dayle Felicia: Microbiology , Health Promotion

Mentor: Anne Camper, Tim Ford (University of New England) -- Center for Biofilm Engineering

Using Community Based Risk Assessment to Address Health Risks from Waterborne Contaminants on the Crow Reservation

Crow Reservation community members concerned about health risks from poor water quality formed the Crow Environmental Health Steering Committee (CEHSC) in 2004. This diverse group of community stakeholders, with support from academic partners, is conducting a community-based risk assessment addressing exposures to contaminants via domestic, cultural and recreational water sources. The hypothesis is that rural residents are at risk due to reliance on shallow wells, subsistence practices, cultural traditions and other factors characterizing Reservation communities. The objective is to reduce health risks through research, education, mitigation and community capacity building. Bacterial and chemical analyses of residents' well water were conducted. Families completed surveys to assess uses and maintenance of wells and septic systems and exposure routes from all water sources. Of 160+ wells recently tested, 54% present health risks from heavy metals, nitrates and/or coliform contamination. The metal-rich area geology, agriculture and multiple sources of bacterial contamination are all factors. Poor quality well water is widely used for cooking. Mitigation strategies implemented include homeowner and community education, shock chlorination of wells, GIS mapping and pilot testing of affordable, high-tech home water treatment systems. The community has used project data to help secure \$20 million in funding for water/wastewater infrastructure improvements.

Meghan Huntoon: Psychology

Mentor: Jessi Smith -- Psychology

Understanding how chemistry helps can help: An experimental investigation of increasing women's motivation to pursue chemistry research

As the theory of goal congruity suggests, one reason women do not pursue science is due to a mismatch between the goals that biomedicine fields are perceived to afford and the goals women find important. For example, science fields and STEM fields in general are stereotyped as not affording communal applications (Diekman, Clark, Johnston, Brown, Steinberg, 2011). This project tests whether the communal applications of chemistry research are less evident than psychology research; using an identical research task framed as either chemistry or psychology. Secondly, this project tests if making the communal applications of a science field explicit increases interest and motivation to pursue scientific research, and if such connections are especially successful in triggering interest in research among women.

Erica Jansma, Angie Ford: English

Mentor: Doug Downs -- English

An Inquiry of Distance: From Old Media to New Media

This project analyzes the rhetorical differences in the user experience of an e-book and a print book. According to the Kindle user guide, its technological body “fades into the background so the author can focus on the text”. Although the device is designed to have its technology “disappear” there are obvious differences in the interactions with it compared to a print book. The technology creates a unique distance between the text and the user compared to that experienced from a print text. We look at what factors shape that difference, and how that difference impacts the user experience. To address these issues, we focus primarily on embodiment, the interface, and the rhetorical canons of arrangement and delivery.

Chris Lustgraaf: Psychology

Mentor: Jessi Smith -- Psychology

Evolution and the Social Environment: Which is the Greater Influence on Liking?

Evolutionary Psychology and Social Psychology are useful frameworks for understanding and predicting human behavior. Recent research from these fields has provided an explanation of factors that influence how much we like other individuals. Behavioral mimicry (evolutionary explanation) suggests that individuals who mimic another’s behavior are rated more positively than those who do not (Chartrand & Bargh, 1999). Furthermore, social norms theory (social explanation) argues that individuals who violate the norms for their gender receive negative ratings from others (Heilman and Eagly, 2008). Participants in this study were randomly assigned to interact with a confederate. The main purpose of this study was to determine if the benefits of mimicry could potentially help to alleviate the negative effects of stereotype incongruence, and be applied to real world situations. We also examined the effects of these factors on perceived competence and warmth. Preliminary results show an interaction between mimicry and gender congruence, such that confederates were rated as less competent when they did not mimic the participant, but only when in the gender incongruent position. This research demonstrates the importance of both evolutionary and social forces on behavior in the present.

Tiphani Lynn: Cell Biology & Neuroscience

Mentor: Rafal Angryk, Charles Gray -- Computer Science, Cell Biology & Neuroscience

Finding repeated patterns in time series data: applications to the study of neural oscillations

Oscillatory voltage fluctuations in low pass filtered neural data are ubiquitous phenomena; because they are so often observed, many studies have detailed the physiological importance of oscillations occurring in different frequency bands. A major challenge for experimental and computational neuroscientists is to detect and characterize these oscillations in massive collections of time series data. Our approach to this problem is to first define epochs of high-amplitude oscillations in the gamma (40-100 Hz) frequency band, and then group the resulting epochs into clusters based on their similarity. Rather than summarize each oscillation by a set of features for comparison, we use dynamic time warping to calculate the Euclidean distances between the actual time series in our data set. After epochs are partitioned into distinct clusters, their association with experimental parameters is easily determined. This approach demonstrates the utility of using dynamic time warping to compare neural oscillations and determine their physiological importance.

Acknowledgements: Timothy Wylie, Michael Schuh, Nick Dotson - Computer Science, Neuroscience

Brooks Marshall: Chemistry & Biochemistry

Mentor: Timothy Minton, George Schatz -- Chemistry & Biochemistry (Northwestern University)

Reactions of Oxygen with Small Carbon Clusters

Small carbon species such as C, C₂, and C₃ are universal transient species in hydrocarbon combustion. They can also be produced from carbon based materials that are used in harsh oxidizing environments, such as thermal protection systems used on re-entry vehicles. A better understanding of the highly exothermic reactions of small carbon species with oxygen atoms and molecules will provide insight into reactions of carbon based materials. We have begun experimental studies of the reaction, C + O₂ --> CO + O. Carbon atoms are produced by laser ablation

of amorphous graphite at 355 nm, and the plume that is produced is entrained in a beam of O₂ seeded in a rare gas. CO products are detected either mass spectrometrically, or by resonance enhanced multiphoton ionization (REMPI). REMPI allows for quantum state specific detection of CO. The results from these experiments can be compared to theoretical results. In addition to the reaction of C with O₂, theoretical calculations have also been carried out on the reactions of atomic oxygen with C₂ and C₃. CO is the dominant product of all the reactions studied, and large fractions of available energy (~40-50%) may go into vibrational excitation of the CO product.

Acknowledgements: Sridhar Lahankar (Postdoctoral Associate), Mausumi Ray (Northwestern University), Biswajit Saha (Northwestern University) - Chemistry & Biochemistry,

Jaimie McNabb: Psychology

Mentor: Michelle Meade -- Psychology

The Effect of Perceptual Elaboration and Re-Study on False Memory in the Social Contagion of Memory Paradigm

The social contagion paradigm has demonstrated false memories occur for items when they are suggested to the participant during a collaborative recall phase. The current experiment examined the effect of perceptual elaboration (generation of sensory and elaborative details) and re-study (repeated encoding) on false memories in the social contagion paradigm. Participants either performed a perceptual elaboration task or completed a math filler task after viewing six slides and collaborating with the confederate. Half of the participants in each condition were given an opportunity to re-study the original slides. Perceptual elaboration increased false recall, but decreased false recognition. Re-study decreased false recall and only decreased false recognition if in conjunction with perceptual elaboration.

Jacob Munson-McGee: Microbiology

Mentor: Mark Young -- Microbiology

Diversity of CRISPR spacer sequences from Archaea-dominated hot springs

Viruses or virus-like particles are the most abundant entities on the planet, and play an essential role in evolution and ecology. Viruses have been identified that infect all three domains of life but little is known about archaeal viruses, and fewer than 50 have been discovered. The hot springs in Yellowstone National Park are dominated by Archaea and provide a unique opportunity to study archaea-dominated microbial communities and the viruses that infect archaea. Spacer sequences in the Archaeal CRISPR (clusters of regularly interspaced short palindromic repeats) loci are derived from viruses and may act as a timeline of viruses that have infected the cell. Through single cell genomics, we identified CRISPR spacers from high temperature (>80°C and acidic pH<4) hot springs and compared them to viral metagenomic libraries. We found that a majority of cells from the same Archaeal species have unique CRISPR loci and that only a small proportion of spacers are shared between cells.

Vanessa Murray: Chemistry & Biochemistry

Mentor: Timothy Minton -- Chemistry & Biochemistry

Hyperthermal Scattering of Atomic Oxygen and Argon from a Hot Carbon Surface

Hyperthermal scattering dynamics of argon and ground state atomic oxygen from a vitreous carbon surface heated to high temperatures were investigated. Angular and translational energy distributions were obtained for inelastically and thermally scattered species using a rotatable mass spectrometer detector. Argon and atomic oxygen collisions on the surface had incidence energies of 8 eV and 5 eV, respectively. The scattered products exhibited both thermal and non-thermal components. An increasing fraction of thermally scattered products was observed as the sample temperature was increased, consistent with increasing thermal roughening of the surface which leads to a higher probability of multiple collisions that drive the incident atoms into thermal equilibrium with the surface. Atomic oxygen reactions at the surface yielded carbon monoxide (CO) and carbon dioxide (CO₂). These products left the surface with a Maxwell-Boltzmann (MB) distribution of velocities described by the surface temperature. As the temperature was increased, the amount of CO produced increased and the CO₂ formed decreased, indicating that CO left the surface before it could react further to CO₂. The amount of CO produced reached a maximum at 1200 K and decreased with increased temperature, probably due to the importance of surface sublimation at high temperatures.

Acknowledgements: Philip (Tino) Woodburn, Sridhar Lahankar (Postdoctoral Associate) - Chemistry & Biochemistry

Matt Queen: Chemistry & Biochemistry

Mentor: Robert Szilagyí -- Chemistry & Biochemistry

Electronic Structure of [Ni(II)S₄] Complexes from S K-edge X-ray Absorption Spectroscopy

Nickel complexes with S-containing ligands can manifest both classical/metal-based (innocent), or inverted/ligand-based, (non-innocent) behavior. Using sulfur K-edge X-ray absorption spectroscopy, we established a spectrochemical series for [Ni(II)SR₄] complexes containing thiolate, aliphatic dithiolate, olefinic and aromatic enedithiolate, conjugated dithiocarboxylate, and aliphatic thioether ligands. In order to obtain quantitative S orbital compositions of the unoccupied frontier orbitals from XAS data, we developed a general method to estimate the S 1s→3p transition dipole integral for the above S-ligands by considering chemical shift in spectral features due to changes in the S effective nuclear charge among the ligands and as a result of binding to Ni. The XAS-based experimental orbital compositions are compared to a comprehensive set of density functional theory-based electronic structure calculations.

Andrew Rivers: Psychology

Mentor: Ian Handley, Keith Hutchison, Michelle Meade -- Psychology

Shifting Goals for Unconscious Thinkers: Reevaluation as Theoretical Test of Unconscious Thought Theory

Accumulating research evidence suggests that slow deliberative processes may actively integrate information even while conscious attention is directed elsewhere (Dijksterhuis, 2004). This “unconscious thought” process has been demonstrated to assist in creative problem solving, impression formation, evaluations of persuasive messages, and decision-making (Dijksterhuis Meurs, 2006; Dijksterhuis, Bos, & van Baaren, 2006; Ham, van den Bos, & Van Doorn; 2009; Handley & Runnion, 2011). However, an alternative explanation derived from the “Fuzzy-Trace” theory of memory and decision-making may account for the pattern of results without the need for an active, sophisticated unconscious thought process. To date, no published research directly addresses this potential alternative. The current experiment shifts criterion for successful judgments after information encoding to test between the two similar theoretical accounts.

Acknowledgements: Ryan Victor, Kristi Stefani, DJ Reimer - Psychology

Daniel Ross: Earth Sciences

Mentor: David Lageson -- Earth Sciences

Structural Geology of the North Half of the Swift Reservoir Culmination

The Swift Reservoir Culmination (SRC) is located in the Sawtooth Range of northwest Montana, south of Glacier National Park, where it forms an anomalous outcrop zone of imbricated and tightly folded Cambrian rocks approximately 20 km x 5 km. The anomalous nature of the SRC is underscored by the fact that Cambrian strata are typically exposed several thrust sheets west of the Sawtooth front, where regionally, the basal décollement has cut deeper into the stratigraphic section. The easternmost thrust carrying Cambrian rocks is the Major Steele Backbone (MSB), which has been interpreted as the roof fault of a hinterland-dipping footwall duplex involving Mississippian and younger strata. The MSB thrust sheet is internally imbricated and disharmonically folded along detachments in Cambrian shale, and well-developed axial-planar cleavage can be observed among folds in the Cambrian Steamboat Limestone. The importance of studying the SRC lies in its potential as an excellent outcrop analogue to subsurface duplex systems along the Rocky Mountain Front. Much can be learned about reservoir-scale structures and fabrics through detailed mapping, coupled with the construction of balanced cross-sections. This study will contribute a better understanding of the structural geometry of the “inner foothills” of the Rocky Mountain Front.

Bradley Towey: Chemistry & Biochemistry

Mentor: Robert Szilagyí -- Chemistry & Biochemistry

Quantification of S mixing of dithiocarbamate ligands in transition metal complexes

The molybdenum site of the iron-molybdenum cofactor (FeMo-co) of nitrogenase has been considered as one of the likely catalytic centers, where the stepwise biological reduction of dinitrogen to ammonia occurs. The MoFe₃S₄(S₂CNEt₂)₅ cluster, which is a biomimetic model of FeMo-co, was synthesized in a one pot reaction. The

determination of the electronic structure contribution of $[S_2CNET_2]^-$ (dtc) ligands to the Mo-3Fe-4S cluster is under development using multi-edge X-ray absorption spectroscopy and density functional theory (DFT). To understand the contributions of these ligands, a series of model dtc complexes for the S K-edge were also synthesized. Transition dipole integrals for dtc ligands were developed from electron paramagnetic resonance data of $Cu(dtc)_2$. The experimental covalencies from the S K-edge of $M(dtc)_x$ ($M=Cu(II), Ni(II), Fe(III)$ and $Mo(IV)$, $x=2,3,4$) were determined and correlated with DFT. The contributions of dtc ligands can now be employed towards the elucidation of the total electronic structure of Mo-3Fe-4S biomimetic models of FeMo-co.

Ryan Victor, Andrew Rivers: Psychology

Mentor: Ian Handley, Jessi Smith -- Psychology

After the Ink Dries: The Impact of Retracted Images on Attitudes Toward Past News Events and People

Although manipulated photography in news media has deep historical roots, anecdotal evidence suggests that the practice may be increasing in prevalence. This may result from broader access to photo editing technology or pressure to fit imagery to narratives that resonate with target audiences. Previous research suggests that altered photographs can create genuine memories for events that never took place (Sacchi, Agnoli, Loftus, 2007). Furthermore, these memories have been demonstrated to impact attitudes and future behaviors. Often though, images found to be altered using post-processing methodology are publicly retracted by publishing sources. The current experiment intends to examine the impact of such imagery long after they are retracted.

Geoffrey Wicks: Physics

Mentor: Aleksander Rebane, Mikhail Drobizhev -- Physics

A systematic evaluation of dipole moment generation in heavy-atom substituted chromophores through the use of two photon absorption

The two photon absorption (2PA) spectra of a series of weakly fluorescing heavy-atom substituted chromophores was measured via a newly developed nonlinear optical transmission (NLT) method, the accuracy of which allows for the quantitative investigation of the excited-state electronic molecular dynamics. The terminating groups of the chromophores have a systematically varied electron donor/acceptor property, which permits a determination of the excited state dipole moment and yields new information regarding conjugation across metal atoms in such molecules. A general overview of 2PA is given, followed by a brief description of the NLT method, and finally the exciting preliminary results and some of their potential consequences are revealed.

THE GRADUATE SCHOOL

Laura Brutscher: Molecular Biosciences

Mentor: Garth James, Elinor Pulcini -- Center for Biofilm Engineering

Bacterial Composition of Chronic Wounds

Chronic wounds are a serious medical issue for patients with underlying diseases such as diabetes and pulmonary disease. Often in these cases, skin epithelium can be damaged and made vulnerable to bacterial infection and biofilm formation. While eubacterial species such as *S. aureus*, *S. epidermidis*, *P. aeruginosa*, *Enterococcus spp.*, and *S. pyogenes* have been isolated from chronic wound samples, no previous studies have searched for archaea in chronic wounds. Archaea, predominantly methanogenic species, have been found in the gut, oral cavity, and vagina. Higher proportions of archaea have been positively correlated with diseases such as IBS, periodontitis, and vaginosis, thus archaea may play a role in chronic wound infections. In this project, patient chronic wound debridements were analyzed for presence of both eubacterial and archaeal species using 16S rRNA sequencing.

Sarah Ohlen: Molecular Biosciences

Mentor: Frances Lefcort, Martha Chaverra, Lynn George -- Cell Biology & Neuroscience

Neurovascular Interaction in the Peripheral Nervous System

Neurons and blood vessels develop in a parallel manner and are dependent on one another. Both systems migrate in close spatial and temporal proximity employing similar methods of movement. Investigating the parallel development of these systems allows for a more thorough understanding of each and the implications for neurovascular diseases. Here, we focused on two dynamic cell populations that give rise to this neurovascular unit, neural crest cells (NCC) and endothelial cells (EC), in developing chick and quail embryos. NCCs and ECs both receive signals from similar guidance molecules, but may also directly communicate with each other during development. The aim of this study was to elucidate this relationship. First, a spatial and temporal map of the two cell types was needed. This was obtained by using a transgenic quail model, immunofluorescent chemistry, and time lapse imaging. Second, ECs were focally eliminated to observe the effect on NCCs. Netrin was used as well as drugs SU5402 and SU416 blocking growth factors FGF and VEGF respectively. A pLenti virus containing the diphtheria toxin receptor driven off the tie1 promotor was also utilized for eliminating ECs. From live imaging, we found that NCCs and ECs not only migrate at the same time and through the same environment but they make direct cell contact through their filopodia. ECs also appear to “corral” NCCs forming the dorsal root ganglia (DRG) through ventral and rostral/caudal boundaries created by the perisomitic and intersomitic vessels (ISV) respectively. Reducing FGF and VEGF signaling successfully eliminated ECs. However, whether these factors act directly or indirectly on NCCs needs to be determined. Currently, we are investigating the VEGF blocker drug SU5416, netrin, and laser ablation techniques. While this study has given an insight into the direct cell interactions between these dynamic cell populations, we have yet to determine the exact molecular mechanisms that mediate neuro-vascular interactions.

Acknowledgements: Haley Dunkel, Jeannie Hunnicut – Neuroscience

2013 STUDENT RESEARCH CELEBRATION

UNDERGRADUATE ABSTRACTS

Sorted by Student Major

COLLEGE OF AGRICULTURE

Nathaniel Ellis: Plant Sciences & Plant Pathology

Mentor: Norman Weeden -- Plant Sciences & Plant Pathology

Using marker genes to aid in the development of a new crop type of pea and in the genetic mapping of pod trait genes in pea (*Pisum sativum*)

One of the objectives of this project was the creation of a new line of edible podded peas containing the purple pod trait among other genes. Currently this project has produced two lines of particular interest. One contains the edible podded trait as well as the purple colored phenotype. This first line also contains the wide pod trait. The wide/edible pod phenotype is often referred to as a snow pea. The other line contains the purple colored phenotype as well as the snap trait. The snap trait is notable because it gives a desirable thicker pod wall. The two lines will be crossed and from the produced offspring a line containing the traits edible pods, purple pod coloration, snap, and wide pods will be obtained. During this research I have tested various markers, including SSR and intron-targeted STS, for linkage with the snap trait. So far polymorphism in two markers has been observed. One of these seems particularly ideal for scoring the snap trait. In the production of the new purple-podded variety this ideal marker will aid in selection. There is also continued work on the fine-mapping and identifying the Pur gene.

Kenneth Gaskill: Animal & Range Sciences

Mentor: Tom Geary -- Fort Keogh Ag Experiment Station

Bovine In Vitro Fertilization and Embryo Development using Nano-particle Depleted Spermatozoa

In beef cattle, fertilization rates to a single service by natural service breeding or artificial insemination are between 90 and 100%. Field studies suggest that approximately 10% of embryonic mortality is the result of fertilization with defective sperm or sperm with suboptimal fertility. Therefore, the purpose of this study was to determine if in vitro fertilization and development could be used to help identify bulls with sub-fertile spermatozoa. Our hypothesis was that nanoparticle depleted semen (semen free of certain abnormalities) would increase fertilization and early embryo development by removal of compromised sperm. Semen from three bulls was sorted with two different methods (ubiquitin antibody or Lectin *Arachis hypogaea* agglutinin "PNA") and one remaining untreated sample for a control from each bull. Ten ovaries were obtained from a local abattoir. Oocytes from these ovaries were collected using standard techniques and matured in vitro. Approximately 100 oocytes were obtained for each semen treatment per bull. Matured oocytes were fertilized with semen from 1 of 3 treatments and cultured in vitro for 8 days. The number of oocytes that were fertilized and had undergone embryo cleavage was recorded 3 days following fertilization. In addition, the number of embryos that reached blastocyst formation by day 8 after fertilization was recorded. Fertilization and embryo development were compared between semen treatments and to a field study that used the same bulls and semen treatments. The development of laboratory procedures as used in the current study that mimic results of field trials may lead to more rapid improvements in livestock fertility for producers using artificial insemination. At this time, no results have been obtained. However, this study will be continued in the summer of 2013, and we anticipate that it will reveal critical information about semen characteristics related to early embryonic mortality, and thus, provide a more accurate measure of semen fertility than is currently available.

Eric Hester: Animal & Range Sciences
Mentor: Clayton Marlow -- Animal & Range Sciences
National Bison Range Rangeland Condition

I will analyze a set of vegetative data taken by a graduate student in 2010 from the National Bison Range and compare the findings to the official range condition report from the NRCS. Using ArcGIS I will compare the 2005 NRCS rangeland condition map with a similar map created from a 2010 vegetation inventory of the same area to learn if there are any significant departures in range condition. To measure if there has been a departure I will analyze percentage of climax vegetation from 2005 and 2010. I will use my data to test the level of agreement between the NRCS official map and the 2010 field based condition estimates. The soil map that forms the base for the NRCS evaluations could be so general that the broad scale scope of the official NRCS soil records could make the accuracy of their maps suspect in describing the condition of the National Bison Range rangeland communities. If my data is not similar to the official NRCS soil map I will create a map based on my own analysis.

Acknowledgements: Neto Garcia (Masters Student) - Animal & Range Sciences

Jakob Kammeraad: Plant Sciences & Plant Pathology
Mentor: Chaofu Lu – Plant Sciences & Plant Pathology
Characterization of Camelina sativa T-DNA mutants

Utilization of plasmid recovery could be a promising approach to increasing genetic information regarding *Camelina sativa*. *Camelina sativa* shows great potential as an oil-based alternative fuel, as well as a source of abundant omega-3 fatty acids. Currently, genetic information regarding *C. sativa* is limited, which restricts the ability to select specific varieties of interest. Insertion of the pUC57-DsRed plasmid would allow for a visual marker when selecting transformed lines. Isolation of novel *C. sativa* genes was increased by gene silencing, and screening for DsRed fluorescence. Along with the DsRed gene, pUC57 codes for ampicillin resistance for the selection of competent *E. coli* cells carrying the pUC57 plasmid. Digestion of the pUC57 plasmid with EcoRI improves chances of plant genome retrieval, as EcoRI sites are abundant in many genomes. After characterization of novel phenotypes, retrieved plasmid/genome fragments were sequenced. Sequenced fragments were then compared to the *Arabidopsis thaliana* genome, due to its close relation to *C. sativa*. Ideally, fragment sequences will match known genes in *A. thaliana*, and *C. sativa* gene function can be determined. Despite successful EcoRI digestion and plasmid retrieval, issues with contamination yielded inconclusive results. The plasmid recovery technique has potential for retrieval of gene fragments associated with fatty acid synthesis.

Gunduz Sinem Kocabas, Cansu Gumus: Land Resources & Environmental Sciences
Mentor: Cathy Zabinski -- Land Resources & Environmental Sciences
Comparison of Wind Energy in Turkey and Montana

All renewable energy, except tidal and geothermal power, ultimately comes from the sun. Approximately 1 - 2 percent of the sun's energy is converted to wind energy, which is about 50-100 times more than the energy converted to biomass by all plants on the earth. Wind turbines create constant, cost-effective, sustainable and pollution free energy, and wind energy has the potential to decrease dependence on oil, gas, and coal and to reduce damage to the environment. The goal of this research is to compare the wind energy in Turkey and in USA, especially in Montana. At the end of 2010 the wind power capacity in Turkey was 1,265 MW. The target of Turkish government is to increase this capacity to 25,300 MW by 2020. The installed wind power capacity in Montana in 2009 was over 270 MW. The target of the Department of Energy is to increase this capacity in 2030 to as much as 5,261 MW. The best reasons to increase power from wind energy are that the wind power reduces carbon dioxide (CO₂) and sulfur dioxide (SO₂), which are important greenhouse gases.

Christian Larson: Land Resources & Environmental Sciences

Mentor: Lisa Rew -- Land Resources & Environmental Sciences

Gallatin National Forest Road Decommissioning Study: Comparing vegetation between three different road treatments.

Due to a change in forest use and resource extraction the Forest Service has cut funding for the upkeep of their roads. This has led to the decommissioning of many Forest Service roads. This occurred locally in 2010 within Hyalite Canyon, Gallatin National Forest; three roads were decommissioned using different treatments: Untreated, Ripped and Seeded, and Recontoured. Using data gathered between 2010-2012 this study researched the relative effect of the different treatment types on plant species richness, abundance and diversity. Plant metrics were assessed both on road and off road at three sites for each of the different treatment types, plus at three sites that had been Ripped and Seeded 18 years prior. The results indicated higher richness on the active treatments sites (Ripped and Recontoured) and higher cover on the passive Untreated sites. They also indicated low similarity between on road and off road ecosystem structure; there were significantly different vegetation, bareground, and litter values. Non-native species richness was higher within the on road plots but not significantly different between treatment types.

Cahill Maffei: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

The Effect of Reservation Casinos on Community Welfare

In 1988 Congress passed the Indian Gaming Regulatory Act, establishing a legal framework for the creation of Native American casinos. Since this acts passage, over 240 Native American tribes have created more than 460 gaming operations (National Indian Gaming Commission, 2011). Unfortunately, the residents of reservation land are some of the most impoverished people in the United States, with some of the highest levels of unemployment, poverty, and alcoholism in the country. This project seeks to examine the welfare implications associated with the installation of casinos on reservation land and empirically tests them in two ways. First, I examine the effect Indian casinos have on unemployment and poverty at the county level, using slot machine data from reservation casinos. Second, an experiment is set up using various county level FBI crime statistics from 1980-1996 for young males against a dummy variable for the existence of reservations within a county. Additionally, this project will specifically report on the effect reservation casinos have had on the wellbeing of Native Americans in Montana.

Katie Rowe: Immunology & Infectious Diseases

Mentor: Jovanka Voyich-Kane, Tyler Nygaard, Shannon Moreaux -- Immunology & Infectious Diseases, Animal & Range Sciences

Characterization of Staphylococcus aureus Virulence Factors isolated in Equine Populations

Staphylococcus aureus (*S. aureus*) is a bacterium that is part of human and animal microbiota. *S. aureus* can invade a host and cause a variety of diseases. The gene *bla_Z*, is associated with penicillin resistance, and methicillin-resistance is encoded by the *mecA* gene (strains with *mecA* are known as methicillin-resistant *S. aureus* or MRSA). *S. aureus* also has an abundance of virulence factors that are directly cytotoxic to host cells. Virulence factors of *S. aureus* are not well understood in equine populations. The focus of the study was to characterize *S. aureus* virulence factors as well as antibiotic resistance, and compare results to studies involving human colonized *S. aureus* and equine colonized *S. aureus*. Methods involved isolating *S. aureus* from the MSU equine herd and looking at molecular characteristics through PCR amplification involving genomic DNA. It was concluded that equine characterized *S. aureus* shared the same prevalence of virulence factors as human colonized *S. aureus* does. Future studies will involve resampling the equine herd to see if re-colonization occurs with *S. aureus*-positive subjects. Investigate clonal relatedness of strains isolated. Characterizing more virulence factors, measuring phenotypic differences such as hemolysis capacity and investigate relatedness of strains isolated from handlers and horses.

George Schaible: Plant Sciences & Plant Pathology

Mentor: Gary Strobel -- Plant Sciences & Plant Pathology

Gene mining for the 1,8-Cineole synthase enzyme in the biosynthetic pathway of cineole production within the fungal species *Annulohyphoxylon* sp.

Annulohyphoxylon sp. is a fungal endophyte isolated from plant material of a lime tree (~*Tilia* sp.) -that was taken from the state of Florida. Analysis of the gases produced by the endophyte resulted in the detection of the monoterpene compound 1,8-cineole. This compound has been classified as a possible alternative fuel and is in need of optimization as a new fuel source. So far there has been no research done on the genes responsible for cineole production in *Annulohyphoxylon* or any other fungal species meaning this research is novel. 1,8-cineole synthesis has been mapped out in several species of plants and the genes according to the cineole synthase have been published on. Research has shown that horizontal gene transfer has been observed between fungi and plants suggesting the possibility that the fungal endophytes that reside in plant tissue could have possibly obtained some of their genes from their plant hosts. From this information it was inferred that genes in the fungal isolate *Annulohyphoxylon* sp. responsible for 1,8-cineole production could be similar to those in plant species. This project employed the polymerase chain reaction (PCR) technique to search for the 1,8-cineole gene in *Annulohyphoxylon* sp. by using primers designed from the genes of 1,8-cineole synthase in plants.

Ross Wardrop: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

Two shades of green: Does charging consumers a deposit on recyclable beverage containers influence their recycling attitudes more broadly?

Suspect atmospheric and climate anomalies have heightened environmental awareness worldwide. A facet of this eco-conscious movement is recycling. Container deposit legislation (bottle bills) has become popular as a policy solution that contributes to the reduction of litter while boosting the total amount of material collected by recycling programs. Because consumers realize a cost of not recycling, the total recuperation of beverage containers in bottle bill states is far greater than in states that do not have bottle bills. What is less known, however, is how bottle bills influence consumers' attitudes towards recycling more generally (i.e. when not faced with a monetary incentive). This project seeks to address this problem by comparing state-level container recycling rates (for both bottle bill and non bottle bill states) from the Container Recycling Institute with the results from the Game Day Challenge (a recycling competition between universities that is held throughout home football games). The underlying assumption is that consumers are not able to recycle for cash at football games, allowing them to make a non-monetary recycling decision. Comparing these rates will elicit consumers' preferences for recycling as either selection (consumers opt to recycle because of monetary considerations) or indoctrination (consumers become more environmentally conscious due to the program) effects.

Erika Whitney: Plant Sciences & Plant Pathology

Mentor: Matthew Fields -- Microbiology

Isolation and Characterization of a Novel, Benthic Diatom for Potential Bio-oil Production from Yellowstone National Park

Unique thermal features in the Heart Lake region of Yellowstone National Park were sampled for novel and unique photoautotrophs with the ability to accumulate lipid. The described project focuses primarily on the characterization an isolated diatom, YNP-1. The organism was identified via *rbcl* and SSU rRNA gene sequences, and the data indicated the diatom to be similar to several freshwater diatoms, especially a benthic *Lemnicola* species. Growth characterization consisted of chlorophyll, cell counts, and Nile-red assays for lipid accumulation as well as preferred nitrogen sources. Different reactor systems (tubular photobioreactor, drip-flow, and CDC reactors) were tested for both planktonic and biofilm growth modes and the impact on lipid accumulation by nutrient deprivation. The diatom preferred a benthic-growth mode, and transiently accumulated lipids upon nutrient deprivation.

Acknowledgements: Jacob Valenzuela (Doctoral Student) – Biochemistry

COLLEGE OF ARTS AND ARCHITECTURE

Colin Cashin: Film & Photography

Mentor: Cindy Stillwell -- Film & Photography

Paradox

“Paradox” tells the story of two young men who after inventing time travel, are confronted by a dangerous, mysterious stranger bent on preventing the use of this destructive invention by any means necessary. “Paradox” is a senior thesis film exploring the themes of free will and choice in the span of a ten-minute narrative. The film not only hopes to raise discussion among viewers on the previously mentioned topics, but was also used as a medium for raising new challenges for the filmmakers in its creation.

Acknowledgements: Stuart Deering, John Sweeney, Garrison Choitz, Max Mackin - Film & Photography

Thomas Gladbach: Architecture

Mentor: Thomas Wood -- Architecture

Lifecycle Embodied Energy Analysis and Reduction Strategies for Residential Housing in the Rocky Mountain Region

The research findings show areas of particularly high lifecycle embodied energy values over a fifty year period for a traditional stick framed single family residence. These values are disproportionately weighted not on the actual build process and the materials associated with this, but rather with the energy consumption and the methods of energy generation associated with this fifty year occupancy period. Electricity for baseboard heating as well as for other appliance usage shows very high embodied energy values. HVAC systems for heating and cooling also show very high embodied energy values. These systems all rely on extensive energy consumption throughout the supply chain networks from initial extraction of raw materials all the way through the end usage at the residence. Some materials associated with the actual build process also show disproportionately high embodied energy values relative to other building materials. This is again the result of extensive material processing. Reduction strategies need to be explored not only with material specificity, but also specific to entire building energy systems with disproportionately high embodied energy as well. These systems as well as specific materials have been “spot lighted” and energy reduction strategies have been outlined with preliminary designs and reduction methods explored.

Halley Heintz: Art

Mentor: Dede Taylor -- Art

Spanish Baroque Fusion Paintings

The emphasis of my research is the treatment of the Holy Family created by the artists Francisco de Zurbarán and Bartolomé Esteban Murillo. The subject of the Holy Family in a genre setting is a response to the efforts of the Church during the Counter-Reformation to appeal to common people, thereby encouraging their loyalty to the Papacy. However, different areas portrayed the Virgin Mary, Christ, and Joseph in regional styles. I observed how Spanish Baroque artists created a “fusion” of both genre and religious artworks by comparing Zurbarán’s “Christ and Mary in the House of Nazareth” and Murillo’s “Holy Family with the Little Bird” with other artworks from Netherlandish and Italian artists. To help prove the fusion style, I answered three questions. First, how would a viewer recognize the figures as the Iconic Family? Secondly, how does each work portray everyday moments like genre paintings? My last question is how these paintings showed religious and family values? These Spanish Baroque artists created a hybrid style that is visually proven through the mixed elements of both religious and genre artwork.

Abigail Ita: Film & Photography

Mentor: Nancy Mahoney, Theo Lipfert -- Sociology & Anthropology, Film & Photography

Curation Crisis

Hundreds of thousands of artifacts from Montana are housed the basements of museums, where they are required to be preserved in perpetuity at considerable cost, and are unlikely to ever be displayed for the public. Many of these artifacts were casually collected by citizens, rather than professional archaeologists, and have little research value. This project explores this poorly understood issue by examining the various pathways by which such artifacts officially and/or legally become part of collections in state and federal repositories, privately-funded county museums, and university departments. In particular, this research will focus on four case studies of personal artifact collections housed at the Museum of the Rockies, the Department of Anthropology at Montana State University, the Billings Curation Center, and the Pioneer Museum. The research uses video of interviews with museum professionals, archaeologists, and collectors to explore the practical and ethical issues involved in curating personal artifacts collections in perpetuity, and will be complemented with footage of archaeological sites, artifacts and the curation facilities. Research and interviews will continue until the end of the spring semester, and the footage will be edited into a 10-minute educational film that is expected to be completed in December 2013.

Jordan Larsen: Film & Photography

Mentor: Jenny Hatchadorian -- Film & Photography

So Sad To Say

So Sad To Say, is a short film about a boy who meets a girl and their struggle to keep their new found love alive in a world trying to keep them apart. Though we are not shooting our film until May, I am still planning on presenting at the MSU Research Celebration in April 2013. For our presentation, our main point of focus will be the promotion video we are submitting to Indie Go-Go for additional funding. It is series of short interviews with our Director, Director of Photography, Producers, and other crew heads. We will also have a monitor set up with links to our Indie Go-Go and Facebook pages, so people can view our promotional efforts. For our presentation poster we will have our film logo, created by a MSU Graphic Design student, presentations from our previous work, photos and biographies of our cast and crew, our budget, and a copy of the script.

Calin Mauch: Film & Photography

Mentor: Ian van Coller -- Photography

The Big Open

I can trace my roots back five generations to David Goodrich Hammond, who first homesteaded in what is known today as Garfield County, Montana. In an oral family tradition passed down through my mother, I was told that when my ancestors first settled in eastern Montana, the grass was a rich and vibrant green that came up past the waist, stretching for miles beyond what the eye could see. This area, however, is now undergoing radical changes with strip mining for surface coal, the discovery and development of the Bakken Oil Field, and new fracking technology which allows more extensive oil removal from the land's oil-rich shale. Bringing the corporate development of the grasslands into a public forum is paramount to me, having seen the destruction of these voracious corporations with regard to the environment.

Danielle Mullens: Film & Photography

Mentor: Christina Anderson -- Film & Photography

Thin Masquerade

A masquerade is defined as "pretending to be someone one is not." For someone with an eating disorder a masquerade is what their life becomes: a dance of secrets, lies, and another identity hidden behind a façade. Conservative estimates note 3 out of 100 Americans struggle with an eating disorder, targeting its victims in adolescent years. When an eating disorder is ignored and left untreated, 20% of its sufferers may die. While eating disorders are the number one killer of all mental disorders, this disease is not about numbers, it is about the individual. This body of work is about normal people who struggle with issues of control, insecurity, self-hatred,

neglect, and often abuse. Collected and viewed as a book, each person's story becomes a chapter. A chapter that is pertinent to their recovery, whether they are ready to begin that process or not. Within the covers of this book contains everyday struggles and secrets often locked away and disguised by the *Thin Masquerade*.

Vanessa Naive: Film & Photography

Mentor: Dennis Aig, Tom Watson, Stephanie Campbell -- Film & Photography

Little Princess

A picture may be worth a thousand words, but those words may not always ring true. In "Little Princess," photographer Aida risks becoming intertwined with a less than picture perfect family from behind the safety of her camera. This senior thesis story, written and directed by Vanessa Naive, is a deeply personal story criticizing the "picture perfect" mentality and divulges the secrets that lurk under the surface. It's about taking that first step into someone else's horror rather than just being witness to a tragedy that could have been prevented. The film also explores what it means to use art and media to expose unethical situations, and the line between creating awareness and exploitation. This film is relatable to anybody who has been the bystander to abuse, and also to those who have been a victim. "Little Princess" has the power to create self-reflection on how we take on the role as observer or activist in our own lives.

Acknowledgements: Jeff Dougherty, Conor Benson, Simone Cordery-Cotter, Sarah Beagle - Film & Photography

Paul Quigley: Film & Photography

Mentor: Tom Watson -- Film & Photography

The Making of a Green Screen Production

The presentation for *The Making of a Green Screen Production* will show, through film, how this project is put together. It will highlight scenes filmed using the green screen, showcasing the process used to produce a finished product. The end result is a fully fabricated city scape that takes the place of the green screen. This process is created during post-production and placed into the film to create the scenery. The green screen is not an easy tool to use in filmmaking. It requires many lighting and camera tests to create a product that does not look like a fake backdrop. This required extensive research and testing.

Sarah Riordan: Architecture

Mentor: Ralph Johnson -- Architecture

Research on Wastewater Systems in the Gallatin Valley and a proposed Living Machine Alternative

The purpose of my project is to research wastewater systems in the Gallatin Valley and develop a proposed *Living Machine Alternative*. The Living Machine is a wastewater treatment system that uses latest technologies and engineering to recreate the ecology of natural coastal wetlands to treat wastewater. From my research I will determine the appropriate size, environmental requirements, and energy/cost savings and apply an alternative treatment facility as a potential upgrade in the Gallatin Valley. The results found will benefit the University in state wide wastewater sustainability research and present an alternative method of treating wastewater and sewage focusing on sustainability and utilizing our resources in a more efficient way.

Jennifer Sanford: Music

Mentor: Jason Bolte -- Music

Spectral Diffraction

"Spectral Diffraction" is an original interdisciplinary composition incorporating film and music inspired by the physical properties of light. While creating this piece, a diffraction grating was placed in front of the camera lens, splitting an apparently white light into all the individual hues that create the beam. I overlaid the splitting of light with many eye shots, showing the windows to the soul in conjunction with the light. This reveals the connection between what we see when we look into a white light or someone's eyes, versus the complexity of parts that make up a human soul.

Jennifer Sanford: Music

Mentor: Jason Bolte -- Music

Spirit World

Sound is a series of sine waves added together to create specific timbres carried in a medium such as air. In music technology, we take these sounds and record them, changing amplitudes into data that can then be manipulated easily through a digital audio workstation. In "Spirit World," an original musical composition, processes such as convolution, FM synthesis, and granular synthesis are used to create a palate of sounds unique to this piece. The more familiar sounds create a worldly environment that quickly transitions into a less familiar and more ethereal plane of existence.

Andrew Stulz, Tyson Abel, Byron Groh: Architecture

Mentor: Ralph Johnson -- Architecture

Design Prospectus for the Reuse of the Abandoned Safeway Building

Andrew Stulz, Tyson Abel, and Byron Groh are working together to research the abandoned Safeway building on Main Street of Bozeman and independently develop programmatic designs for the reuse of the building in commercial, residential, and office settings. The goal of this project is to develop designs for specific aspects of reuse potential and combine those designs with our research to provide the city with options of transforming the presently abandoned space. It is also a goal of this project to preserve or salvage as much of the existing building as possible to reduce the need for demolition and new construction. Each researcher is focusing on one of the following building occupancy types: commercial, residential, and office to provide the city and/or the realtor company with displayable possibilities to generate ideas and conversation with potential buyers. Collectively, the research group has communicated with the realtor company for floor plans and structural information, other proposed uses, and to enter the building to more thoroughly study the integrity of the space and its overall feel. Thus far research has produced a site model and contextual studies of the location and surrounding area, scale models of each proposal fit onto the site model for contextual relation to the neighboring buildings. Researchers independently studied the building code and zoning to alter their design and parking scheme to match or exceed what was required for their respective occupancy type. Market conditions influenced the designs as researchers attempted to develop the most realistic and profitable proposals.

COLLEGE OF BUSINESS

Kathleen Chamberlin: Business

Mentor: Phenocia Bauerle -- Office of Diversity Awareness

Improving Campus Inclusivity: An Assessment of Minority Student Needs

Montana State University is a campus of students of diverse interests, countries of origin, ethnicities, socio-economic backgrounds, sexual identification, race, religion, and gender identity. The purpose of this project is to identify how students of all backgrounds feel they are being provided for by their university. Through dialogue sessions with MSU student organizations of traditionally underrepresented demographics, I will explore and subsequently analyze perceptions of community as well as the strengths and barriers that exist in making Montana State University an inclusive campus for all students. Part of the university's newly adopted Strategic Plan is to increase the diversity of its student body. It is one thing to admit a higher number of minority students, but another all together to retain them. I aim to discover ways that minority students may feel more welcome and provided for at Montana State University. Engaging current minority students to gain their perspective is an essential first step toward actions of change. It is the goal of the university to increase diversity, and it is my goal as a student of MSU to find ways to do so.

COLLEGE OF EDUCATION, HEALTH & HUMAN DEVELOPMENT

Michael Fast Buffalo Horse: Education

Mentor: Jioanna CarjuzaaJioanna Carjuza -- Education

Montana's Native American Tribes and Language Revitalization

Prior to European contact, it is estimated that as many as 300-500 Indigenous languages were spoken in what is now the U.S. and Canada (McCarty, Romero, & Zepeda, 2006). Today, although more than 200 of those languages remain, only 34 of them are being spoken by children as their maternal tongue. As a result of the genocide and linguistic suppression perpetuated by the U.S. government, in combination with the omnipresence of English in modern day life through media, technology, and schools, many ancestral languages are on the verge of extinction. In Montana, despite the rhetoric of tribal policies and the Native American Languages Act, the 11 Indigenous languages are endangered (Kipp, 2009). The traditional languages of Montana's Native American tribes are vital to maintaining important cultural aspects, these languages have been so greatly suppressed that the transmission of them to new generations has been severely disrupted due to cultural shame and a higher value being placed on the learning of English by parents, the general education system, and Montana's government. In our research we describe the current status of and efforts to restore, revitalize and maintain Montana's Indigenous languages. To do so we examine the effects of historical suppression of Indigenous languages and cultures, and highlight methods, materials, and motivation to save these languages and maintain a healthy speaking population. In our work, we embrace Sonia Nieto's view of social justice as a fundamentally political and democratic project which deals with power and promotes inclusivity and fairness (Nieto, 2000). Social justice in our context supports the sovereign American Indian nations' efforts to embrace self-determination and provide tribal members with an education focused on ancestral language, knowledge, and traditions.

Elena Harriman: English

Mentor: Sarah Schmitt-Wilson -- Education

The Fallacy of 'The Smart Kid': Grit and Goal Orientation as Determinants for Academic Success

According to recent research, certain personality traits and motivational constructs, the aggregate of which are referred to as "non-cognitive skills," are displacing measures of intelligence as the primary predictor of academic success. Using MSU freshman as the sample and two motivational constructs proposed by educational researchers, the research examines the correlation between a student's goal orientation style, ego-orientation or task-orientation, and his or her scores on self-control and grit scales. It was hypothesized that higher levels of ego orientation would be correlated with lower grit levels because ego-orientation precludes a student from developing the grit necessary to pursue a goal independent of performance evaluation. In contrast, higher levels of task orientation would correlate with higher grit scores. The results suggest that there is a significant relationship between ego orientation and perceived expectations, as well as a significant relationship between self-control and grit. In the future, it would be beneficial to explore the relationship among grit, self-control, and task orientation. The findings have implications for why students with a history of high academic performance often struggle when beginning college.

COLLEGE OF ENGINEERING

Alissa Bleem: Chemical & Biological Engineering

Mentor: Ross Carlson, Jeffrey Heys -- Chemical & Biological Engineering

Response Surface Analysis of Acetate Inhibition in Escherichia coli

Acetate is a ubiquitous byproduct of bacterial metabolism; its secretion is linked to competitive physiological functioning but it inhibits growth and reduces substrate yields. A better understanding of acetic acid inhibition is important to fundamental biology and the design of efficient industrial bioprocesses. The present study utilized a combination of experiments and computational modeling to quantitatively define the role of acetic acid as both a substrate and inhibitory byproduct. Wild-type *Escherichia coli* K-12 as well as a glucose-positive/acetate-negative *E. coli* mutant and an acetate-positive/glucose negative *E. coli* mutant were used to uncouple the effects of acetate on cellular behavior. Steady-state chemostat and batch reactor experiments measured culture specific growth rates as a function of acetate concentration and pH in the presence of excess glucose. These data were used with a symbolic regression approach to generate novel mathematical, acetate-based growth and inhibition terms as well as develop a response surface for these variables. In the presence of acetate, small changes in pH resulted in substantial changes in cellular inhibition quantified as specific growth rate. Additionally, synthetic consortia studies utilizing a combination of glucose-positive/acetate-negative and acetate-positive/glucose-negative strains demonstrated the emergent property of enhanced biomass productivity relative to monocultures. The computational model and accompanying experimental procedures establish fundamental quantification of acetate inhibition and provide a metabolic engineering paradigm which can be easily adapted to bioprocesses to improve system efficiency.

Acknowledgements: Hans Bernstein (Doctoral Student), Emily Harvey (Postdoctoral Researcher) - Chemical Engineering

Matthew Danczyk: Mechanical & Industrial Engineering

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

Two-Phase Immiscible Flow Through a Porous Medium

Demonstrations of numerical simulations and a mean field calculation show that immiscible two-phase flow in a porous medium behaves effectively as a Bingham viscoplastic fluid. The theoretical work claims the correct relation between change in pressure, across the porous medium, and the capillary number (Ca) scales as a power law with two distinct flow regimes. Previously done experimental work on two-phase flow through a porous medium in a low Ca system confirms the lower scaling regime that the theoretical work predicted. To experimentally verify simulations of the two distinct flow regimes, and expand upon previous experimental work, a more comprehensive range of pressure drops scaled as a power law with the Ca must be tested. To do this a high pressure bead pack was constructed to reach the high Ca regime. A conclusion has not been reached yet as to whether or not theoretical calculations correctly model two-phase flow through a porous medium

Acknowledgements: Joshua Bray (Postdoctoral Researcher) - Magnetic Resonance Lab

Steven Davis: Chemical & Biological Engineering

Mentor: Ross Carlson -- Chemical & Biological Engineering

Syntrophic Cyanobacteria and E. coli Consortia

Strategically chosen strains of photoautotrophic and heterotrophic bacteria were grown and analyzed in engineered consortia biofilms. In an attempt to synthetically replicate a naturally occurring syntrophic template, an artificial consortia comprised of cyanobacteria and *Escherichia coli* was assembled and analyzed. The presented experiments and data quantifiably demonstrate functional benefits of cross-feeding behavior.

Acknowledgements: Hans Bernstein (Doctoral Student), Alissa Bleem - Chemical Engineering

Mandi Durch: Chemical & Biological Engineering**Mentor: Garth James, Laura Boegli -- Chemical & Biological Engineering, Center for Biofilm Engineering*****Analysis of efficacy for various solutions for Negative Pressure Wound Therapy with Instillation against *S. aureus* biofilms***

Negative pressure wound therapy with instillation (NPWTi) can be used to treat infected medical devices. This project involved testing the efficacy of various solutions against *Staphylococcus aureus* biofilms. Biofilms were grown for 2 days on titanium coupons (to simulate an implanted medical device) in drip-flow reactors. The solutions were tested using an NPWTi system. Three-stage treatments (instillation, soak, negative pressure) were cycled over 24 hours. The solutions tested were: saline, acetic acid, Dakin's solution, 0.1% Prontosan, and 0.04% Prontosan. Surviving bacteria were enumerated by plate count and log reductions were calculated relative to untreated control biofilms. ANOVA was used for data analysis and mean log reductions were 3.1 (Prontosan 0.1%), 2.8 (Dakin's), 2.2 (Prontosan 0.04%), 1.3 (acetic acid), and 0.7 (saline). Pair-wise comparisons (Tukey's method) indicated that Prontosan 0.1% and Dakin's solution were both significantly better than saline ($p=0.0232$ and 0.0490 , respectively). Conversely, Prontosan 0.04% and acetic acid were not significantly better than saline ($p=0.2098$ and 0.8891 , respectively). It should also be noted that Prontosan 0.1% and Dakin's were not significantly better than Prontosan 0.04% and acetic acid. Overall, the results indicate that Dakin's solution and Prontosan 0.1% were the most effective for NPWTi in this system.

Kevin Ellingwood: Chemical & Biological Engineering**Mentor: Paul Gannon, Preston White -- Chemical & Biological Engineering*****Zinc Air Batteries and their Obstacles and Applications to Society***

With environmental and economic concerns always at question, there is a need for technology that will allow the world to transition from dependence on oil and other nonrenewable resources to energy that is not only clean but inexpensive. The application of the zinc air flow battery may just allow for that transition. The battery itself uses basic concepts of electrochemistry to store and reproduce great amounts of energy that is not harmful to the environment. Also, the battery is capable of being recharged after usage rather than thrown away like many other batteries. However, the implication of the battery to industrial use has obstacles as dendrites form through usage and buildup of other materials render the batteries useless. The conclusion of my research is still in process and yet to be determined.

Jude Eziashi: Chemical & Biological Engineering**Mentor: Paul Gannon, Roberta Amendola -- Chemical & Biological Engineering*****Measuring Cr volatility from ferritic stainless steels: Novel and conventional methods compared***

Reactive evaporation of Cr-species from ferritic stainless steels is a technical challenge for solid oxide fuel cell (SOFC) systems and other devices operating in high-temperature ($>600^{\circ}\text{C}$) oxidizing environments. One traditional method for quantitatively measuring Cr volatility is by using a transpiration system, in which oxidizing gases are flown by Cr-containing materials and the exhaust is condensed and subsequently analyzed using ICP-MS. While this method is well established and accurate, it also has limited sensitivity and challenges associated with sample collection. Novel methods have recently been developed to more quickly and accurately quantify lower levels of Cr volatility. These include the denuder technique, which employs a water-soluble reactive collection and optical analysis; a cold quartz wool collection method with ICP-MS; and, a cold Si-wafer collection with ion-beam analysis. Each method has advantages and disadvantages in terms of cost, operation, sensitivity and accuracy. In this poster, Cr volatility measurement techniques will be presented and compared in the context of facilitating new and ongoing research efforts.

Yida Fang: Civil Engineering

Mentor: Xianming Shi -- Western Transportation Institute

Best Practices to Protect DOT Equipment from the Corrosive Effect of Chemical Deicers

This presentation reports on the relevant information from collected data through an ongoing two-year research project with the goal of identifying, evaluating and synthesizing best practices that can be implemented to minimize the effects of de-icer's corrosion on DOT winter vehicles and equipment, such as design improvements, maintenance practices and the use of coatings and corrosion inhibitors. From a nationwide survey result, we can obtain that chloride-based deicers have the best efficiency for winter maintenance but cause serious corrosion problem to DOT winter vehicles and equipment. Based on the survey result, four anti-corrosion coating products (Zero Rust Red, Zero Rust Black, Rust Bullet and Lubra-Seal), four spray-on corrosion inhibitors (Krown, Ship-2-Shore, Vegetable Oil and Rust Oleum), and five salt removers (MR 35, HoldTight, ChloRid, SaltAway and Soap Water) have been identified and a screening test using electrochemical impedance spectroscopy (EIS) technique was conducted to compare their anti-corrosion performance in magnesium chloride solutions. The screening test results show that all of the selected anti-corrosion products, inhibitors and salt removers have good anti-corrosion properties. The screening test results of EIS also prove that the anti-corrosion products Zero Rust Black, Rust Bullet and Lubra-Seal have the best anti-corrosion property and inhibitors Krown and Ship-2-Shore along with salt removers HoldTight and ChlorRid also have the best anti-corrosion property.

Blaine Ferris: Electrical & Computer Engineering

Mentor: Todd Kaiser -- Electrical & Computer Engineering

Flexible Radiation Monitoring Strip with Particle Identification for use in a Wearable Sensor Network

This research project has explored the functionality and fabrication of flexible radiation sensor pixels. A process has been researched and developed to fabricate the radiation sensors. Sensor fabrication will begin in March in the Montana Microfabrication Facility (MMF).

The sensors will be fabricated on silicon wafers. The wafers will be doped in order to form a p-i-n junction for radiation detection. When radiation is presented incident to the sensor, the photonic energy will induce electron excitation. The produced electron-hole pairs will be swept to an external load by the intrinsic electric field formed by the p-i-n junction. The radiation spike will be monitored and characterized by the external load. The fabrication and preliminary characterization of the sensors will take place before the MSU Research Celebration in the MMF clean-rooms. Once fabricated, the sensors will ideally be implemented into a wearable network, or other malleable systems. The sensors will allow for the detection and characterization of incident radiation on the system. Additionally, because the sensors absorb radiation in the same manner as photovoltaic solar cells, they may be adapted to use the DC photonic input to generate energy in the external load.

Emma Garcia: Chemical & Biological Engineering

Mentor: Michelle Flenniken -- Plant Sciences & Plant Pathology

Viruses as Biomarkers for Honeybee Health

Commercially managed honey bee colonies pollinate numerous crops, e.g almonds, and therefore this industry contributes strongly to the vitality and production capacity of the agricultural industry and global food production. Since 2006, the annual loss of honey bee colonies has increased. The phenomenon known as Colony Collapse Disorder (CCD) is responsible for a portion of the honey bee colony losses. The factors believed to play a role in colony losses are pathogens (including viruses, fungi, bacteria, mites), agrochemical exposure, and colony nutrition. To address the hypothesis that viruses may serve as biomarkers for the sub-lethal effects of pesticides on honey bee health, we examined virus abundance in bees that were exposed to agrochemicals within their diet. Specifically, newly emerged bees were inoculated with a model virus (Sindbis virus tagged with green fluorescent protein (GFP)) before being exposed to the fungicide (Pristine) via their food, ensuring the bees were exposed to another stress in addition to the virus. The virus counts of the bees were monitored over the course of the experiment and analyzed using molecular biology techniques such as quantitative Polymerase Chain Reaction (qPCR), PCR, and Western Blot analysis of viral proteins. The objectives for this experiment include the increase in personal knowledge and skills in the microbiology field, the expansion of understanding of the effects of fungicide on honey bee health and colony systems, as well as the effects of two stresses on colony health. Analyzed bees

from a pilot study performed last summer demonstrates bee to bee variability in regards to the response to the pesticides, but the general trend seems to be that the greater the dose of pesticide, the greater the virus count. Analysis of this sample cohort is ongoing. More data will either result in a clear association of virus titer and agrochemical exposure or suggest that individual bee variability is the major driver of virus levels in bees. Future experiments involving additional agrochemicals and stresses (mites, nutrition, etc.) will be performed this summer and used to further evaluate the use of virus titer as a biomarker for honey bee health.

Derek Gengenbacher: Computer Science

Mentor: Clemente Izurieta -- Computer Science

The Struggle For Success In Fantasy Baseball Is Over

The Fantasy Sports Trade Association reported in 2011 that 32 million people played fantasy sports of some sort. It is estimated that nearly 40% of fantasy players vied for a portion of the \$1 billion up for grabs in fantasy playing fantasy baseball. Money like that drives competition, which makes any competitive edge over competitors via statistical information and analysis extremely important. In the world of fantasy baseball there are no shortages of websites to find information and statistical analysis to help back up your intuition. Sites like ESPN.com and CBSSPORTS.com are at the top of that list. However, these sites do not fully utilize historical data to make predictions about players and their fantasy value throughout a season. In my quest to win a portion of the prize money up for grabs, I have created software that will keep track of players based on their current season and their potential going forward based on their historical statistics. By tying these aspects into software that can analyze a player/trade and make projections about players values throughout a season, even the most novice Fantasy Baseballer will be able to make informed trade decisions with just a few clicks of the mouse.

Joshua Gosney: Chemical & Biological Engineering

Mentor: Jeffrey Heys -- Chemical & Biological Engineering

Force of Microbubbles in the Vascular System

Microbubbles have been recently developed to image pathology not previously detectable using current approaches. These microbubbles have ligands, which are specific for the desired target, attached to their surface. The bound microbubbles can then be imaged using non-invasive ultrasound. In vitro experiments have demonstrated the potential of microbubbles for imaging, diagnosis, and even treatment, but the conditions of the in vitro experiments were not consistent with the expected in vivo conditions, particularly with respect to the hydrodynamic forces on the microbubbles. To better understand and predict the effectiveness of microbubbles for disease detection, the hydrodynamic forces on the microbubbles needed to be modeled for various biological conditions, including within the human circulatory environment to determine if the proposed treatment method could be deemed feasible. An analytical model has been developed based on the well-known Navier-Stokes flow equations. The model estimates the lift force and drag force on a sphere using an approximate solution originally developed by P.G. Saffman. The necessary strength of the adhesion forces required to withstand the hydrodynamic shear, lift, and drag forces from different biological fluid flows has been determined to be within a range: 2.3×10^{-5} N to as low as 7.5×10^{-8} N, depending on the location in the system.

Kyle Gray: Electrical & Computer Engineering

Mentor: Wataru Nakagawa -- Electrical & Computer Engineering

Improved Silicon Nanostructure Characterization System

The Nano Optics Group is developing a number of polarization-selective optical devices based on nanostructures in silicon. In order to accurately analyze the optical properties of these devices, an optical characterization system is needed which can perform polarization-resolved measurements of both sample reflectivity and transmissivity. Several improvements were made to an existing tool to meet these needs. First, the imaging system was improved through the addition of control over the incoming/outgoing beam diameter in addition to a variable magnification of the image supplied to the camera. Next, the optical path was extended to allow simultaneous measurement of the input modes (transmission and reflection) as well as the possibility of phase-resolved detection using interferometry in the future. Finally, the data acquisition and processing software was substantially improved to simplify data acquisition and processing. The performance of the system was verified using known test samples,

and found to be acceptable. Further improvements to the system, as well as characterization measurements of nanostructured devices fabricated in the group, are ongoing.

Acknowledgements: Ethan Keeler - Electrical Engineering

William Hamel: Mechanical & Industrial Engineering

Mentor: William Schell -- Mechanical & Industrial Engineering

A Quantitative Approach Towards the Selection of Medical Tourism Destinations

Medical Tourism, the act of traveling across international borders to receive medical treatment, is an increasingly common practice as developed nations struggle to provide quick, affordable healthcare to their citizens. Although this practice is growing in popularity, currently no widely available mathematical model exists to assist patients in deciding the recommended location for a needed or desired procedure. This project creates a multi-attribute model to assist the patient with this decision by applying the Analytic Network Process (ANP). The model was developed using a multi-step approach that included identifying the attributes important in choosing a hospital and rating a sample group of hospitals on these attributes using both research and patient input. The model was built and tested using two surgeries commonly sought in medical tourism: hip replacement and rhinoplasty. Findings show how the model provides an unbiased framework that gives patients greater support when considering medical tourism and finding the hospital most suitable to them for their procedure. Through reviewing patient utilization of the pilot model, additional opportunities for model improvement are identified and recommendations for future work made.

Luke Hines: Computer Science

Mentor: Clemente Izurieta -- Computer Science

Non Profit Business Solutions Interdisciplinary Project

Non Profit Business Solutions is a project that describes a dynamic web application for nonprofit organizations. This application enables new and existing nonprofit organizations to connect with each other and establish new partnerships. The key content and services for this application were obtained via informal interviews and surveys with nonprofit personnel. "N.P.B. Solutions" is a weave of interdisciplinary elements from business and computer science, with the emphasis on business administration. The web application was created using the Java programming language. Software engineering components were incorporated to improve the flexibility of the web application, allowing for future modifications. Following the deployment of the initial project prototype, interviews with local nonprofit businesses will be followed up on to gain feedback on the services and information provided. Research into effective aspects of nonprofit business structures, budgeting techniques, and essential services for nonprofit organizations will be contained in the website. The end product will be a fully-functional, free web service application that centralizes resources, services, and other nonprofit organizations' information. The end product will allow nonprofit organizations to grow and expand, sharing resources through this web application.

Katherine Kent: Chemical & Biological Engineering

Mentor: Jennifer Brown -- Chemical & Biological Engineering

Rheological Response of Dilute and Semi-dilute Polymer-particle Dispersions

Polyacrylamide and alginate solutions were rheologically characterized with and without silicon dioxide nanoparticles (10-20 nm diameter) to determine how they behave when put under a stress. Polyacrylamide is a synthetic polymer used in enzyme immobilization and in the delivery of drugs, while alginate is an anionic biopolymer used in wound healing and cell transplantation. An AR G2 rotational rheometer was used to characterize 1% by weight solutions of polyacrylamide and alginate with and without silicon dioxide nanoparticles using linear and non-linear tests such as steady state flow, frequency sweeps and peak hold tests. Rheological experiments indicated that, with the addition of silicon dioxide nanoparticles, these polymer solutions behaved much differently and that varying the nanoparticle concentration greatly affected the type of rheological response observed. Further characterization of these polymer-particle dispersions could potentially lead to better control of fluid properties, necessary for design of materials for specific treatments and devices in the biomedical industry.

Acknowledgements: Chelsie Wharton - Mechanical Engineering

Arrika LaSalle: Chemical & Biological Engineering

Mentor: Edward Dratz, Duane Mooney, Mike Davenport -- Chemistry & Biochemistry

Automated Protein Extraction and Analysis

Proteins typically contain many post-translational modifications (PTMs) that change in response to biological/environmental stimuli, and that control protein activity, cellular localization, or partners in multiprotein complexes. Mass-spectral analysis characterizes PTMs, but since there are many possible combinations of PTMS it is often desirable to isolate the intact target protein isoforms using two-dimensional polyacrylamide gel electrophoresis (2DPAGE). Some of the proteins of interest are potential disease markers and are often present in low abundance, making recovery challenging. Current protein isolation and characterization methods suffer from long, manual processes, sample losses (low yields), and risk of contamination. Our protein extraction system aims to avoid these problems, using automated electrokinetic extraction, in-line protein digestion, and integrated mass-spectral analysis. Nanogram levels of fluorescently-labeled standard proteins are separated by sodium dodecyl sulfate 1D or 2D-PAGE. Target proteins are rapidly eluted directly from the gels into a microcapillary system, using a computer-controlled, high-voltage electric field, and sensitive fluorescence detection. A microfluidic bioreactor digests proteins into peptide mixtures and deposits the peptides onto a CHIP LC trap column, and then the peptides are resolved for mass-spectral analysis. The bioreactor and trap column will eventually be coupled with the extraction system with automated switching. Automation will reduce the manual portion of the process to loading the gel onto the device. Our system is efficient (~90% recovery of proteins) and 1-2 orders of magnitude more sensitive and faster than traditional processes.

McLain Leonard: Chemical & Biological Engineering

Mentor: Paul Gannon -- Chemical & Biological Engineering

Performance Of Electroless Nickel Plating On 441 Stainless Steel For SOFC Interconnect Applications

Solid oxide fuel cell (SOFC) systems are promising energy conversion devices due to their potential high efficiencies and fuel flexibility. Each cell consists of an anode, a cathode, and an electrolyte. To achieve appreciable voltage, SOFC systems often utilize a stack design in which individual planar SOFCs are connected in electrical series by a ferritic stainless steel (FSS) interconnect (IC), with or without protective surface coatings. SOFCs operate at high temperatures, leading to a thermally grown oxide layer on the IC outer surface. The real working condition of the stack demands the interconnect to be simultaneously subjected to high temperature (800°C) moist oxidizing conditions on the cathode side and moist reducing conditions on the anode side, creating a dual-atmosphere exposure. While single-atmosphere exposure (air-only) of the FSS have shown consistent oxide layer growth, during the dual-atmosphere exposure, anomalous oxidation have been observed and it could potentially lead to early fuel-cell degradation. To decrease the FSS oxidation rate, nickel has been considered as a protective coating for its high temperature resistance. In this study, the performance of electroless nickel plating on 441 stainless steel has been evaluated both in single (air only) and in dual atmosphere at operating temperatures of 800°C. Results have shown that highly anomalous oxide layer growth occurs in the dual-atmosphere environment leading to severe degradation of the protective nickel layer. A mixed chromium and manganese oxide within the nickel layer, along with an outer iron oxide layer contribute to the breakdown of the protective coating.

Gavin Lommatsch: Electrical & Computer Engineering

Mentor: Nathan Pust, Joseph Shaw -- Electrical & Computer Engineering

Characterizing Light Polarization in the Near Infrared

Knowledge about skylight is used in many different fields for different purposes, and polarization is one of the measurements of the sky which is used for things such as advanced sensing of aerosols for climate studies. The polarization of light varies with wavelength, and little is known about skylight polarization in the 0.7 to 2.5 micron range. To learn more about skylight polarization in this spectral range, a commercial spectrometer that measures the spectrum of light from 0.4 to 2.5 microns is used as a detector and is paired with a calibrated polarized optical module which is placed at the front of the input fiber. This setup is used to determine three of the four possible Stokes parameters describing the polarization state of the observed skylight. With these measurements, all linear states of polarization are characterized. Improvements on the system include automated operation using a

computer-controlled astronomical mount controlled by Matlab software that will also perform the full matrix-inversion-based polarization calibration.

Rachael Luhr: Computer Science

Mentor: Clemente Izurieta -- Computer Science

Visualizing the Flow of Multiple Currencies in Flux Networks

This research describes an innovative model to visualize the flow of currencies in flux networks. Visualizations are facilitated through the use of the Digistar 4 digital theater planetarium software developed by Evans and Sutherland. The initial focus of the visualization was to accurately represent temporal movement of a single currency. The movement of multiple currencies was then added to facilitate the visualization of significantly more complex simulation outputs. A currency is any artifact within a model that can be exchanged between components. A currency fluxes across components and can be modeled as a data flow between classes in the software. The final product consists of a software design and implementation that facilitates visualization of a simple model with multiple fluxing currencies. Each currency is separately described by an input file and can be controlled by a different time step; thus allowing each currency to behave according to separate clocks. The software was architected using cutting edge software engineering modeling techniques that are extensible and abstract so that future work to represent flows in any field of study can be easily integrated.

Daniel McDonald: Chemical & Biological Engineering

Mentor: Brent Peyton -- Center for Biofilm Engineering

Microbial Characterization and Health of Biofilters in a Large-scale Fish Hatchery

Biofilters are used in all recirculating aquaculture systems (RAS) and are an ecological means of controlling waste release and water usage in fish hatcheries. RAS incorporates the use of biofilters which provide surfaces by which complex bacterial communities can attach and potentially mediate the reduction of nitrate and oxidation of ammonia, redox products of nitrogen metabolisms which are known to accumulate in recycle streams of fish hatcheries. Identification and quantification of the microbial communities growing on the biofilters surface is a first step in understanding the growth and activity of beneficial microbial populations. Research has shown that in relation to Flow through Systems (FTS), RAS is far more beneficial toward survival and growth of fish populations. Pyrosequencing of the small subunit rRNA gene amplicon targeted the V1-V3 sequence region was used to determine genus level taxonomic classification. Three isolated recirculating filters were sampled at the Bozeman Fish Hatchery. 454 pyrosequencing began with DNA extraction from each separate filter. Samples from separate filters were maintained as isolated communities for comparative analysis after sequencing. Results include the identification of bacterial genera in this specific RAS system used for improving water quality and providing a sustainable water usage system. Comparative analysis of the separate sequencing results illustrated trends in microbial populations growing within the biofilters. Characterization of microbial community health may be possible by examining the taxonomy within each healthy filter and then comparing it to future sampling of "sick" biofilters.

Acknowledgements: Karen Moll, Dana Skorupa (Doctoral Students) - Microbiology

Erin McDonald: Electrical & Computer Engineering

Mentor: Hashem Nehrir -- Electrical & Computer Engineering

Electricity Use in Rural Kenya and the Economic Potential for Alternative Energy Source Implementation

The purpose of my research project is to collect data about electricity usage in the rural district of Khwisero, Kenya and analyze the information from an economic perspective to determine which, if any, types of alternative energy sources could be implemented in the community for the benefit of the people living in the region. The lack of a reliable electrical supply afflicts many regions in under-developed countries today, so my research will contribute to finding the solution to this problem. I will complete my project by traveling to Kenya and interviewing locals from Khwisero about day-to-day use of electricity. My research also entails recording locations where power is accessible and the different methods people employ to gain access to it. The information I collect will allow me to analyze the best way to bring electricity to the region that will benefit community members. My results will also positively impact current and future work in the region by Montana State University's chapter of Engineers

Without Borders. The duration of my trip to Kenya is five to six weeks, but pre-travel preparation and post-travel analysis will span approximately nine months. My faculty sponsor is Dr. M. Hashem Nehrir, whose research interests are in power management and alternative energy sources. I will work closely with him to research the strengths and weaknesses of different types of renewable power sources in order to complete my economic analysis.

Nathan Murphy: Chemical & Biological Engineering

Mentor: Brent Peyton -- Chemical & Biological Engineering

Cryopreservation and Staining Methods to Determine Cell Viability

Culturing algae in labs requires consistent time consuming transfers in liquid media to keep the algae in a healthy growth phase and in a condition that allows reproducible results. This project focused on determining an optimal method for cryopreservation of one green algae, *Chlorella vulgaris*, and one diatom, RGD-1, by varying an existing cryopreservation method developed by the University of Texas. These cultures were selected as being representative of a large array of cultures used in our lab. The cultures in our lab consist of both green algae and diatoms isolated from Yellowstone National Park primarily for their high lipid content which are used in studies of biofuel production. Current methods used to determine cell viability include plate counts and chlorophyll quantification before and after cryopreservation. This is not a very reliable method, since algal cultures do not grow well on plates. Due to the lack of information on both ways to determine cell viability and on cryopreservation methods, this project has turned into a more long term study. Improved techniques to store cultures for long periods of time without damage to the culture and still recover high viability could impact many labs that work with algal cultures. Therefore, an additional goal of this project was to identify a live/dead staining method to determine cell viability. The diatom cultures have been more of a challenge to find a live/dead stain as their cell wall is silica which does not readily stain with anything. Tests to stain diatoms for cell viability using nucleic acid stains are ongoing.

Acknowledgements: Karen Moll (Doctoral Student), Lisa Weeks (Masters Student) - Microbiology, Chemical Engineering

Hannah Newhouse: Chemical & Biological Engineering

Mentor: Brent Peyton -- Chemical & Biological Engineering

Strain identification and unialgal determination of Yellowstone green algae cultures using 454-pyrosequencing

Microalgae are considered a promising biofuel source, potentially helping to offset a proportion of the world's petroleum dependency. Current algal biofuel production efforts are focused on the isolation of naturally high lipid producers that can be used for biodiesel production. The isolation and characterization of numerous high lipid-producing algal isolates from Yellowstone National Park (YNP) necessitated the need for strain identification. Using high-throughput 454-pyrosequencing, the 18S rDNA gene sequence from nine different YNP strains was used for genus-level taxonomic classification, as well as to ensure axenic cultures were being properly maintained in the laboratory setting. Sequencing efforts focused on algal isolates with ongoing growth optimization and lipid accumulation studies. Sequencing was also used to confirm whether several algal isolates were actually a single strain, which was suspected based on similar morphological and growth characteristics. Results indicated that most cultures were unialgal, with a few exceptions. The confirmation of axenic strains helped to validate other research being performed by the MSU Algal Biofuels Group. Future work will include similar sequencing efforts using the internal transcribed spacer (ITS) region of the 18S-28S rDNA as a means of confirming results and determining species-level classification.

Acknowledgements: Karen Moll, Dana Skorupa (Doctoral Students) - Microbiology

Matthew Olson: Chemical & Biological Engineering

Mentor: Ron June -- Mechanical & Industrial Engineering

Improved Quantification of Cartilage Degeneration in Osteoarthritis

Arthritis has plagued man since the beginning of time, yet there is still no known cure. Treatments are used to alleviate pain and slow down the disease, but no method has been found to completely stop its progression. My research is focused on developing a model to better quantify and thus better understand the degeneration of cartilage in osteoarthritis. In order to accomplish this task we bred a novel transgenic mouse that contains

cartilage specific luciferin genes. When the mouse joints are injected with luciferin, the cartilage emits bioluminescence. Using in vivo imaging techniques we are able to quantify the amount light emitted thereby quantifying the amount of cartilage in that area. We believe that utilizing quantitative information about the cartilage without destructive histology will aid in improving the sensitivity of rodent osteoarthritis models.

James Pallardy: Mechanical & Industrial Engineering

Mentor: Doug Cairns -- Mechanical & Industrial Engineering

Composite Wind Turbine Blade Flaw Characterization

This research investigates the effects of defects in composite structures and how they may be characterized in order to prevent failure and predict material behavior. The flaws characterized thus far are porosity, in plane waves, and out of plane waves. The research includes developing manufacturing methods to control flaw characteristics in coupon sized samples as well as extensive material testing. Currently, models developed using coupon test data are being verified on a full scale wind turbine blade test with controlled flaws. This research has and will continue to provide valuable data to the wind turbine blade industry in investigating what types of composite flaws can lead to critical failure and in identifying flaws before a failure occurs, saving time and money in repairs and replacements of wind turbine blades.

Kyle Palmer: Chemical & Biological Engineering

Mentor: Brian Bothner -- Chemistry & Biochemistry

Analysis of Fatty Acid Methyl Esters from Sulfolobus during Viral Infection

Sulfolobus solfataricus is an extremophile found within natural hot springs. While this species is of great interest to the scientific community, there has been little information obtained in regards to its fatty acid profile, especially with STIV infection. By studying archaea, there may exist additional methods for understanding and affecting the pathogenic bacteria within the human microbiome. Isolating the fatty acid chains contained within the membrane lipids of the archaea and converting them to methyl esters can confirm the presence of fatty acids within microbes, which can then be analyzed through gas chromatography to determine the mass and identity of each compound. The project focused on obtaining the fatty acid profile of the *S. solfataricus*, namely the strain SsP2-3, both with and without STIV infection taking place, to see how the virus affects the profile. This was done by finding the Fatty Acid Methyl Esters, or FAMES. Through this method, it was confirmed that fatty acids can be identified through fatty acid extraction for *S. solfataricus*. At present viral infection has shown few changes within the SsP2-3 FAME process. More analysis is required to determine if STIV creates a substantial change of fatty acid content within SsP2.

Elle Pankratz: Chemical & Biological Engineering

Mentor: Brent Peyton -- Chemical & Biological Engineering

Growth Kinetic Studies on Cellulose Substrates by Ascocoryne sarcoides

The growth kinetics by *Ascocoryne sarcoides* were studied on three cellulose based substrates: glucose, carboxymethyl cellulose (CMC), and insoluble cellulose to determine optimal growth conditions for the endophytic fungus that produces fuel-related hydrocarbons. Cultures were grown in three oxygen conditions: aerobic, sealed batch, and anaerobic. Growth on the soluble substrates (glucose and CMC) was measured using turbidity (optical density wavelength 600 nm) and cell dry weight methods and growth on insoluble cellulose powder was measured using a modification of the Bradford protein assay. Results yield highest growth rate on CMC in sealed batch conditions while the highest biomass concentration was produced on insoluble cellulose in sealed batch conditions. Growth on cellulose powder was very slow relative to soluble substrates; studies were conducted to determine the effect on cellulase activity with the addition of phenolic compounds to growth media. Preliminary results show seventeen percent increase in cellulase activity during exponential phase with the addition of 1.7 mg salicylic acid per 5 mL *A. sarcoides* culture. More experiments will be completed using cellulose powder substrate to determine a final analysis of phenolic compound influence on cellulase activity.

Acknowledgements: Natasha Mallette (Doctoral Student) - Chemical Engineering

Todd Pedersen: Chemical & Biological Engineering

Mentor: Brent Peyton, Rob Gardner -- Chemical & Biological Engineering, Center for Biofilm Engineering

Analysis of TAG accumulation with the use of alternative grades of bicarbonate and alternative bicarbonate salts.

Culturing of microalgae for triacylglycerol (TAG) accumulation has increasingly become a focus of professional level research due to TAG's potential for use as a biofuel precursor. Most often, cultures are grown utilizing CO₂ as the inorganic carbon source. However, bicarbonate (HCO₃⁻), another inorganic carbon source, has also been shown to function as a lipid accumulation trigger in select strains of microalgae. Here, we amend cultures with bicarbonate salts, as the inorganic carbon source, in varying salt composition and grades, and detail the results using quantitative measurements of neutral lipids (i.e. TAG's). Cultures of *Chlorella vulgaris*, (UTEX 395) were grown until near nitrogen depletion in Bold's basal medium. They were then centrifuged and re-suspended in Bold's basal medium that is deplete of nitrogen and amended with bicarbonate salts. Inorganic carbon effects from sodium bicarbonate, potassium bicarbonate, and ammonium bicarbonate were studied in both scientific and industrial grades at 50 mM initial concentrations. Cultures were grown in triplicate batch flasks and cell density, media pH, chlorophyll a + b, and carotenoid concentrations were measured until maximum TAG accumulation. Lipid accumulation was monitored with an optimized procedure for Nile Red fluorescence with 20% dimethyl sulfoxide (DMSO) and incubated 10 minutes prior to fluorescence measurement. Nile Red Fluorescence ranged from 500 A.U. - 55,000 A.U. and remained close for both scientific and industrial grades of salts. Nile Red Fluorescence did not exceed 5000 A.U. for the 0 mM HCO₃⁻ control indicating the bicarbonate acts as an effective lipid accumulation trigger and does not have a noticeable decrease in lipid accumulation with industrial grade salts when compared to the scientific grade.

Varsha Rao: Chemical & Biological Engineering

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

Molecular Weight Characterization of Alginate Solutions

Alginate, a polymer found naturally in brown algae, is also produced by two strains of the bacteria *Pseudomonas aeruginosa*. This polysaccharide has a myriad of applications in the food industry, particularly as a thickening agent. Furthermore, with the addition of divalent cations, alginate, both from bacterial and algal sources, will form a gel, of interest as a biomaterial for biomedical applications such as tissue constructs. The alginates produced by these three different organisms are theorized to differ in molecular weight and degree of acetylation, which should alter their material properties in solution. The material property viscosity of the alginates were characterized via rheological methods. Viscosity was measured at different concentrations and was found to vary with type of alginate and the addition of sodium chloride. The intrinsic viscosity, an extrapolated value defined to be the viscosity of a material at zero concentration and no applied shear, was found for the algal alginate solution. Using the Mark-Houwink-Sakurada (MHS) equation, and accounting for the solvent-solute system and the temperature, the molecular weight of algal alginate was determined and the method validated to be used for the determination of the molecular weights of bacterial alginates.

Acknowledgements: Matthew Sherick, Sarah Vogt (Doctoral Student) - Chemical Engineering

Brian Redman: Electrical & Computer Engineering

Mentor: Joseph Shaw, Paul Nugent -- 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 and comparisons to existing cloud measuring instruments will be presented.

Acknowledgements: Sabino Piazzolla (NASA Jet Propulsion Laboratory)

David Riesland: Electrical & Computer Engineering

Mentor: Joseph Shaw, Nathan Pust, Paul Nugent -- Electrical & Computer Engineering

Developing a multi-wavelength optical aurora detector

The Aurora Borealis is a naturally occurring phenomenon that has captivated people for centuries. As a research and public outreach tool, MSU has developed and built several prototypes of an aurora detection system that detects the occurrence of an aurora event and notifies the public through cell phone text messages or emails. The current system uses single-channel instruments that measure oxygen emission at 557.7 nm, which is the green light most common from an Aurora Borealis. However, this system would fail to detect a rare all-red aurora, which is found at 630 nm, and has difficulty distinguishing between weak aurora emissions and scattered moonlight or light pollution. The current system is being upgraded with a multi-wavelength module to address these issues and increase system resolution.

Acknowledgements: Jasmine Brewer

Griffin Ruehl: Chemical & Biological Engineering

Mentor: Stephen Sofie -- Mechanical & Industrial Engineering

Synthesis of multivalent perovskite and scheelite structures for use as solid oxide fuel cell anodes

My research has focused on optimizing and characterizing the synthesis of ceramic oxide materials for use in solid oxide fuel cells. I am still in the process, but am progressing through my research by optimizing one factor at a time. I have developed various synthesis recipes and procedures and have fabricated numerous test batches of material. I have since transitioned to an analysis stage, and am characterizing the composition, structure, and morphology of the synthesized material using X-ray diffraction and scanning electron microscopy analysis techniques.

Skyler Rydberg: Electrical & Computer Engineering

Mentor: Wataru Nakagawa -- Electrical & Computer Engineering

Design and Fabrication of Optical Waveplates Using Silicon Nanostructures

One area of focus in the modern Optics field is the design of “effective materials” using nanostructures. These “effective materials” allow for a new approach to engineering optical devices. Instead of stacking or otherwise combining materials in macroscopic ways that allow for the expression of specific desirable optical properties, nanostructures allow for the development of composite materials that possess the desired properties. Silicon is an ideal medium for the development of these devices for several important reasons. There is an incredible wealth of knowledge available on nanofabrication in silicon that can be borrowed from the microelectronics industry. It is transparent to near- and mid-infrared light, which is suitable for a number of applications, including communications, environmental monitoring, and sensing. Additionally silicon is relatively cheap, abundant and is the native material for many MEMS devices. This project aimed to produce devices, called waveplates, that cause a relative phase delay in one of the polarization components of an infrared electromagnetic wave. Waveplates are critical components in any polarization-resolved optical system, and in this case are designed to be compatible with eventual integration onto optical MEMS devices.

Acknowledgements: Ethan Keeler, Kyle Gray, Carol Baumbauer - Electrical Engineering

Emel Sen: Center for Biofilm Engineering

Mentor: Brent Peyton -- Center for Biofilm Engineering

Microbial Community Dynamics In Open Pond Algal Biofuel Systems

Lake Velence, Fejér Hungary, is one of the important alkaline environments in Carpathian Basin, a region dominated by high pH lakes and ponds.(Voros et al., 2007) These systems can be used as a model environment for the design of open algal ponds for biomass production intended for biodiesel. The lake samples were monitored

for 6 weeks during the summer of 2012 and studied by DNA based molecular methods tied to hydrological parameters. 16S rDNA sequences of bacterial and 18S rDNA sequences of eukaryotic organisms were characterized and compared by using Quantitative Insights into Microbial Ecology (QIIME) Program. Bacterial Operational Taxonomic Unit (OTU) richness were estimated and correlated to lipid production and community stability. It showed that there is an important correlation between microbial richness and algal lipid production in the Lake Velence. As a model natural system Lake Velence has promising results, which can be used to develop strategies to stabilize and optimize algae growth and lipid production in an open pond systems utilizing naturally occurring communities for biofuel production in different regions of the world.

Acknowledgements: Tisza Bell (Doctoral Student) - Microbiology

Matthew Sherick: Chemical & Biological Engineering

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

An Examination of Reaction Front Dynamics and Microscale Structure Formation in Diffusive Microbial Alginate Gelation using Magnetic Resonance

Alginate is a biopolymer isolated from brown algae and certain genera of bacteria, such as *Pseudomonas aeruginosa*. Research involving alginate is relevant to biotechnology and biomedical applications due to its ability to form a physical gel with divalent cations, such as Ca_2^+ and Cu_2^+ . In this work, gelation properties of algal alginate and alginate from two mucoid *P. aeruginosa* strains are examined using magnetic resonance (MR) techniques. Each type of alginate studied differs in molecular structure and/or molecular weight, and differences in gel properties can be associated with these molecular variations. Gelation under diffusive reaction conditions is examined, which allows for analysis of microscale structure formation, such as capillaries. Imaging and 1D experiments performed on diffusive gelation of alginate show that, under certain conditions, bacterial alginates have a higher reaction rate than algal alginate, as characterized by reaction front dynamics. Imaging techniques have been used to observe capillary formation in each type of alginate gel, with algal alginate gel forming highly ordered capillaries in the presence of low NaCl concentration. Capillaries in algal alginate gel are also shown to coalesce under certain conditions. Finally, results from related experiments involving the diffusion of microbeads through a homogeneous alginate gel are shown.

Acknowledgements: Varsha Rao - Chemical Engineering

Sean Stettner: Chemical & Biological Engineering

Mentor: Seth Walk -- Microbiology

Multilocus Sequence Typing (MLST) of carbapenemase-producing Klebsiella pneumonia isolates from symptomatic patients

Klebsiella pneumoniae is a Gram negative bacterium that often causes nosocomial as well as community acquired infections which can prove severe when the isolates display antibiotic resistance. In this study, we used MLST, a nucleotide sequence based approach for genotyping isolates, to characterize a collection of 50 *K. pneumoniae* isolates from the Loyola University Medical Center that produce carbapenemase, an enzyme that provides resistance to beta-lactam antibiotics. MLST examines the DNA sequence of a set of genomic loci within seven housekeeping genes that can be amplified from all isolates using PCR. Nucleotide polymorphisms within each gene are used to define distinct alleles, and all of the combinations of alleles are used to define distinct sequence types (STs). Nucleotide sequences are compared to an online *K. pneumoniae* MLST database at the Institut Pasteur to identify isolate STs. This information allows us to determine whether resistance determinants were likely to have been transmitted or whether a single *K. pneumoniae* clone was responsible for disease.

Luyun Su: Chemical & Biological Engineering

Mentor: Chaofu Lu -- Plant Sciences & Plant Pathology

Overexpression of PDCT Enzymes in Camelina Seeds

In this project, I chose *Camelina sativa* as my target plant to study the oil content. The prior objective in my project was to test whether the overexpression of PDCT in Camelina can finally increase the oil content and change the plant's features. So, first step in my project was to construct a recombinant plasmid with mutant ROD1 gene. By using the digestion and ligation techniques, the mutant ROD1 gene was inserted into the pBIN vector. Additionally, a Ds-Red marker was added to the plasmid as well, to color the trans-genetic seeds to red. Second, the recombinant plasmid was transferred to the Camelina MT5. This transformation was achieved by Agrobacterium-mediated transformation, which uses Agrobacteria (which carries the foreign gene) to infect plants. The third step was to harvest Camelina seeds. The dry seeds were collected based on different lines. In each line, red seeds were divided from brown seeds. The fourth step was to use various methods to analyze the differences between red and brown seeds, to finally tell whether the overexpression of PDCT has changed plants' original features and increase the seeds' oil. In the germination test, the germination of red seeds was 34.40% higher than the germination of brown seeds. This difference indicated that the germination potential of trans-genetic red seeds was higher than the normal seeds. After the weight measurement, the weight of red seeds was 8%-10% higher than the weight of brown seeds. Because the difference was not significant, thus it was hard to say that the trans-genetic red seeds had a higher weight. The result from the oil measurement was unsatisfying. The average oil content of red seeds was 27.53%, while the brown seeds' oil content was 26.42%. Even though the number 27.53% was greater than 26.42%, as the oil content in Camelina has a range of 35%-38%, these two numbers were too low to be real. In this case, my mentor and I finally decided to replant these red seeds to obtain a second generation. A further oil measurement should be done on the second-generation seeds.

Dayla Topp: Center for Biofilm Engineering

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

Application of a Michaelis-Menten Based Kinetics Model on Ureolysis by *Sporosarcina pasteurii*

Microbial kinetics is a major part of predicting rates of microbially driven processes in natural and engineered systems. Urea hydrolysis is one reaction that occurs in several environments, such as soils, wastewater treatment and the human urinary system, where it can induce kidney stone formation. It is also a key reaction that can promote microbially induced mineral formation, which is being studied for engineering applications. However, one of the biggest challenges to making this technology field relevant is understanding the dependence of urea hydrolysis on factors such as cell density, pH, concentration of urea and potential product inhibition by ammonium. The aim of this research was to develop a Michaelis-Menten enzyme kinetic model of urea hydrolysis by the ureolytic bacterium, *Sporosarcina pasteurii*. Results showed that the data fit a Michaelis-Menten model best with an R^2 value of 0.95. The K_m and V_{max} were found to be $181 \frac{mmol}{L}$ and $280 \frac{mmol}{Lhr}$, respectively. Within the cell density range that was tested, a linear correlation between rate and optical density was observed, indicating that the rate correlates with cell density. This knowledge could be used in model simulations of processes that include ureolysis, such as biomineralization for applications like carbon sequestration, in the near future.

Daniel Wagar: Computer Science

Mentor: Clemente Izurieta -- Computer Science

Machine Translation Software for Undocumented Languages

The focus of this research project is to develop software capable of aiding in the process of translating text from a known language to an undocumented and unrecorded language. Typically, machine translation relies on a bilingual corpus in order to perform statistical analysis which allows rules relating two languages to be discovered. Since no bilingual corpus is available in developing the translation of an undocumented language, this research project focuses on the development of more rudimentary techniques such as word order transference and user defined rules in order to create the most accurate translation possible. The result of these techniques is a trial translation which is highly useful to a team of translators who are seeking to develop a sophisticated translation of a text from a given, known language to a poorly known and undocumented language.

Logan Warberg, Alison Figueira: Computer Science
Mentor: Hunter Lloyd -- Computer Science
Computer System Review and Design for NASA Lunabotics 2013

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
Laboratory Flow System of the Human Urinary System

Proteus mirabilis is an infectious bacterium known to contribute to the formation of kidney stones, and is especially harmful to individuals with long-term catheters. *P. mirabilis* is a ureolytic bacterium, meaning that it can hydrolyze urea to ammonia and carbon dioxide. The rise in pH due to ureolysis as well as the ammonium and carbonate produced through this reaction are thought to contribute to the formation of struvite kidney stones. My goal in this project was to develop a laboratory model flow system which would allow for the testing of the spatial and temporal relationship between biofilm formation of *P. mirabilis* and mineral formation. We are interested in the biofilm formation of this organism, and how biofilm growth might affect the precipitation of kidney stones. Other experiments utilizing this system could include other infectious bacteria, as well as medications and their effects on the formation biofilm and kidney stones in a controlled setting. The model itself consists of a chemostat kept at 37°C which models an infected kidney, connected to tubing the size of a normal catheter, through which the culture is pumped in a solution of artificial urine. A capillary is connected in line with the tubing for imaging and observation purposes. Observation of the biofilm and mineral formation over time in the capillary can be achieved with a stereomicroscope to determine if mineral formation is associated with the biofilms. Analysis of the fluid exiting the capillary is performed to evaluate changes in the fluid chemistry including pH, urea degradation and precipitation of dissolved salts into the kidney stone minerals. If successful this model could allow for direct measurements of conditions which could contribute to the formation of kidney stones, and allow for careful monitoring of all conditions within the experiment.

Christopher White: Chemical & Biological Engineering
Mentor: Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering
Self Diffusion Coefficient Model Development of HPMCAS Polymer Solutions and Gels with PGSE NMR

Spray drying is an important industrial process that is commonly used, particularly in drug production. In this process, a solution is sprayed through a fine nozzle and then passed through a hot drying gas that evaporates the solvent. The desired product is obtained as a fine, dry powder. Since this is a diffusion dominated process, diffusion coefficients are needed to model and optimize the spray drying process. In this project, the diffusion coefficients of hydroxypropyl methylcellulose acetate succinate (HPMCAS) and acetone were measured in different solutions of acetone and HPMCAS with varying weight percents of HPMCAS. In the future, this data could be used to design an effective spray drying process. One of the best and most accurate methods of determining diffusion coefficients is pulsed gradient spin echoes (PGSE) on a high field NMR magnet. With this instrument, the coefficients of diffusion can be spectrally resolved. However, it is difficult to make high polymer concentration samples because, a solution of roughly 20 weight percent HPMCAS in acetone will gel. Much of this project involved creating methods to make and measure solutions with a high weight percent of HPMCAS in acetone.

Acknowledgements: Nathan Williamson (Masters Student) - Chemical Engineering

Cailin Wilson: Mechanical & Industrial Engineering
Mentor: Joel Cahoon -- Civil Engineering
Effects of Bubbly Flow on Acoustic Doppler Velocimeter

The Acoustic Doppler Velocimeter (ADV) is an instrument that is used to measure the velocities of water in three dimensions, and is often used in both hydraulic research facilities and the field. The device is easy to set up and handle, but requires continuous connection to a laptop computer during use. The ADV can record both the velocity of flow and the deviation from the mean velocity (a measure of turbulence) in the three cardinal directions at a rate of up to 30 Hz. Experience with the device in a chaotic flow field (Plymesser, 2012) has shown that the device suffers from calibration deficiencies in flows where air bubbles create spike noise (Mori, 2007). This project is testing how air bubbles entrained in the flow affect the ADV velocity estimates, and will develop a calibration based on the air bubble (mass) to water ratio in the range where the air bubbles should be considered. Preliminary data analysis indicates a strong correlation between the amount of air bubbles in the water and the reliability of the ADV. The analysis is still ongoing.

Micah Workman: Computer Science
Mentor: Clemente Izurieta -- Computer Science
Automated Theorem Prover

This work describes an Automated Theorem Prover. The system is designed to accept a hypothesis and set of assumptions in the form of propositional logic. The hypothesis is then proven by a series of proof steps upon the assumptions. The focus of the work centers on making the computer's process understandable and to make the steps easy to follow in order to assist students and users with their own proof techniques. Various techniques from the field of Artificial Intelligence have been used to make the theorem prover more efficient. In general this Automated Theorem Prover can solve simple problems in logic and assist those in learning logical proof.

Kaysha Young, Erica Pimley, Kelly Borden: Mechanical & Industrial Engineering , Exercise Science
Mentor: Laura Stanley -- Mechanical & Industrial Engineering
Are Teen Drivers Aware of the Top Five Dangers Affecting their Safety?

This research aims to determine if teenage drivers are aware of the top five dangerous activities that affect their high fatality rate. The top five dangers are night driving, speeding, alcohol, distractions (cellphone/texting) and low seat belt use (www.t-driver.com). Methods: Four high schools are taking part in this study, two rural and two urban schools. One urban and one rural school have been selected to be treatment schools. All four high schools administered surveys to students (2,733 students) to determine what students thought were the most dangerous driving activities. From these survey results student organizations in the treatment schools are conducting activities to educate their peers on the top five driving dangers. At the conclusion of this study a survey will be administered to evaluate the effectiveness of peer-to-peer traffic safety education. It is thought that through positive peer pressure students will choose to engage in safer driving practices. Results to Date: Thus far, students in both treatment schools chose alcohol, distractions, texting, cell phone use and carelessness as the top five dangers. Students will be educated through the peer to peer learning activities to determine if the activities taught them the true top five dangers.

Hauwa Yusuf: Computer Science
Mentor: Clemente Izurieta -- Computer Science
EAS: Efficient and Applicable 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 and students 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 yield different results on the same of data set (due to

differences in mathematics and mechanics of the package). The majority of users are unaware of the mathematical differences and so they choose arbitrary packages to perform a test, as long as that package contains the name of the test they seek. This leads to the researcher and/or student unknowingly reporting erroneous results. This project is 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.

Neerja Zambare: Chemical & Biological Engineering

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

Biofilm Induced Biomineralization in a Radial Flow Reactor

Biomineralization is the formation of minerals by living organisms, which can be performed actively or passively as in the case of microbially induced mineralization. Microbially induced calcium carbonate precipitation or MICP occurs when bacteria create conditions favorable for carbonate precipitation in an environment. MICP is being looked at as a reinforcement technique. Some potential applications of MICP are sealing fractures around wells to prevent leaks, sequestering heavy-metal contaminants in groundwater by co-precipitation with carbonate minerals, or making subsurface barriers to prevent flow by plugging subsurface pores. These applications all involve injecting MICP treatments into wells, where radial flow of fluids can impact the transport and reactions involved in MICP. Our research deals with ureolytic micro-organisms which facilitate calcium carbonate precipitation under engineered conditions. We specifically deal with *Sporosarcina pasteurii* which contains an enzyme that catalyzes the hydrolysis of urea (aka ureolysis). The main objective of this project was to study the effects of calcium carbonate precipitation formed by a bacterial biofilm on fluid flow through porous media. The radial flow reactor is made of two circular parallel plates with 1 mm diameter glass beads packed between the plates, which comprise a porous medium. The effects of varying parameters on calcium carbonate precipitation are being investigated through this project. The parameters that are being varied are the calcium media flow rate and the urea to calcium concentration ratios. Three experiments with flow rates of 2.5 mL/min, 5 mL/min and 10 mL/min have been performed. Plugging in certain regions by the precipitated calcium carbonate caused flow channels to form. Tracer study photos showed how preferential flow had developed because of the plugging. Current experiments at a flow rate of 5 mL/min have shown an average carbon precipitation efficiency of 12%. In comparison, at the slower flow rate (2.5 mL/min), 14% of the influent calcium was precipitated in the reactor. Concentration varying experiments are currently in progress. The results of these studies will provide us with data to quantify the effects of fluid velocity on biofilm induced biomineralization. Relationships for fluid velocity, calcium carbonate formation, ammonium formation, plugging of the pore space etc. can be formed based on the data from this project. The Damköhler number for flow in this radial system is being studied based on the calcium precipitation rates and the spatial fluid velocity.

Eric Dietrich, Varsha Rao: Civil Engineering , Chemical Engineering

**Mentor: Anne Camper, John Doyle, Mari Eggers, Tami Old Coyote -- Center for Biofilm Engineering
Crow Environmental Health Steering Committee, Little Big Horn College**

Service Learning to Address Drinking Water Quality through Community-Based Participatory Research on the Crow Reservation

This investigation tested prototype biofilm filtration units as a source of safe drinking water on the Crow Reservation through a collaboration between the Crow Environmental Health Steering Committee, Amway Corporation and MSU's Engineers Without Borders (EWB) chapter. In response to long-standing community concerns about the poor quality of well water available to homeowners in rural areas on the reservation, Amway-designed and donated units were tested as a potential means to treat surface water as a substitute. Working with community members who operated prototype units in their homes, EWB student members conducted sampling trips on a monthly basis for eight months, testing source and product water for microbial contamination and collecting source water samples for chemical analysis. Qualitative data were also collected regarding operators' experiences with the units, indicating in combination with quantitative data that they represent a viable water treatment technology for Crow homeowners. Additionally, the project, which ultimately provided 15-20 students with a hands-on research opportunity and meaningful cross-cultural experience, represents a potential model for future efforts to foster engagement experiences at MSU and in other higher education settings.

Acknowledgements: Chris Allen (Doctoral Student) - Environmental Engineering

COLLEGE OF LETTERS AND SCIENCE

David Aderholdt: Cell Biology & Neuroscience

Mentor: Christa Merzdorf -- Cell Biology & Neuroscience

Evaluation of the interaction of Zic1's interaction with Beta-Catenin in Xenopus Laevis embryos

Wnt signaling is involved in many aspects of embryonic development and Wnt pathway-Zic interactions are thought to play roles in embryonic development. The Aruga lab has determined that Zic transcription factors interact with the Wnt/beta-catenin signaling pathway by binding to the Tcf transcription factor, thus inhibiting the binding of beta-catenin through competitive inhibition (Fujimi et al., 2011). This project aims to determine how the Zic1 transcription factor interacts with Tcf to block its normal function in neural tube development. When beta-catenin is injected into the ventral side of *Xenopus* embryos, it causes formation of a second axis, including a second neural tube. Zic transcription factors are able to inhibit dual axis formation caused by beta-catenin (Fujimi et al., 2011). So far it has been established in this project that Zic1 transcription factor does inhibit the dual-axis formation caused by both wild-type beta-catenin and constitutively active beta-catenin. Thus, the results of this project further establish the Aruga lab's work. Injection of embryos with constitutively active beta-catenin resulted in a 77.9% induction of dual-axis development. Co-injection of Zic1 with the constitutively active beta-catenin resulted in 19.5% of embryos showing dual-axis development, a 58.4% reduction from injecting constitutively active beta-catenin alone. Injection of wild-type beta-catenin alone in embryos has shown a 54% induction of dual-axis development. Injection of Zic1 with the wild-type beta-catenin resulted in 14% of embryos showing dual-axis development, a 40% reduction from injecting wild-type beta-catenin alone. Future work on this project will test the ability of Zic1 deletion mutants to inhibit beta-catenin's interaction with the Tcf transcription factor.

Kyle Allemeier, Jacob Danczyk: Physics, Mechanical Engineering

Mentor: Hugo Schmidt, Paul Rugheimer -- Physics

Growing Barium Zirconate Films by Pulsed Laser Deposition for use in Low Temperature Solid Oxide Fuel Cells

Solid Oxide Fuel Cells typically have an operating temperature in excess of 600°C, which results in some unique disadvantages. Among these is the necessity of using expensive materials capable of withstanding the high operating temperatures involved. The utilization of Low Temperature Solid Oxide Fuel Cells, operating from 350-600°C, would have numerous benefits. Such benefits include equivalent or even increased performance, the ability to use more traditional, less expensive materials in the construction of the cell, and an increase in the long term stability of the device. Proton conducting electrolytes offer lower activation energies than more common oxygen conducting materials, and thus are an important area of research in efforts to reach lower operating temperatures. This research will attempt to grow Yttrium-doped Barium Zirconate (BZY) thin film electrolytes. This will be accomplished via Pulsed Laser Deposition (PLD), which offers further enhanced performance as the films resulting crystal structure will be nearly defect free.

Susan Andrus: Sociology & Anthropology

Mentor: Danielle Hidalgo -- Sociology & Anthropology

Children are for Women and Sports are for Men: Gender and Heteronormativity in Local Print Advertising

Although much attention has been paid to advertising, particularly to the portrayal of women in advertising, most research has focused on advertising with a wide geographic audience. In contrast, this paper looks at the reinforcement of gender and sexuality stereotypes in print advertising in and around the community of Bozeman, Montana. This narrow focus paints a more accurate picture of the advertising encountered by this population.

An analysis of more than 1,800 local magazine and newspaper print ads from fall 2012 showed that Bozeman-area advertising commonly used gender stereotypes and robustly supported heteronormativity. Women were more often depicted as caregivers and men were engaged in work activities or leisure activities outdoors. Women were also more often shown in part, with unnecessary nudity, or engaged in what Erving Goffman dubbed the "feminine touch." Heterosexuality was reinforced through the depiction of heterosexual couples and, especially, families with young children. Understanding the messages sent through advertising is important, as is keeping a critical eye open for outdated messages or messages that do not accurately represent the values of the community. This

research illuminates the specific types of advertising messages the community of Bozeman, Montana is exposed to on a daily basis.

Gabrielle Antonioli: Ecology

Mentor: Frances Lefcort -- Cell Biology & Neuroscience

Investigating the Role of FGF8 in Neural Crest Cell Dynamics During Formation of Dorsal Root Ganglia and Sympathetic Ganglia

This project investigated the role of fibroblast growth factor (FGF8) in neural crest cell migration and development of the peripheral nervous system. The neural crest is a migratory populous of cells that produce many diverse structures within an embryo. Trunk neural crest cells give rise to the dorsal root ganglia (DRG) and sympathetic ganglia (SG). The importance of understanding how trunk neural crest cells navigate through their normal environment, as well as their interactions with chemotactic molecules like FGF8, will potentially reveal previously unidentified molecular and cellular interactions integral to the formation of the peripheral nervous system. Preliminary findings show that blocking FGF signaling kills endothelial cells and disrupts the ventral migration of neural crest cells. Current efforts involve testing the effects of SU5402, a fibroblast growth factor receptor inhibitor, as well as dominant-negative fibroblast growth factor (DNFGF), a blocker of FGF8 expression, on quail and chick embryos.

Chanda Barber: English

Mentor: Linda Karrell -- English

A Convoluted Examination of a Historical Construction-Helen

What is known about Helen of Troy? What makes her so intriguing? And, why are there so many reformations of her story? The conviction, that Helen exists as a historical figure of Ancient Greece, is interesting in and of itself. Perhaps the story is fascinating because of the collision between fiction and non-fiction blurring together -which is then- the collision between mythology and historical facts. My topic will examine these questions through a variety of sources.

Erin Birdinground: Sociology & Anthropology

Mentor: Tamela Eitle, David Eitle -- Sociology & Anthropology

Stress Exposure and Adolescent Pregnancy

Prior research suggests that adolescents who experience higher levels of stress are more likely to engage in a variety of risky behaviors, including risky sexual behaviors. Using data collected as part of the Montana Teen Stress and Health Study, a survey of rural Montana high school students, my research will examine the relationship between stress exposure and pregnancy among Montana female high school students. Preliminary analysis indicates that American Indians were more likely than white females to have unwanted pregnancies. Further analyses will explore whether the higher level of stress experienced by American Indian teens can explain this racial difference in the likelihood of becoming pregnant while still in high school.

Justin Brewer: Cell Biology & Neuroscience

Mentor: Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience

Isolation and Cloning of zic Genes from Chick

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 in researching zic genes. Since only zic1 has been isolated from chick, it hasn't been possible to use chick for zic gene research. My objective 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 per pool. The phage was then plated on solid medium, screened using PCR, and replated. Plaques from the next round of plates will then undergo excision to convert to useable plasmids. We have also attempted to isolate the gene using high-fidelity PCR. To do this, we need to optimize the reaction conditions and identify the best PCR enzyme.

Currently, we have isolated liquid pools of zic3-containing phages and have done several rounds of plating to reduce the phage number.

Elizabeth Browning: English

Mentor: Michael Sexson -- English

Learning (Dis)abilities: Viewing the Imaginative World Through Dyslexic and Synaesthetic Processes

Vladimir Nabokov's work, *Pale Fire*, is noted for its unique narration and odd structure. For some, the novel is complete genius, accessible only to high-brow audiences. To others, it is complete nonsense, whimsical and pointless. Either interpretation, however, acknowledges a highly imaginative story, something creative and new, whether readers understand it or not. Reading this novel has led me to question the meaning of imagination, creation and originality. Nabokov's book, as well as other Nabokov works and works from Lewis Carroll, who inspired Nabokov, suggest that the art of imagination is really different forms of perception; that the worlds literature depicts are never new or original, but the way, or process, they are viewed from, the way authors order the reality is what makes the work imaginative. In Nabokov's case, with *Pale Fire*, the process or frame of perception used is synesthetic and dyslexic. The purpose of this thesis is to research the link between synesthetic and dyslexic processes and an imaginative frame of mind evident in authors Nabokov and Carroll. Through better understanding of this link I wish to explore how one might further foster the creative process in K12 education.

Belinda Buck: Sociology & Anthropology

Mentor: Danielle Hidalgo -- Sociology & Anthropology

Christianity and Sexuality: A study of how to "do Christianity" in an Evangelical Church

This study examined the way sexuality is dealt with in the confines of an Evangelical Christian church in Bozeman, MT. This study aimed to see if there was a significant push to "do Christianity" a certain way in regards to sexuality, and if gender roles were an important factor in church life. Through participant observation, it was determined that there are definitive ways in which a Christian in this church should act. From analyzing field notes, it was determined that this church promotes heteronormativity and stereotypical gender roles. There is a strong push for church members to follow biblical morality and stay away from mainstream values.

Noelle Carpenter: Agricultural Economics & Economics

Mentor: Carly Urban, Mark Anderson -- Agricultural Economics & Economics

The Effects of Alcohol Taxes in Montana on State GDP Per Capita

I am studying the effect alcohol taxes in Montana have had on the state's GDP. I am doing this by gathering data from the Economic Bureau of Analysis, on state alcohol consumption, state GDP per capita, and which year alcohol taxes were implemented or increased. Then the data will be analyzed using the statistical software program Stata. My hypothesis is that when alcohol taxes are implemented, alcohol prices will increase causing a decrease in consumption, and an increase in state GDP.

Paul Castle: Cell Biology & Neuroscience

Mentor: John Miller, Brian Bothner -- Cell Biology & Neuroscience, Chemistry & Biochemistry

Determining the Concentration of Ethylene Thiourea in Various Local and Regional Beers

Certain craft beers are intentionally brewed to have a bitter component as part of the flavor profile. Bitterness in IPAs and similar beer styles is achieved by brewing with hops (*Humulus lupulus L.*). The flowers of this plant contain high levels of α -acids that isomerize during the brewing process and become suspended in the beer. However, some of the bitterness may also come from a different compound, ethylene thiourea. Ethylenebisdithiocarbamates are used as a hop fungicide, and when the hops is boiled in the wort this compound degrades to ethylene thiourea. High levels of ethylene thiourea in beer are undesirable for two reasons. First, ethylene thiourea is a compound with a distinctly unpleasant, bitter flavor generated by binding to a different taste receptor than the receptor α -acids interact with. Secondly, according to the National Toxicology Program, ethylene thiourea is a potential carcinogen. Ongoing research is being conducted to determine the concentration of these chemicals in various beers. Beer samples are derivatized using pentafluorobenzyl bromide

(PFBBBr) to enable sufficient separation with a reverse phase chromatography column. After the derivatization, the samples are analyzed using liquid chromatography-mass spectroscopy. This allows the concentrations of ethylene thiourea and α -acids to be determined and compared.

Kelly Christensen: Microbiology

Mentor: Christa Merzdorf -- Cell Biology & Neuroscience

Species Diversity Studies on the Developmental Expression of Aquaporin 3

Neurulation is a developmental process where the flat neural plate forms the hollow neural tube, the precursor to the adult nervous system. Failure to close the neural tube properly results in neural tube defects (NTDs), which are the most prevalent birth defects today. To better understand NTDs, it is crucial to study the role of genes that direct normal neural tube closure. Aquaporin3b is expressed in the neural folds of the frog *Xenopus laevis*, and when it is interfered with, the neural tube does not close properly. The question is whether there is evolutionary conservation of aqp3 expression in the embryos of other vertebrate species, such as *Xenopus tropicalis*, zebrafish, and chicken. In situ hybridization was used to analyze aqp3 gene expression patterns, where organism-specific antisense RNA probes. All four species demonstrated aqp3 expression patterns. *Xenopus tropicalis* embryos expressed aqp3 in neural folds, in a pattern similar to *Xenopus laevis*. Zebrafish embryos expressed a broader pattern, possibly throughout the entire neural plate. In chicken embryos, specific determination of aqp3 expression requires further testing. In the future, I will test whether aqp3b/aqp3 is required for mediating neural tube closure in zebrafish and chicken embryos, as it does in *Xenopus*.

Cameron Clevidence: Ecology

Mentor: Alexis Pike -- Film & Photography

Ecological Winter

Winter comes to us in many different forms, but regardless of whether we experience it through heavy rains or powder snow, its importance is incredible and often overlooked. During the 2012-13 academic year, I had the unique opportunity to experience ecological winter in both Costa Rica and Montana. I saw this as a great opportunity to express some love for winter, and so I've put together a photographic essay displaying winter's effect on nature, its similarities and differences in two unique environments - Montana and Costa Rica - with the goal of showing how important this season is to us all.

Jesse Cook: Chemistry & Biochemistry

Mentor: Mary Cloniger -- Chemistry & Biochemistry

Effects of Lactose Functionalized PAMAM Dendrimers 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.

James Cwick: Microbiology

Mentor: Jovanka Voyich-Kane, Michele Hardy -- Immunology & Infectious Diseases

The Effect of Glycyrrhizin and its Derivative 18 β -Glycyrrhetic Acid on Clinically Prominent Bacteria

Due to the increasing antibiotic resistance with bacteria, natural compounds and other alternatives to traditional antibiotics are being pursued. An alternative to antibiotic treatment of clinical bacteria like Methicillin-resistant *Staphylococcus aureus* (MRSA), 18- β Glycyrrhetic acid (GRA) has shown promising results of reduced virulence expression and bactericidal effects on MRSA. In these experiments, further tests of GRA were done on bacteria within the *Streptococcus* and *Staphylococcus* genres including: *Streptococcus pyogenes*, *Streptococcus agalactiae*, and *Staphylococcus aureus*. Results obtained from the bactericidal assays of both *Streptococci* species indicate GRA has an antimicrobial capacity against diverse bacterial species but that its efficacy varies among target bacteria. Further research needs to be done in order to further characterize the effect of GRA on different species of clinically relevant bacteria.

Dominique David: Earth Sciences

Mentor: Wayne Stein, Lisa Lone Fight -- Native American Studies, Land Resources & Environmental Sciences
Indigenous Science Knowledge Inherent in Native Language Place Names

Exploring Native language place names reveals Indigenous science about the natural environment that may contribute to sustainable resource management and development in the coming generations. Based on centuries of observation, this knowledge has survived in the context of Elders' oral histories and Native language place names. In order to preserve and re-contextualize these valuable scientific resources, this study looks at GIS (Geographic Information Science) technology as a viable instrument for integrating Indigenous and Western science. Original Native names for the Gallatin Valley Headwaters Rivers will be overlaid with ecological and topographic data layers to demonstrate the relationships between Native language place names and Indigenous science knowledge. As community-based participatory research, this study will allow Elders and Indigenous science experts from communities familiar with this study area to define the context surrounding Native place names. In the future, GIS models like the one developed in this study may be utilized as tools for more culturally relevant science education, natural resource management, and sustainable development. Ultimately, this research will serve as a bridge between the knowledge of Indigenous Elders and the environmental challenges that will need to be addressed by future generations.

Alexandra Davis: Liberal Studies

Mentor: Ada Giusti -- Modern Languages & Literatures
The Free People of Morocco

The Amazigh embody a truly unique and fascinating culture. These tribes have overcome extreme obstacles of surviving in the High Atlas Mountains of central Morocco. Throughout history they have been capable of preserving their customs even with multiple empires attempting to conquer them and eradicate their culture. Historically, these people have utilized their harsh lands in such harmonizing ways that they mostly relied on their local community and environment. The inhabitants of the Zawiya Ahansal region have evaded total dependence upon outside resources. In fact, as indicated by the sheik, the political and religious leader of this region, the population has remained stable. A majority of rural cultures, similar to this one, lost their sustainable lifestyle to the effects of globalization. This presents itself as the biggest obstacle for the preservation of traditions of the Zawiya Ahansal villagers. An investigation into the historical practices of this culture of sustainability, and their modern perspectives on maintaining their customs and lifestyle in the mountains, will be extremely beneficial for education on sustainability and the rising problems linked with globalization.

Christine de Caussin: Ecology

Mentor: Robert Garrott -- Ecology

Beaver in the Upper Madison Beaver Management Area Outside of West Yellowstone, Montana

Through the late 1960s and early 1970s, trappers harvested most of the beaver in the Hebgen Lake watershed outside of West Yellowstone, Montana. In an attempt to bring back the beaver, Montana Fish, Wildlife, and Parks and the Forest Service established the Upper Madison Beaver Management Area (UMBMA) to regulate the number of the licenses made available to trappers. Both agencies wanted beaver on the landscape because of the important role beaver play in watershed ecology. By building dams, beavers raise water levels which improve wetland habitat for birds, fish, moose, and other animal species. My project included surveying one kilometer of good beaver habitat in the major drainages throughout the Hebgen lake watershed while looking for different beaver signs. These signs include recent beaver clippings in the willow, caches (piles of willow where beaver store their winter food supply), slides (folded down grass where beaver enter river), active lodges, and active dams. The objective of my paper was to evaluate the status of the beaver population by looking at the indices of presence to help FWP decide whether reintroductions and/or changes in the trapping season regulations are necessary.

Gregory Doctor: Cell Biology & Neuroscience

Mentor: Christa Merzdorf, Dan VanAntwerp -- Cell Biology & Neuroscience

Investigating the Roles of zic1-zic5 in aqp-3b Expression in Xenopus laevis

The goal of this project was to determine the specific transcription factor(s) responsible for expression of the aquaporin aqp-3b gene in *Xenopus laevis*. Data from the Merzdorf Laboratory has shown that aqp-3b plays a vital role in neural tube closure in *Xenopus laevis*. Additionally, the Merzdorf Lab has shown that over-expression of the Zic1 transcription factor directly activates aqp-3b expression. However, Zic1 exhibits promiscuous binding with targets of Zic2-Zic5 and it could not be determined whether the observed up-regulation of aqp-3b expression was due to normal Zic1 activity or Zic1 binding to a target of a different Zic transcription factor due to over-expression. Morpholino oligonucleotides (MOs) were used to block the expression of different combinations of Zic 1-5 transcription factors along one neural fold and a tracer (co-injected these with MOs) was used to mark which half of the embryo was injected. Aqp-3b expression in experimental embryos was visualized via in-situ hybridization of injected embryos. The results of this experiment show that combinatorial inhibition of zic 1-3 leads to a significant decrease in aqp-3b expression along the injected half of embryos when compared to the control half. Individual testing of zic 1, zic2 and zic3 is currently underway.

Jordan Dood: Chemistry & Biochemistry

Mentor: Bern Kohler, Jinqun Chen, Tom Zhang -- Chemistry & Biochemistry

Protonation and Ion Binding of Adenosine Oligomers

In order to explore the effects of cation binding on the vibrational spectra of DNA oligomers, steady state infrared spectroscopic methods were used to probe different protonation states of various adenosine oligomers. One of the primary advantages to steady state infrared studies is the well characterized nature of vibrational frequencies. Because vibrational signatures are associated with specific bonds and electronic environments within molecules, changes in the frequencies can be more definitively associated with structural changes. Using Fourier transform infrared spectroscopy, it is possible to identify vibrational frequencies which may result from protonation or the binding of ammonium ions to adenosine oligomers. Several vibrational frequencies have been proposed to result from ion binding, but the exact nature of this binding and the conditions, including protonation, that govern it are not fully understood. Similarly in question is the role that base stacking plays in both protonation events and ion-molecule interactions. These studies will ultimately form the foundation for further research using ultrafast transient infrared spectroscopy. This technique will further reveal how these chemical events alter the photochemistry of DNA oligomers and will aid in the determination of effects that base stacking has on small DNA oligomers.

Parker Dunn: English

Mentor: Gretchen Minton -- English

Performance History of Shakespeare's "Much Ado About Nothing" and its Influence on Critical Thought

At the 2013 Spring Research celebration, I would like to present the findings of my current USP project, "Modernized Edition of Shakespeare's *Much Ado About Nothing* for Internet Shakespeare Editions." Dr. Gretchen Minton and I have been working to create a modernized edition of Shakespeare's *Much Ado*, which has been thoroughly entrenched in the nuances of textual editing. Alongside the textual process, I have been working individually to compile information about the play's performance history, in order to provide readers with information about the theatrical aspects of the text. I have researched printed sources in relation to the play's performance history, and over the course of spring break I visited two archives, the Globe Theater in London, and the Shakespeare Birthplace Trust in Stratford-upon-avon and gathered information from primary documents to bolster my performance history. I am currently in the midst of writing a scholarly paper, which analyzes how small moments of textual editing affect a play in performance. In *Much Ado*, the choices of editors, directors, and actors have significant impacts on a performance, and my essay will explore the ways in which various trends in these decisions have affected critical attitudes towards the play.

William Dupree: Physics

Mentor: Bennet Link -- Physics

Hydro Static Equilibrium, the study of the Lane Emden and TOV Equations

Hydro static equilibrium was used to find core temperatures of main sequence stars, mainly our sun, as well as using the general relativistic version to calculate upper mass limits of neutron stars. A better understanding of the equation of state of these stars can be known by studying the properties and parameters found by solving these differential equations. To gain an introductory understanding the hydro static equilibrium equation was looked at, and made dimensionless. The new form is known as the Lane Emden equation, and numerical methods were used to find solutions. Once found, back substitution into the defined variables were used to calculate core temperatures by plugging in characteristics into the ideal gas equation. This problem set up the background understanding to numerically solve the TOV equation for a given equation of state. Two different equations of state were used, a polytropic equation of state as well as the EOS used in Analytical representations of undefined equations of state of neutron-star matter by Haensel and Potekhin. The found values for upper mass limits were then compared to observed masses of neutron stars to confirm/deny the validity of the proposed EOS.

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. Both analytical methods and computational methods were used.

Margerie Durban: Modern Languages & Literatures

Mentor: Ada Giusti -- Modern Languages & Literatures

Moroccan Local Soap Project

In summer 2012, MSU students went to Morocco for an international service learning project where they interviewed extensively women of the Zawiya Ahansal region. The data collected from this series of interviews was compiled into a report that was aimed to develop the health and education programs in this region of Morocco. The report focused on the women's issues in the region. Amongst these issues, it was brought to light that some families in these villages cannot access soap for financial reasons. A second suggestion made by the women of the villages was to be taught a handicraft; this could be an opportunity for them to create a product that could be sold to tourists. The Local Soap Project answers both of these issues raised by the women of Zawiya Ahansal. I have researched a soap making process that uses local products from this region. I have explored different soap making methods that are adapted to the community and the resources they have access to; this research was implemented in the Zawiya Ahansal region and could represent the first step for the women's handicraft business.

Elesia Fasching: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

Does the WIC program reduce infant birth weights?

The government spends millions of dollars each year on the WIC program. WIC provides free benefits in the form of specific healthy foods for qualifying low-income expectant and breastfeeding women, as well as those with children under age 3. These benefits are provided in the hopes of ensuring healthier babies to mothers whose pregnancies may be compromised by limited income to buy healthy foods, which are often more expensive. A lowered incidence of low birth weight babies since the implementation of WIC is needed to justify large government spending on the program. To conduct an econometric analysis on the program, I combined data from

the CDC on infant birth weights by state from 1990-2008 with a data set from the University of Kentucky Center for Poverty Research that contained variables on WIC participation rates by state. I analyzed the data using the STATA program, and found that there was a very weak relationship between the percent of WIC participation and the number of low birth weight babies over time, indicating that WIC may not have a very large impact on infant birth weights. The cost of WIC and low marginal benefits could signal the need to scrap the program, or create a new one that has a stronger influence on healthy eating during pregnancy.

Kevin Ferris: Mathematical Sciences

Mentor: Jim Robison-Cox -- Mathematical Sciences

How to Build a Better Baseball Team

To succeed in the competitive environment of Major League Baseball (MLB), team front offices must assemble the best possible team. While doing so primarily involves acquiring the best players, teams must also account for how these players fit together. Here, we explore how the distribution of player talent affects the team's performance during the regular season. To do so, we used the Wins Above Replacement (WAR) metric as an estimate of player talent; the WAR values for each individual player on a team could be used to form a distribution of the talent on that team. We then looked at the moments of these distributions and analyzed how team performance was affected by altering the moments. We find that increasing the standard deviation of a team's position players tends to negatively impact the team; we also find that teams with higher pitching standard deviation and skewness tend to perform slightly worse. These results suggest that teams could benefit by reducing the spread in player talent.

S. Kathleen Fogg: Ecology

Mentor: Billie Kerans, Ryan Lamb -- Ecology

Effects of *M. cerebralis* on the competitive ability of *T. tubifex*

Whirling disease (*Myxobolus cerebralis*), a disease linked to declines in salmonid populations, is currently a critical issue throughout the Intermountain West. The life cycle of this parasite includes two obligate hosts, salmonids and the oligochaete worm *T. tubifex*. In this study we will study parasite-mediated competition between *T. tubifex* and *Limnodrilus hoffmeisteri*, an associated worm species. We will be testing this by a response surface experiment. This experimental design will elucidate relationships between inter- and intra-specific competition by identifying growth rates of pure and mixed cultures. In addition, we are using *M. cerebralis* infected *T. tubifex* and uninfected *T. tubifex* in order to understand the effects of parasite-mediated competition. This design is carried out with multiple (7) treatment types, each having (6) replicates. We hypothesize that *M. cerebralis* will hinder the competitive ability of *T. tubifex*. Previous studies suggest that *M. cerebralis* does not have an effect on the competitive abilities of *T. tubifex*. This work did not show 100% infection rate of *T. tubifex* which could lead to compensatory growth of the uninfected portion of the population. Understanding the interactions among *T. tubifex*, *L. hoffmeisteri* and *M. cerebralis* will help develop management strategies for the control of whirling disease.

Elizabeth Forbes: Physics

Mentor: Joseph Shaw, Nathan Pust -- Electrical & Computer Engineering

Effects of Wildfire Smoke on the Optical Polarization of Skylight

The purpose of this project is studying the effects of wildfire smoke on the optical polarization of skylight (scattered sunlight). When a wildfire releases aerosols as a smoke plume in the atmosphere the resulting additional optical scattering changes the skylight polarization. Here we measure those changes with an all-sky polarization spectral imager to analyze and interpret the effects. In the all-sky polarization images, we were able to optically follow the progression of a smoke plume as it traveled across a clear sky and the eventual dispersal of a thick layer of aerosols across the whole sky. We also used in-situ sampling instruments to measure size distribution and optical scattering and extinction coefficients of the aerosols in the plume. The combination of the aerosol and all-sky polarization data allow a unique study of aerosol effects on skylight polarization in a situation that transitions from uniformly clean to highly asymmetric (clean on one side with a thick smoke plume on the other side), proceeding an uniform haziness when the smoke filled the valley. These data help us understand the

physical processes underlying the observed skylight polarization, and can help in the development of algorithms to retrieve aerosol properties from skylight polarization measurements.

Colin Gaiser: Sociology & Anthropology

Mentor: Danielle Hidalgo -- Sociology & Anthropology

The Post-Debate Information Waltz: Online media interpretations and distortions of the 2012 presidential debates

Media has never been more ubiquitous than it is today, and the proliferation of devices through which to consume media has only added to the total presence of media in modern society. However, despite the vast number of media outlets available to us, it has only become more difficult to find one that is an objective and non-partisan source of information. In order to investigate these modern media outlets, this research project explored online coverage of the 2012 presidential debates between the incumbent Democratic candidate Barack Obama and Republican candidate Mitt Romney. Research was completed by watching the debates and monitoring the online coverage of three major news outlets for the 24 hours following the debates. Qualitative and some simple quantitative content analysis was conducted in order to determine the slant, purpose, and value of each respective source's coverage, and content was evaluated in an attempt to find consistent themes between the sources. Major conclusions include: 1) Strategic partisanship was present in two of the three news outlets, 2) Significant usage of war, fighting, and/or sports vocabulary attempted to make coverage more accessible and entertaining, and 3) The focus tended to be on quantity of coverage over quality of reporting.

Edward Gillig: Chemistry & Biochemistry

Mentor: Mary Cloninger -- Chemistry & Biochemistry

Dendrimers: Functionalization and Toxicity

Dendrimers are highly branched, symmetrical molecules that we are using to study multivalent protein-carbohydrate interactions. To study these interactions, dendrimers must first be functionalized with the appropriate ligands. During this academic year, mannose functionalized dendrimers were synthesized for binding studies with a mannose-binding protein. Because of their possible ultimate applications as therapeutic agents, one important aspect of dendrimers that was studied was their toxicity to eukaryotic organisms. Toxicity assays involving lactose functionalized dendrimers with cancer cell lines were performed. After one hour, the lactose functionalized dendrimers were shown to have minimal toxic effects. After 24 hours, a much larger toxic effect was generally exhibited by the dendrimers. Toxicity assays with four generations of lactose-functionalized dendrimers were performed, and consistent trends were observed for second, fourth, and sixth generation dendrimers. Third generation dendrimers afforded significantly different toxicity results, and studies to determine the reason for this anomaly are ongoing.

Catherine Gilligan: Cell Biology & Neuroscience

Mentor: Laura Mentch -- Bridgercare

Assessment of MSU Student Knowledge of STIs and Local Resources

Through the use of a survey, a knowledge assessment of MSU students was conducted and analyzed. Approximately 300 surveys were distributed to undergraduates, aiming to target an equal number of males and females and equal representation from each grade level. Each survey included questions regarding prevalence of Sexually Transmitted Infections (STIs), their symptoms, methods for prevention and treatments and options for medical institutions in Bozeman that offer testing and treatment. As of right now, only qualitative data has been analyzed (no analysis of quantitative data is complete, but will be within the next few weeks). In general, it has been found that the majority of students are aware of basic prevention and treatment methods as well as institutions available for treatment/testing. However, most students have very little knowledge of specific STIs and seem unaware of which portray symptoms and which do not. Once numbers are obtained, more specific conclusions can be drawn but for now, it seems apparent that college students are lacking STI knowledge indicating that more education is necessary.

Bryan Gonzalez: Sociology & Anthropology

Mentor: Laurence Carucci -- Sociology & Anthropology

Memory & Vatican II: Effects and memories of Vatican II on local Catholic communities

The purpose of this research is to show how the memories of the Second Vatican Council (Vatican II) had and continue to have an effect on Catholic thought and world view of Catholic parishes in Bozeman, MT in the present. The event of Vatican II had a profound effect on the ways in which Catholic masses and parishes were dealt with both at the local level, and at the relation with the individual parishes and the Papal See. The first phase of this research began in 2011 with participant observation by the researcher in both interviews and attending masses at two Catholic parishes in Bozeman. The second phase of the research was concerned with analyzing the interviews from both parishioners and clergy members through previous anthropological work on memory conceptualization. Major conclusions that have come from this work are that Vatican II continues to have profound effects on various facets of Catholic life in the present; with a particular focus of this research on the intertext of written works by the church published at both the Papal See and local level.

Carly Grant: Microbiology

Mentor: Joshua Obar -- Immunology & Infectious Diseases

Induction of highly protective CD8⁺ T cells by *Listeria monocytogenes*

Listeria monocytogenes is a bacterium that causes widespread disease in humans and domestic animals. To date, there is no licensed vaccine for *L. monocytogenes* infection. More importantly, *L. monocytogenes* has great potential as a recombinant vaccine vector. We hypothesize that the avirulent double chaperone mutant, $\Delta prsA2 \Delta htrA$, is an ideal vaccine vector. To test our hypothesis, we have compared the $\Delta prsA2 \Delta htrA$ mutant with the slightly avirulent $\Delta actA$ strain and the highly attenuated Δhly strain. Here we demonstrate that the $\Delta prsA2 \Delta htrA$ double mutant induces strong dendritic cell maturation and CD8⁺ T cell responses. Importantly, 30 days post-infection the number of memory CD8⁺ T cells induced by the $\Delta prsA2 \Delta htrA$ double mutant was slightly higher than the $\Delta actA$ mutant and much higher than the avirulent Δhly strain. Fitting with the size of the memory CD8⁺ T cell population, we found that both the $\Delta prsA2 \Delta htrA$ and $\Delta actA$ mutants were highly protected against *L. monocytogenes* challenge, while memory induced by the Δhly mutant was not protective. These results demonstrate that the $\Delta prsA2 \Delta htrA$ mutant is an ideal vaccine candidate. Future studies will be aimed at testing the efficacy of recombinant *L. monocytogenes* $\Delta prsA2 \Delta htrA$ mutants against heterologous infections.

Emily Gravens: Chemistry & Biochemistry

Mentor: Robert Szilagyi -- Chemistry & Biochemistry

Synthesis and Characterization of Fe-S Particle Clusters in Clay

This project explores the possibility of forming iron-sulfur particles in well-ordered clays. Sulfur, as hydrogen sulfide (H₂S), was introduced anaerobically to three types of iron-enriched clays including kaolinite and a clay sample collected locally outside of Dillon, Montana. Samples were probed by X-ray Absorption Spectroscopy (XAS) to identify changes in electronic and geometric structure as a result of iron-doping and the presence of H₂S. Additionally, we show the first developments toward a proposed computational program for describing kaolinite. The model uses a cluster technique that is computationally inexpensive and would allow for easy manipulations of the known kaolinite structure. The proposed model will accurately describe the complete chemical system and predict the outcome of chemical reactions, particularly the intercalation of H₂S in natural and Fe-containing kaolinite. The combination of experimental and theoretical results lay the groundwork for more detailed studies that would look for catalytic activity in Fe-S clusters formed in clays.

Elliot Gray: Physics

Mentor: Dana Longcope -- Physics

Magnetic Helicity and Plasma Energy in Solar Corona

Instantaneous magnetic field energy in active regions in the Corona is hypothesized to depend upon the shape of visible plasma "loops" whose footprints rise from the Photosphere and take a contorted path through the Corona. Magnetic helicity, defined as a volume integral of (vector potential)dot(magnetic field) relative to the potential

field is proportional to free energy, and is therefore the object of our study, however, relative helicity is an extremely difficult quantity to measure directly. In order to extrapolate relative helicity without direct measurement, our strategy was to use the observed shape of the loops in extreme ultraviolet images taken from the XRT satellite as boundary conditions to extrapolate helicity numerically. We also used a complex fitting algorithm based on the concept of a “force-free-field,” which plasma loops theoretically must exist in.

David Halat: Chemistry & Biochemistry

Mentor: Rob Walker -- Chemistry & Biochemistry

Optical Studies of Solid Oxide Fuel Cells (SOFCs) with in situ Vibrational Raman Spectroscopy

Electrocatalytic devices are subject to extreme non-equilibrium conditions, including high temperatures, strong oxidizing or reducing environments, and non-uniform electrochemical potentials. Solid oxide fuel cells (SOFCs) encounter all three conditions simultaneously, including operating temperatures as high as 900°C. Recently developed optical spectroscopic methods can identify mechanisms associated with electrochemical oxidation, reduction and degradation in SOFCs. Specifically, in situ vibrational Raman spectroscopy and electrochemical techniques are used to identify and correlate chemical species observed in functioning SOFCs with electrochemical performance. The formation and persistence of deleterious graphite deposits on the SOFC anode is this work's primary focus. Ni-YSZ anodes were tested with syn-gas fuel feeds (CO and H₂) at 700°C and show slower kinetics of graphite formation as compared to anodes operated with methane (CH₄) at the same temperature. Graphite deposition with syn-gas also shows a marked temperature dependence, becoming less favorable at higher temperatures. Electrochemical removal of graphite simulates long-term stress on the cell and reveals consecutive failure mechanisms. In particular, correlated chronopotentiometric and spectroscopic equivalence points show initial removal of graphite, followed by electrochemical oxidation of the Ni anode and loss of electronic conductivity, and finally oxide recombination and irreversible delamination. Near-IR thermal imaging data supports these mechanistic details.

Kevin Hall: Sociology & Anthropology

Mentor: Tamela Eitle -- Sociology & Anthropology

Association of Depressive Symptomology and Adolescent Sexual Behavior

This study examines the association between depressive symptomology and adolescent sexual behavior. Prior research suggests that adolescents that suffer from depression are more likely to engage in risky sexual behaviors, however, much of this research is based on surveys of urban adolescents and inadequate attention has been given to whether this relationship differs for males and females. Using data collected from the Montana Teen Stress and Health Study (MTSHS), I test the hypotheses that increased levels of depressive symptomology are associated with increased levels of adolescent sexual behavior generally, and that among sexually active adolescents, increased depressive symptomology will be associated with higher levels of risky sexual behavior. I hypothesize that this relationship will be significantly stronger among females compared to males, given the large body of literature documenting that females report more depressive symptomology than males and that males and females experience different affect with regards to depressive symptomology and engagement in sexual behavior. The results of this study are forthcoming pending completion of further statistical analysis.

Brandon Haller: Microbiology

Mentor: Jovanka Voyich-Kane -- Immunology & Infectious Diseases

Role of Leukocidin A/B in Staphylococcus aureus Virulence

Staphylococcus aureus is a bacterium that can cause pneumonia, endocarditis, sepsis, toxic shock syndrome and necrotizing fasciitis as well as highly contagious skin infections. In 2005 it was responsible for over 18,000 deaths in the United States alone, claiming more lives than HIV/AIDS. In addition, drug resistance is now a major problem. Methicillin-resistant *Staphylococcus aureus* (MRSA) is very difficult to treat because it is strongly resistant to drugs such as penicillin and cephalosporins. One mechanism of pathogenesis used by MRSA to infect the human host is to target and kill neutrophils, the body's main innate immune defense mechanism. One method it uses to accomplish this is by releasing cytotoxins that target phagocytes. Dr. Jovanka Voyich's lab believes that the two-component leukocidin A/B (LukA/B) secreted by MRSA is partly responsible for killing human phagocytes thereby

directly contributing to pathogenesis of the bacteria. In previous research, LukA/B was shown to lyse human neutrophils, but it is unknown if it modulates the host response in other ways. For my project, I hypothesize that LukA/B modulates the host response by promoting pro-inflammatory cytokines. Over the course of 10 weeks, I will perform numerous experiments using mouse models of pathogenesis and become proficient in technical assays to determine if LukA/B contributes to the production of cytokines known to be important in inflammation including TNF and IFN γ .

Eric Halverson: Cell Biology & Neuroscience

Mentor: Amy Cory -- Greater Gallatin United Way

Constructing a Community Resource Guide for Families in Gallatin Valley

Agencies from the Gallatin City-County Health Department to Community Health Partners and the Early Childhood Community Council (ECCC) all recognize the need for a comprehensive community resource guide in Gallatin County. An understanding of the needs of families in the Gallatin area was developed through analysis of the 2012 Gallatin County Community Early Childhood System Needs Assessment which expressed "Improving access to information" as a top concern. The construction of this guide aims to help Gallatin area families access valuable information about helpful resources throughout Gallatin Valley. This report details how the information for the resource guide was compiled. Further, I examine and display three specific hypothetical scenarios of community members and how they may navigate the local resources available to them.

Felicia Hamilton: English

Mentor: Linda Karell -- English

Fictionality and Factuality: Where is the Line?

Of the many types of literature popular in American culture today, one potentially problematic genre for writer and reader alike is the nonfiction novel. These "based on a true story" works are often adapted into films and one of the most appealing features of these stories are their basis in true events. But a primary tension within this genre is the question of where fictionality and factuality collide. The line between these seemingly mutually exclusive components is blurred but cannot be completely erased. If the story deviates from true events too much, then the story can no longer make legitimate claims to factuality but authors, publishers, and readers continue to ask how far of a deviation is too far?

Christian Heck: Cell Biology & Neuroscience

Mentor: David Varricchio, Frankie Jackson -- Earth Sciences

Evaluating deformation in *Spheroolithus* dinosaur eggs from Zhejiang, China

Lack of stratigraphic context for dinosaur eggs inhibits understanding of their reproductive biology, and the taphonomic processes of egg preservation. Past taphonomic work suggests two features, compression ridges (sharp edge of broken eggshell around egg circumference) and deformation asymmetry (proportion of crushed to rounded sides of the egg), as geopetal structures. We examined these features across a large sample of *Spheroolithus* eggs from the Cretaceous of Zhejiang, China to test their utility. On 103 isolated eggs, we determined asymmetry ratios (crushed side egg height divided by rounded side height), and observed an average asymmetry ratio of 0.71. Additional observations of in situ eggs demonstrate the stratigraphic-down side as more rounded and less fractured, the stratigraphic-up side as flatter with heavier fracturing, and compression ridges as parallel to original bedding plane. Burial-caused fractures on the upper side of the egg allowed sediment to partially fill, subsequently supporting the bottom portion. Examining these features within 16 clutches allowed differentiation of biotic versus taphonomically altered arrangements. Three common clutch arrangements include: planar (minimal egg overlap), offset (extreme overlap), and agglomerate (randomly arranged, closely packed). Analysis of egg strike and dip across clutches favours planar clutches as the principal configuration for *Spheroolithus* clutches.

Acknowledgements: Hannah Wilson – History

Lena Heuscher: Physics

Mentor: Joseph Shaw, Paul Nugent -- Electrical & Computer Engineering

MSU Heat Island Effect

A heat island is “an urban area where the air temperature is consistently higher than in the surrounding region because of the generation and retention of heat created by human activity and human-made structures” (Microsoft Encarta Dictionaries). Research weather stations that we operate on and off the MSU campus have shown that there is a heat island effect that often elevates the air temperature on campus above the air temperature in open agricultural fields near campus. To test the hypothesis that such a heat island arises from the predominance of concrete and asphalt building materials on campus, we deployed a radiometrically calibrated thermal imager to capture time-stamped thermal images of different regions on and adjacent to the MSU campus. These images show that concrete, asphalt, and various man-made materials on and near the MSU campus consistently emit more thermal radiation than nearby areas covered with natural vegetation. This information will be combined with meteorological data from fixed and portable weather stations to quantify and explain the spatial and temporal variation of the heat island effect on and near the MSU campus.

Emmy Hill: Earth Sciences

Mentor: David Lageson -- Earth Sciences

A paleoecological analysis of corals in the Sun River Member of the Castle Reef Dolomite (Mississippian) at Swift Reservoir, Sawtooth Range, Northwest Montana

The Sun River Member of the Castle Reef Dolomite (Mc) is part of the Mississippian Madison Group (Meramecian and Osagean) in the Sawtooth Range of northwest Montana. Although many excellent outcrops of the Mc occur throughout the range, those forming the abutment of Swift Reservoir Dam along Birch Creek in the northern part of the range were selected for this study because of abundant and well-preserved Mississippian corals on pristine bedding surfaces. Research questions include the following: 1) what is the spatial distribution of different coral taxa (especially coral heads) in the field area? 2) Does this distribution reflect an environment of deposition based on modern analogues? 3) What is the diagenetic history of the fossils versus country rock; has this area experienced localized low-temperature hydrothermal dolomitization? My anticipated research methods include using a Trimble total station to map the distribution of coral species on well-exposed bedding surfaces, identifying coral taxa and other fossils and documenting their relative abundance, conducting petrographic analyses (including CL) of the corals and country rock to assess the imprint and history of diagenesis, and integrating all these data into a GIS (ArcMap 10.1) to create a “paleo-seafloor map” and depositional-diagenetic history of the Sun River Member.

Courtney Holland: Cell Biology & Neuroscience

Mentor: Phillip Sullivan – Chemistry

Comparison of Organic Photochromic Compounds’ properties and BSA interaction

Organic photochromic compounds (OPC) undergo reversible chemical and physical changes when irradiated with the appropriate wavelength of light. These changes are manifested both at the molecular and bulk material level and include photo-induced shifts in: color, refractive index, molecular length, and polarity. Such photo-controllable properties are of interest for bio-orthogonal control of biological processes, as well as in the fields of optical computing, and data storage. A thorough understanding of molecular and material level structure-property relationships is imperative to enable effective design and optimization of organic photochrome structures for each specific application. Such relationships govern the magnitude and timescale of each desired photo-process. The experiments described here were utilized to design, prepare, and examine organic photochrome structures and their use in the photo-sensitization of retinal neurons to mimic the innate processes of sight. The focus was placed on physical and photophysical properties, such as isomerization wavelength, quantum yield, and decay rate. Organic chemistry, time-resolved laser spectroscopy, fluorescence, and fluorescence lifetime analysis were employed to analyze three photochromic Azobenzene dyes: PheNAQ, TVI, TVI acid, and MeNAQ.

Kasey Holland: Cell Biology & Neuroscience

Mentor: Ed Schmidt, Emily Talago -- Immunology & Infectious Disease

Hepatocyte Lineage and Liver Regeneration

The liver is a vital organ necessary for detoxification, regulation, and production of critical processes that are necessary for bodily function. One of the unique functions of the liver is that it repairs itself when damaged. Understanding how hepatocytes—the cells that make up the liver—regenerate is an important process. The goal of this project was to develop a tool that can track hepatocyte lineage after a liver has been damaged. The lab used transgenic mice with a genetic marker system that caused new cells coming from progenitor cells to fluoresce red, and cells arising from pre-existing hepatocytes to fluoresce green. The marker system used the Rosa locus, which is ubiquitously expressed causing all cells to fluoresce red. Upon exposure to active cre recombinase, the red is removed, yielding green fluorescence instead. An inactive Cre ER in the Alb locus provides hepatocyte specific expression. This Cre ER is activated upon administration of the drug Tamoxifen. This cell conversion from red to green is called time-stamping. The goal was to be able to track the amount of new cells forming from progenitor cells. The results showed a contribution from progenitor cells, but they were inconsistent and showed great variation. This was partially due to spontaneous conversion of green cells due to endogenous estrogens. Further work will need to be done to find a way to avoid this spontaneous conversion.

Shannon Holmes: Psychology

Mentor: Ada Giusti, Louise Ryder -- Modern Languages & Literatures, Psychology

Mental Health Support Nongovernmental Organizations in Morocco and the United States

I am researching nongovernmental organizations (NGOs) in Morocco and the United States that advocate for people with mental illnesses and provide support for their friends and families. Organizations such as the National Alliance on Mental Illness (NAMI) and Mental Health America (MHA) in the US and Association Marocaine pour 'Appui, le Lien, l'Initiation des familles des personnes souffrant de troubles psychiques (AMALI) and CHAMS l'association de Tensift pour la santé; mentale in Morocco work to provide access to medical care, family support systems, help to integrate people suffering from illnesses into daily society and much more. Organizations like these are numerous and easily accessible in the United States where nearly everyone has access to the internet. However in Morocco they are much more difficult to find and they do not have the reach that the American NGOs have. They do not have access to the seemingly endless amount of advertisement like in the US. In addition, they do not have access to adequate mental health care like we have in the US. Although their mission is more challenging, they manage to do some truly incredible things for the people of Morocco.

Kristen Ingman: Sociology & Anthropology

Mentor: Danielle Hidalgo -- Sociology & Anthropology

Gender in the Gym: Exploring the Ways Gender Inequality Manifests Itself in the Taylor Fitness Center and in Popular Fitness Magazines

This paper describes how women are marginalized in sport through the social association of strength with maleness, which limits women's access to achieving physical strength and power. The institutional organization of gym spaces and rigid gender roles suggested in popular sports magazines perpetuate inequality in sport. This study relies on participant ethnography at University A's Taylor Fitness Center, informal interviews with female and male gym users, and content analysis of Women's Health and Men's Health magazines to answer the research question, "In the context of University A's Taylor Fitness Center, how does gender play out in the gym?" This study demonstrates that fitness centers are institutionally gendered through the organization of space. Along with this gendered spatial arrangement, the oppressive effects of popular fitness magazines allow for male dominance in sport. The findings of this study suggest that a departure from traditional reinforcements of gender roles and emphasized biological differences is necessary in order to achieve gender equality in sport.

Brennan Ireland: Physics

Mentor: Nico Yunes -- Physics

Numerical Computation of on Resonance EMRI Black Holes

One of the most exciting areas of research in General Relativity in recent years has been the pursuit of Gravitational Waves. With the detection of Gravitational Waves becoming more and more probable with each passing day, the call for research of systems that could produce these Waves are becoming popular as well. I study one such possible Gravitational Wave source, EMRIs. In particular, I study the orbital evolution of such inspirals, specifically when these systems become resonant. To study these resonances, I am improving a numerical C code, Chimera, by adding the relevant Post Newtonian order corrections to the mass quadrupole, mass octopole, and current quadrupole moments of the system. With these corrections, we will be able to more accurately identify gravitational waves that may be coming from sources such as this. Without a proper understanding of such resonances, the detection of gravitational waves emitted by EMRIs could be in question. If so, this would greatly limit the physics that future space-born gravitational wave detectors could do, including astrophysics and tests of Einstein's General Theory of Relativity.

Rachael Johnson: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

Urbanization and Government Health Spending

Economic theory suggests that as a country develops, migration occurs from rural to urban areas; traditionally, from agricultural economies to more industrial economies. As countries become more urban their economies become more developed. This migration from rural to urban is largely due to cost advantages for producers and consumers; more and higher paying jobs are often located in more urban areas. Governments often serve as an advantage in these urban areas. Firms located closer to a government may better able to get together with other firms so that they may lobby for advantages such as tax breaks or more government spending. This research looks into the effect urbanization has on government spending of health. An econometric analysis was used to determine the effect urbanization has on government health spending. It was found that as countries become more urban, government health spending increases. The result may be due to many different reasons which will be discussed in this presentation.

Tony Junghans: Chemistry & Biochemistry

Mentor: Michele Hardy -- Immunology & Infectious Diseases

Purification and Characterization of Rotavirus NSP1

Rotavirus causes life-threatening gastroenteritis in 400,000 children, under the age of five, per year. This laboratory studies the innate immune response to viral infection where induction of the cytokine interferon is required for an effective antiviral response. Interferon regulatory factor 3 (IRF3) is required to induce an interferon response, and many viruses block the function of IRF3. Hardy Laboratory has identified Viral non-structural protein 1 (NSP1) to be a strong candidate in IRF3 inhibition and proposed the hypothesis, due to circumstantial evidence, that NSP1 (acting as an E3 ligase) interferes with the cellular ubiquitin-proteasome system to effectively degrade IRF3. To test this hypothesis, a glutathione-s-transferase pull-down assay, in combination with protease digestion to cleave the GST moiety, was used to purify NSP1 in its biologically active conformation. Purified NSP1 was then used in a functional assay designed to test possible E3 ligase activity of NSP1. As of yet, no direct evidence of E3 ligase activity by NSP1 has been clearly identified, however, this is likely due to non-specific cleavage of NSP1 by thrombin protease resulting in a biologically inactive protein. Experiments to identify the site of non-specific cleavage so as to purify NSP1 in an intact and biologically active form are ongoing.

Christopher Kloth: History & Philosophy
Mentor: Sara Waller -- History & Philosophy
Suburban Coyote and Feral Cat Vocalization

There is reason to believe that vocalizations of social and cooperative animals are intentional and have communicative meaning. In this project, we seek to better understand what they mean, how they communicate, and how they cooperate. This project stems from the Social Predator Vocalization Project, in which there are over thirty coyote vocalizations. From here, we have started to try and understand the vocalizations of feral cats, as they, like coyotes, are social and cooperative animals. This project hopes to present a comparative analysis of the vocalization spectrograms of both coyotes and feral cats, in order to better understand the meaning that is associated with various activities. It hopes to gain a deeper understanding of the societies in which feral cats live. This project seems to have the potential to reveal interesting and exciting aspects of the vocalization patterns of feral cats. This is an ongoing project.

Jackson Knoll: Physics
Mentor: Charles Kankelborg -- Physics
Optical Testing of Concave Diffraction Gratings for MOSES

MOSES stands for Multi-Order Solar Extreme Ultraviolet Spectrograph, and it is an experimental solar physics project headed by Dr. Charles Kankelborg at Montana State University. The purpose of the project is to gain insight into the processes in the atmosphere of the Sun. The objective of the project is to launch a rocket with the MOSES payload above Earth's atmosphere and have the payload collect images of the sun in a specific wavelength band. The portion of the project that I worked is the optical testing of the MOSES diffraction grating. Before MOSES's previous flight the team did not have the equipment necessary to test the optics. Obviously the manufacturing process is not perfect and we would like to know what kind of minor asymmetries aberrations exist in the diffraction grating. These measurements will allow us to predict the quality of images to be obtained in flight. We have attained results to the problems posed above by using a phase measuring interferometer and other optical testing tools such as mirrors, beam splitters, and of course the diffraction grating that was used in MOSES's last launch.

Acknowledgements: Tom Rust (Doctoral Student) - Physics

Craig Kozeluh: Cell Biology & Neuroscience
Mentor: Steve Stowers -- Cell Biology & Neuroscience
Optogenetic Circuit Mapping In Drosophila Larvae

It is one of neuroscience's primary goals to gain a deep understanding of how living organisms sense the environment, translate this into electrical and chemical signals, process this sensory information, and finally produce a behavioral response. Since the human nervous system is very intricate and large it would be very difficult with today's technology to map pathways such as this in great detail. However, in Professor Steven Stower's lab, we have decided to use an animal that is much simpler and very genetically malleable due to previous research and generation speed, the *Drosophila* Larva (fruit fly). This animal is also perfect because of the size of its nervous system, it is simple enough to realistically map its somatosensory circuits, and similar enough to a larger animal's nervous system that the knowledge gained can be used in studying more complex organisms. In this project it has been our goal to map a specific neural circuit in the fruit fly larvae. This circuit is the larvae's sense of cold and its behavioral output. To begin the mapping of this circuit, we have been working to be able to express transgenes in the specific subset of sensory neurons involved in transduction of cold stimulus. Once this subset of neurons is controlled, it is our hope to use a cutting edge technique called GRASP (GFP Reconstitution Across Synaptic Partners) to begin mapping second and third order neurons of the circuit.

Ben LaFrance: Chemistry & Biochemistry

Mentor: Trevor Douglas -- Chemistry & Biochemistry

Hierarchical Assembly of Protein Cage Nanoparticles: A P22 Super-lattice

The protein cage nanoparticle derived from bacteriophage P22 has been shown to be a valuable and easily modified platform for nano-materials applications. In addition to controlled morphological transformations, the exterior of P22 can additionally be modified for cell targeting and display. The interior also provides a well-defined space for encapsulating a variety of cargos. Expanding the P22 system into a hierarchical structure has many applications as a novel nanomaterial. This work describes the use of a modified trimeric decoration protein complex (Dec) that binds to the exterior of P22 exclusively at the pseudo 3-fold symmetry axes, towards the creation of a P22 super-lattice. DPS is a protein cage like P22 and has four 3-fold axes. Genetic fusion of the Dec trimer to these 3-fold axes creates a tetrahedral Dec-DPS particle. Addition of P22 to this Dec-DPS construct allows the Dec to interact with the P22 to create a well ordered super-lattice of P22-Dec-DPS. This new hierarchical assembly provides a novel platform for study and applications in nanomaterials science.

Ian Macdonald, Rob Mackin: Cell Biology & Neuroscience

Mentor: Steve Stowers -- Cell Biology & Neuroscience

Optimization of GRASP

For this project we optimized a method called GRASP (GFP Reconstitution Across Synaptic Partners). The original method utilized two binary transcription systems to express Green Fluorescent Protein (GFP) split into two fragments. Each fragment can be individually expressed on specific pre and post synaptic neurons. When these neurons synapse the two fragments of GFP are brought into direct contact which reconstitutes the fluorescence. We are using the model organism *Drosophila Melanogaster* to express the GFP fragments on Class III mechano-sensory neurons and the second order neurons they synapse with at the third instar larval stage. The original method gave false-positive reconstitution in non-synaptic areas of the neuron. Our project focused on finding proteins to drive the localization in a much more precise manner in order to make reconstitution specific for synapses. We are experimenting with proteins associated with the synaptic cleft to find the best candidates in the pre and post synaptic neurons. Using con-focal microscopy we are able to visualize the reconstituted GFP. This is a preliminary step in creating a map of the circuitry of Class III mechano-sensory neurons.

Patrick Madden: Chemistry & Biochemistry

Mentor: Trevor Douglas -- Chemistry & Biochemistry

Investigating the P22-Dec protein system as an influenza vaccine platform

My project is investigating the ability of P22 to serve as an influenza vaccine platform. Using the P22-virus like particle (VLP) and the Decoration protein isolated from bacteriophage L to deliver influenza viral proteins to the immune system. The Decoration (Dec) protein from bacteriophage L will bind to the outside of the P22 capsid. Hemagglutinin (HA) protein from the influenza virus will be genetically fused to the C-terminus of the decoration protein, which will extend it away from the surface of the P22 capsid. Conserved regions of HA will be used to attempt to elicit a cross-protective antibody response that will protect the mice from multiple influenza strains. The in vivo effects of the P22-Dec-HA construct will be probed by using a model mouse system. The size, length, and fold of the HA protein needed to elicit a broadly neutralizing cross-protective antibody response will be studied using many techniques. Dec binding will be determined using techniques such as gel shift assays, analytical ultracentrifugation, and multi angle light scattering. The data gathered about the ability of the P22-Dec system to elicit an immune response in vivo, as well as the ability of Dec to bind P22 with different sizes of polypeptides will be critical in the development of the P22-Dec system as a vaccine platform for many other viral infections.

Kelsey March: Cell Biology & Neuroscience

Mentor: Thomas Hughes -- Cell Biology & Neuroscience

Light: The New Drug

Approximately forty percent of all medicinal drugs target G-protein coupled receptors (GPCRs) in the body, but we have few ways of studying their signaling pathways in living cells. Drug applications can be used to activate signaling pathways but lack the spatiotemporal precision necessary to measure the kinetics of short-lived pathways. To overcome this difficulty, we use light to excite a short-wavelength zebrafish opsin, which couples to the Gq signaling pathway via our chimeric Gq/t protein. The red calcium-sensitive fluorescent protein, R-Geco, detects the subsequent calcium response. The blue light used to excite the opsin causes a reproducible spike in R-Geco fluorescence directly, due to the photoisomerization of the protein; however, the calcium signal eclipses this phenomenon and is easily distinguished. To study this optically activated pathway, we labeled PKC-gamma with either the A or B proteins of a dimerization-dependent red fluorescent protein. When the GPCR pathway is activated, PKC translocates to the membrane, bringing the A and B proteins close together and increasing fluorescence. These optical methods of inducing and detecting calcium signaling are spatiotemporally precise, allow for sub-threshold stimulation, and are a unique method for future studies of GPCR induced Gq signaling.

Jordan Maxwell: Physics

Mentor: Dave Klumpar -- Physics

Separations of Cube-Satellites in Orbit

Montana State University's Space Science and Engineering Laboratory will launch two identical cube-satellites (FIREBIRD 1 and 2) late in 2013. The goal of the FIREBIRD mission is to collect temporal and spatial data on Electron Micro-Bursts (EMBs), a poorly-understood phenomenon that takes place in the radiation belts around Earth. The quality and quantity of data collected depends partly on the rate of separation between the two satellites. Upon deployment, the two satellites (which are initially in end-to-end contact) will be separated by a small spring located at one corner. The kinetic energy imparted by the spring takes two forms: translational and rotational. Using the Law of Conservation of Energy, we find that the translational energy is equal to the energy imparted by the spring minus the rotational energy of the satellites. In order to exercise greater control over their separation, FIREBIRD 1 and 2 will have magnets either to decrease or increase separation. With a known value for the translational energy mentioned above, we can manipulate the orientation and strength of the magnets to achieve an ideal separation.

John McGlenn: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

The Affects Community Water Fluoridation has on Dental Hygiene

Water fluoridation has proven to be a controversial issue since examination trials were first introduced in the 1940's and became commonly practiced a decade later. The intended purpose of fluoridating community water systems is to reduce the number of tooth caries. The Centers for Disease Control and Prevention reported, "Fluoridation of community drinking water is a major factor responsible for the decline in dental caries during the second half of the 20th century" (Division of Oral Health, 1999). However, the World Health Organization compared countries with and without community water fluoridation and found the number of decayed, missing, and filled teeth to have an identical downward trend from 1970 to 2010. The purpose of my study is to test these two claims and find the true affect community water fluoridation has on dental hygiene by controlling for technology advancements in dentistry and other access to fluoride. I will run a multiple regression analysis to control for the number of dental visits per state and the percent of community water systems that are fluoridated and compare these variables to the percent of dental carries per state.

Isabel Milkovich: English

Mentor: Gretchen Minton -- English

Javert's Revenge: Ethical Suicide in Les Misérables

The research I am doing this semester discusses the suicide of Inspector Javert in Victor Hugo's story *Les Misérables*. Specifically, I am interested in Alain Boublil and Claude-Michel Schonberg's portrayal of Javert and presentation of his suicide in their musical of the same name. To conduct my research, I am looking extensively at Boublil and Schonberg's musical and Hugo's novel. In addition to these primary texts, I am incorporating scholarly articles written on the novel and performance reviews written on various musical productions. As the culmination of my research, I will see the musical live in London when I travel there for a Spring Break study abroad trip. By seeing the musical first-hand, I will be able to draw my own conclusions about that particular production and incorporate them into my research. While in London, I will also have the opportunity to speak directly with the actor playing the part of Inspector Javert. I will ask him questions regarding his portrayal of Javert, the research he himself did in preparation for his role, and the rationale behind his and the director's decisions that enhance or otherwise change the character of Javert. As a strictly self-disciplined, rational, and Christian character, Javert must have justification for committing Christianity's one unforgiveable sin. By looking at the original novel, journal articles, reviews of various stagings of the musical, and by seeing firsthand and analyzing a production of the longest running musical in history, I will be able to determine at what point in the story Javert decides to kill himself, exactly why he takes his own life, and how the implications of his suicide change the interpretations of Hugo's Javert and Boublil and Schonberg's Javert nearly 150 years later.

Tanner Moe: Sociology & Anthropology

Mentor: Tamela Eitle, David Eitle -- Sociology & Anthropology

Parental Bond, Gender and Adolescent Coping Skills

Coping skills among all age groups throughout the lifespan, but particularly in adolescence, have been shown to play a leading role in the ability to manage one's life efficiently for both males and females. Prior research has suggested that adolescents who lack adequate coping skills can resort to substance abuse, delinquency, or other risky behaviors when faced with stress. This study aims to develop a better understanding of how both gender and the perceived parental bond might or might not influence the type of coping skills implemented by adolescents. The Montana Teen Stress and Health Study collected surveys from roughly 620 students in 5 rural high schools in Montana. Similar to previous studies, our preliminary analysis of the research has shown that a strong parental bond does result in a stronger likelihood of using positive coping skills, while a weak bond results in a greater chance of using negative coping skills among adolescents. These findings were the same for both males and females. However, females were more likely to use support-focused positive coping skills, while males and females were equally as likely to use active positive coping skills.

Rebekah Mohr: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

Racial Bias in Lending Markets

In this project, I analyze the effect of racism in the modern lending industry. To do this I use an economics model to analyze data from home mortgages that includes information on demographics of borrowers and characteristics of loans. If there is a racial effect in the lending market, I expect to find that individuals in specific racial groups, all else equal, have higher interest rates. If this is true it will show that lenders are biased against individuals in these groups, viewing them as a higher risk simply due to their racial background. If there is no racism in the lending industry then expect that rates are evenly distributed across all racial groups. I will use statistical tools, such as regression analysis, to appropriately estimate the relevant variables and results.

Lindsay Murdock: Sociology & Anthropology

Mentor: Danielle Hidalgo -- Sociology & Anthropology

The Female President: The Redefinition of Gender Roles in Higher Education

The following research questions how and if gender roles are still present in the administration at a Land Grant University. The majority of the literature on gender roles in leadership focuses on government, community or K-12 education so the current research seeks to fill those gaps. Though there were several emergent themes, the two that stood out the most were the “Small Touches” theory and the women vs. women phenomena present in other research. Additionally, being female does allow for more exploration of masculinity in leadership styles, but feminine leadership styles are still criticized. There was also an incredible emphasis on mentorship within the workplace. Finally, throughout this research there was talk about the feminization of higher education and the implications for future female leaders in higher education.

Gourav Krishna Nandi: Mathematical Sciences

Mentor: Robert Szilagyi -- Chemistry & Biochemistry

The Retrosynthesis of Amino Acids with Relevance to Prebiotic Transformations

The proposed study focused on building a mathematical model of the Miller- Urey experiment to stimulate the formation of the amino acids required for the evolution of life on the earth. The model examines the reaction at the molecular level by studying the synthesis of amino acids and simulating different energy sources, including volcanic thermal activation, ultraviolet irradiation and high energy particles, as part of a chemical activation process of the primordial Earth. Computational tools and quantum chemical software were used to calculate the structure of the reactant, transition state, and product molecules for chemical reactions as abiotic processes.

Molly Neale: Agricultural Economics & Economics

Mentor: Carly Urban -- Agricultural Economics & Economics

How Shall I Send Thee?

Prior to *Brown vs. The Board of Education* students were segregated by race. Today we no longer see mandated segregation but instead segregation due to geography which often times leads to racial segregation. Much policy discussion has been done on the costs and benefits of bussing students in an attempt to integrate and “level the playing field” so to speak. While extensive research has been done on the effects of peer groups, little emphasis has been put on how higher populations of white students affect the minority populations. Research as such may give insight into what extent segregation should actually be fought. I have chosen to explore the effects of higher White student populations on Hispanic or Latino students’ English and Language Art scores. Once income has been controlled for, the theory behind peer effects would suggest a positive correlation between higher populations of White students and higher English and Language Arts scores among Hispanic or Latino students. A finding as such may suggest a different type of bussing schedule than the ones previously proposed.

Kristen Newman: American Studies

Mentor: Robert Rydell -- History & Philosophy

Does America Have a Totem Animal? Exploring the Cultural Impact of Dinosaur Sculpture Gardens

America's world's fairs have had significant impact on American culture, providing a venue for experiencing new ideas and seeing the world around us in a new light. One of the fascinating scientific contributions to this experience was introducing paleontology in a big and exciting way. In the 1964 World's Fair, the Sinclair Oil company contributed to this fascination by installing enormous dinosaur sculptures for visitors to experience. These sculptures later went on to travel the United States. Today, sculpture gardens such as these are still widely popular destinations throughout the United States, especially in the West. In *The Last Dinosaur Book*, author W.J.T Mitchell argues that the dinosaur is America's “totem animal.” Through an interactive touch screen exhibit, people will have the opportunity to visit these locals, learn the history behind them, as well as explore W.J.T Mitchell's argument and decide for themselves whether the dinosaur truly is America's totem animal.

Jared Nigg: Microbiology

Mentor: Gary Strobel -- Plant Sciences & Plant Pathology

Biofuel from a Fungus: Activating 1,8-Cineole Production in an Endophytic Fungus

1,8-cineole is an octane derivative with fuel, industrial, and medical applications. Currently, cineole is obtained by a time consuming and inefficient process, limiting its commercial production. A recently discovered cineole producing fungus (MT-13) produces the compound in high concentrations when cultivated on potato dextrose agar (PDA) alongside sterile pieces of its host plant. As the host plant is taken away and the fungus is attenuated via serial transfers on PDA it gradually loses its bioactivity, which corresponds to a loss in cineole production. When the fungus is placed back on to its host or certain other plant materials it resumes production of cineole as measured by proton transfer reaction mass spectrometry and bioactivity assays, suggesting the presence of a cineole production activation molecule (CAM) present in the host. Identification of the CAM would allow optimization of MT-13 for commercial cineole production via solid state fermentation. Accordingly, the active components of a plant exhibiting cineole production activating effects similar to the host plant have been isolated and fractionated by water extraction, dichloromethane extraction, column chromatography, thin layer chromatography, and high performance liquid chromatography. Liquid chromatography mass spectrometry and nuclear magnetic resonance will be applied to these fractions to identify the CAM.

Marisa O'Sullivan: English

Mentor: Linda Karell -- English

Female Insanity in Literature

My paper investigates the literary depictions of female insanity in fiction and in nonfiction in order to examine the importance to contemporary readers of representations of women. Texts examined may include *Jane Eyre* by Charlotte Bronte, *Wide Sargasso Sea* by Jean Rhys, *The Yellow Wallpaper* by Charlotte Gilman, and *Through the Looking-Glass* by Lewis Carroll.

Jake Parker: Physics

Mentor: Charles Kankelborg -- Physics

Radiometric Calibration of the MOSES Rocket Payload

The Multi Order Solar Extreme Ultra Violet Spectrograph (MOSES) rocket payload is a novel instrument for imaging the solar atmosphere in extreme ultraviolet (EUV) wavelengths. We report progress toward the radiometric calibration of the MOSES rocket payload. We have calculated the etendue of our system, have performed charge transfer measurements on the CCD detectors, and are now preparing for an end-to-end throughput measurement. We will present the experimental design and procedure for this measurement.

Chelsey Pengra: Sociology & Anthropology

Mentor: Tamela Eitle, David Eitle -- Sociology & Anthropology

Parental Bonding and Teen Polysubstance Use

Teen polysubstance use places adolescents at increased risk for suicide, lower educational attainment and divorce compared to mono-substance use. Using data from the Montana Teen Stress and Health Study, this research explores the impact of family substance use and parental bonds on polysubstance use. This study explores whether or not strong bonds to parents are protective for substance use as suggested by social control theory, or whether strong bonds with parents who use are a risk factor for teen polydrug use as suggested by social learning theory. Preliminary results of this study identifies parents as primary agents of socialization, that can and do influence the progression from minor use of marijuana and/or alcohol to engaging in illicit (cocaine, meth, and heroin) drug use or polysubstance use.

Natasha Pettinger: Chemistry & Biochemistry
Mentor: Bern Kohler -- Chemistry & Biochemistry
Photoreduction of Aqueous Cerium(IV)

Hydrogen production through photocatalyzed water splitting has gained increasing interest over the past couple of decades as a potential environmentally and economically sustainable energy source. Metals have been at the center of this research because they can lower energy barriers by facilitating bond formation and breakage through modification of ligand orientation. The majority of research done on these systems has been electrochemical, and knowledge of the primary mechanisms of these systems is lacking. Using ultrafast transient absorption, we monitored the fundamental electron transfer mechanisms in aqueous Ce(IV) systems to develop a better understanding of the initial reaction steps in this water-oxidation model system. Varying the coordination sphere has a drastic effect on the efficiency of photoreduction of the metal. We established that in an aqueous Ce(IV) system with no complexed counterions at pH 0, cerium is reduced within the laser pulse by complexed hydroxide ions. This initial excited population decays with a 3 ps lifetime through back electron transfer. About ten percent of the initial photoproducts escape through diffusion, giving Ce(III) and hydroxyl radical as the primary photoproducts. Cerium serves as a simple model system to show the fundamental electron transfer events in water oxidation and to exhibit the power of ultrafast transient absorption in monitoring populations on the time scale of electron transfer and diffusion. *Acknowledgements: Jinquan Chen (Postdoctoral Researcher) - Chemistry & Biochemistry*

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

The chemical properties of molecularly thin films play an important role in the performance of working surfaces in industry, research, medicine, biological systems, and various other applications, but are not yet fully understood. Research described in this poster investigates the effect of strategic subtle substitutions to the molecular structure of 7-amino-coumarin dye derivatives relating to the properties of their respective molecular films. Characterization of liquid/solid, liquid/vapor interfaces are compared to previous work with these compounds in the bulk solution medium for reference. , The use of a surface specific method, total-internal-reflection fluorescence spectroscopy, allows for in situ measurements of the liquid/solid environment with sample populations residing within 100nm of the planar silica surface giving accurate information intrinsic to the molecular film. The three coumarin derivatives studied in methanol, chloroform, and n-hexanes with a combination of TIR-fluorescence and time correlated single photon counting displayed unique adsorption mechanisms to a silica surface. Results summarized in this poster show that small changes the amino functional group lead to drastically different adsorption mechanisms to a planar silica surface.

Jesse Powell: English
Mentor: Doug Downs -- English
The Elementary Emergence of Rhetoric within Questions

The proposed inquiry is how rhetoric capitalizes on embedded linguistic mechanics. The focus is on *wh*-movement and linguistic trace. Rhetorical questions exist as a basic function derived from linguistic nuance. The presentation evaluates the functions of trace and *wh*-movement and how they transfer more than simple inquiries. Rhetorical foundations are proposed to be as much a part of human language as *wh*-questions. This research project explores rhetoric as emergent from the complexity of language *au natural*. Rhetoric, specifically rhetorical questions, is a grooming and conditioning of what exists by natural capacity. Whether or not a person is trained in rhetoric does not matter to the subconscious processing effects of language as a discrete combinatorial system.

Virginia Price: Physics

Mentor: Charles Kankelborg, Philip Judge -- Physics

Calibration and testing of an EUV hollow cathode light source

The main objective of this project is to characterize an EUV hollow cathode light source to be used for testing and calibration of the MOSES rocket. The instrument is a continuous gas discharge source (McPherson Model 629 Vacuum UV Hollow Cathode Light Source) used with helium gas at a pressure of ~0.5-1 torr to produce spectral lines of interest to the MOSES rocket. The lines of interest are the 30.4 nm and 46.8 nm spectral lines of doubly ionized helium (He II). These lines will be used for testing and calibration prior to the launch of the MOSES rocket.

Marnee Rand: Political Science

Mentor: David Parker -- Political Science

IRS Intimidation and Deep Water Horizon: How Contingent Oversight Theory Explains the Politics of Congressional Investigations

We review the police patrol/fire alarm dichotomy of congressional oversight and find it wanting both theoretically and empirically. We develop a new theoretical account explaining the frequency and duration of committee investigations of alleged executive branch misdeeds. Using this new perspective, we explain the very different oversight experiences of two executive agencies over the past two decades: Minerals Management Service (MMS) and the Internal Revenue Service (IRS). We demonstrate with contingent oversight theory that congressional investigations are driven not only by member opportunity costs but by broader contextual opportunity costs imposed by partisan, institutional, committee structures, and divided government. We argue that the police patrol/fire alarm model of oversight be dispensed with in favor of a more robust theory of investigations which better explains the varied attention of Congress' watchful eye.

Acknowledgements: Matthew Dull, Center for Public Administration and Policy, Virginia Tech University

Jacob Remington: Chemistry & Biochemistry

Mentor: Bern Kohler -- Chemistry & Biochemistry

Probing the Structural Dynamics of Single Stranded DNA Labeled with 2-Aminopurine Using Simulated Annealing to Analyze Time-Resolved Fluorescence Measurements

DNA contains sequences of adenine (A), thymine (T), cytosine (C), and guanine (G), connected via flexible phosphate and 2'-deoxyribose linkers which allow the natural bases to take on a vast array of conformations, including base stacking. This project aims to determine whether the degree of base stacking changes between bases positioned at the middle and ends of a single strand of DNA (ssDNA). A single 2-aminopurine residue was placed either at the middle or the end of ssDNA 15-mers that otherwise contained only adenine bases. Steady-state fluorescence excitation measurements indicated that charge transfer from UV-excited adenines to 2-aminopurine is more efficient when 2-aminopurine is in the middle of the strand. To pursue this observation further, a time-correlated single-photon counting (TCSPC) spectrometer is used to show that fluorescence lifetimes increase when 2-aminopurine is placed on the interior residues of the strand. The TCSPC data showed a multiple exponential decay that is fit using both the commercial program (FloFit) and an in house simulated annealing technique to reinforce minima found in the multidimensional parameter space. These results are providing new insights into the conformational preferences of terminal vs. interior residues in ssDNA.

Acknowledgements: Charles Stark (Doctoral Student) - Chemistry

Amanda Richards: Microbiology

Mentor: Michael Franklin -- Microbiology

Fluorescent Imaging of Pseudomonas aeruginosa Biofilms

Biofilms are associated microbial communities where the cells are attached to surfaces by extracellular matrix materials. The extracellular matrix is thought to include secreted extracellular polysaccharides. The primary goal of this research was to characterize extracellular matrix of biofilms by using fluorescent probes and microscopic imaging. *Pseudomonas aeruginosa*, an opportunistic pathogenic bacterium, was used due to its ability to produce three different extracellular polysaccharides, Psl, Pel, and alginate. *P. aeruginosa* PAO1, which produces Psl, was

the main strain used. Three commercial fluorescent stains, Cell Mask Orange (CMO), Bodipy 630/650 X-SE (BOD), and Griffonia (Bandeiraea) simplicifolia lectin I (GSL-I) were found to stain the matrix of this strain as well as one stain from the MSU fluorescent probe core facility. Two stains, CMO and BOD appear to bind different components of the matrix, suggesting that the matrix may contain material other than polysaccharide.

Recently, we analyzed *P. aeruginosa* PA14, which produces the Pel polysaccharide. Thus far, no stains have been found that effectively bind Pel, but CMO had some small sections of sporadic staining of the bottom layer of the matrix. These results demonstrate that the matrix material of *P. aeruginosa* biofilms is structured and forms adhesive material for the bacterial cells. Future work will examine the developmental process associated with biofilm extracellular matrix formation.

Bronwyn Rolph: Modern Languages & Literatures

Mentor: Ada Giusti -- Modern Languages & Literatures

Moroccan Literature and Stories

This project involved researching Moroccan literature and stories and how both play a role in Moroccan culture. It was used to assist Professor Giusti to create a syllabus for the French capstone course on Moroccan literature. The background of numerous famous Moroccan authors and literature was researched and evaluated for the course.

Throughout the course, students gave feedback on how the selected works influenced their perspective on Morocco. During Professor Giusti's service learning trip to Morocco, Moroccans were interviewed on literature and stories in their culture. Upon return, students who traveled to Morocco also gave feedback on whether the literature discussed had resonated with them and whether the works discussed had helped them understand the culture. All of this information will be compiled to form conclusions and give Professor Giusti recommendation for her future literature and lecture content.

Jesse Ruzicka: Chemistry & Biochemistry

Mentor: Robert Walker -- Chemistry & Biochemistry

The Effect of Surfactants on Lipid Membrane Structure and Stability

Lipids comprise a large family of molecules having different headgroups, tail lengths and degrees of unsaturation, however, virtually all lipids are amphiphilic. Work described here examines the effects of neutral surfactant head groups on the structure and organization of Dipalmitoylphosphatidylcholine (DPPC) lipid monolayers adsorbed to the air/water interface. Of particular interest was the nature and strength of surfactant-DPPC interactions. The surfactants employed in these studies contained a 16 carbon backbone and differed only in head group; these included 1-hexadecanol (HD), 1-hexadecylamine (HA), palmitic acid (PA), and N,N-dimethylhexadecylamine (DMHA). Mixtures of DPPC and the other surfactants spanned the entire composition range, $\chi_{\text{DPPC}}=0.00-1.00$. In this study it was found that all systems deviate from ideality, but the systems containing DPPC mixed with HD, HA, and PA all exhibited negative excess free energies of mixing (ΔG_{ex}) indicating the surfactants stabilized the lipid monolayer. The DPPC/DMHA system, in contrast, showed positive ΔG_{ex} at some monolayer compositions implying either 2-dimensional phase separation or at least the formation of concentration gradients. These differences are attributed to DMHA larger size and lack of hydrogen bonding capabilities.

Saurab Sainju: Cell Biology & Neuroscience

Mentor: Mike Vogel -- MSU Extension

Healthy Kids Make Healthy Homes

Indoor air in the United States is two to five times more polluted than outdoor air. The purpose of this project was to teach young children about keeping healthy and safe in the home. Indoor air quality was among the topics that were covered; also it included home safety and the environment. Issues like air quality are only recently being well understood, and this knowledge must be passed down to youths in order to ensure their own health. A second grade class in a semi rural school was taught; the method of teaching had kids show what they learned by creating their own publication with their own illustrations and tips. By allowing the kids free range in making a book, the motivation was to instill these values more effectively. In order to keep track of learning, the kids were tested about their knowledge of various health and safety guidelines before and after. Also the teacher recorded the kids' thoughts and beliefs before and after lessons. This project was able to combine the creativity of drawing with the

technical writing of a reference book while teaching the children important safety and health habits to be applied in their everyday lives.

Alyssa Sandner: Ecology

Mentor: Michele Hardy -- Immunology & Infectious Diseases

Site Directed Mutagenesis as a Strategy to Understand Viral Protein: Cell Protein Interactions

Viruses that are able to infect mammals have created mechanisms evade host response by antagonizing cellular antiviral responses such as interferon response. Rotavirus NSP1 protein causes the degradation of certain antiviral Interferons Regulatory factors depending on the particular strain. Antiviral Interferon Regulatory Factors 3 and 7 are important to initiate interferon creation, and post infection NSP1 induces degradation. We compared three strains from bovine, Human and porcine sources and used in vitro Site Directed Mutagenesis to try and investigate what about the protein causes such specificity in it's selection of which antiviral Interferon Regulatory to degrade. The overall test was to determine if mutagenizing NSP1 from one strain to another would change the substrate the NSP1 selects to degrade. This leaves the question, what does the transition from OSU to W161 mean? Site directed Mutagenesis changes nucleotides to create a mutation. These amino acids they code for are thought to be important to protein function.

Audrey Schadt: Cell Biology & Neuroscience

Mentor: Renee Harris, Julia Middleton -- Montana Area Health Education Center

Worksite Wellness in Montana Critical Access Hospitals: Importance and Implementation

After a review of the literature regarding worksite wellness programs, a strong determinate for reducing employee absenteeism, increasing employee productivity and decreasing health insurance costs, has been effective employee worksite wellness. Hospital employees are an ideal population for wellness programs because their jobs are demanding and they generally work in high-stress environments. These conditions steadily wear on an individual's health and may even promote poor health choices. The goal of this research is to develop a wellness program to be implemented in a Montana Critical Access Hospital (CAH). CAHs are limited service hospitals designed to provide essential services to rural communities. Currently, a lack of wellness opportunities for CAH employees exists statewide. Evidence-based support for various wellness plans has been gathered from both local Montana businesses and organizations nationwide. Because CAHs have a small employee population, the wellness programs surveyed were from businesses of similar size. Existing hospital wellness programs were also investigated from other states. This wellness program has not been adopted by any Montana CAHs yet. However, studies performed around the country show similar benefits. With the implementation of a basic worksite wellness program, CAHs in Montana could achieve all of the aforementioned results.

Emily Jo Schwaller: English

Mentor: Doug Downs -- English

E-mailing and Its Effects on Construction of Professional Identity in Workplace Communication

In the past 20 years, workplace communication has become increasingly e-mail based. Although multiple studies have been done about e-mailing and its affect on small group projects (e.g., Martins; 2004; Staples, 2007; Johnson, 2009), there is a lack of research on the rhetorical implications of computer mediated-communication in relationship to the individual. My presentation addresses the question: How is professional identity constructed through the rhetoric of e-mail? Communication relies heavily on inflection, social cues, and positions of authority. When each of these elements is mediated by various positions of authority, the rhetoric has to change to symbolize the same level of clarity as well as consistent formality. To research this question, I am collecting a corpus of e-mails from a university press to analyze how individuals involved with the production of scholarly books -such as editors, editorial assistants, peer reviewers, and authors- construct each other's professional identities through e-mail, without meeting face-to-face. The corpus is not complete, so I am as yet in the early stages of developing a code based on Huckin's (1992, 2004) context sensitive text analysis. My presentation will report on the findings of this analysis, focusing on the way authority presents itself as well as the formality of language in professional e-mail communication.

Tia Sharp: Modern Languages & Literatures

Mentor: Ada Giusti -- Modern Languages & Literatures

Creating Basic English and French Lessons and Conversation Plans

In Zawiya Ahansal, Morocco, the residents of the small Berber village asked the Atlas Cultural Foundation (ACF), as well as Montana State University (MSU) students and Dr. Ada Giusti to teach adults and children of the region English and French language skills. Inspired to fulfill these villagers' requests, I traveled with Dr. Ada Giusti and a small group of French speaking students to Morocco in March 2013. In response to the villagers' requests, before traveling, I created basic English and French lessons. I was challenged to create two basic Handbooks; one in English and one in French. I also recorded a CD of the two Handbooks to incorporate the auditory learning aspect to aid in understanding concepts for the illiterate students of the village. Once in the village I taught conversation skills for both the adult climbing guides and the elementary aged children. I am currently revising my handbooks and plan to publish a "Colors" book for the children and an English Climbing Guide for the adults to be sent back to Morocco. These will be used for future MSU student teams that will be traveling to Zawiya Ahansal.

Charity Shumaker: English

Mentor: Linda Karell -- English

Fairy Tales and The Construction of The Feminine Identity

Are fairy tales merely a reflection of the social constructs of their times or do they contribute to the construction of cultural norms? I am especially interested in researching the extent to which mainstream fairy tales contribute to the creation of the feminine identity. I also am exploring the ways in which non-mainstream authors are creating a different feminine identity and whether or not these alternative constructions are impacting current social norms.

Jacob Simon: Physics

Mentor: Hugo Schmidt -- Physics

Exploration of Lithium Coated Yttrium Doped Barium Zirconate as Material for Solid Oxide Fuel Cells

Solid oxide fuel cells (SOFCs) have the potential to be a major component in the global quest to replace fossil fuels as the ubiquitous energy source of the modern world. Though current SOFCs are disadvantaged in their high operating temperatures, proton conducting SOFCs are promising because they minimize this disadvantage. Yttrium doped barium zirconate (BZY) has been recognized recently as a possible electrolyte for proton conducting SOFCs. The result of an operational lithium SOFC will be the extraction of pure hydrogen from syngas.

Two lithium deposition methods are explored; the first being metallic lithium melted onto the sample, the second being the decomposition of lithium nitrate. Concerns of lithium tarnishing in atmosphere are address. There is also exploration of decomposing lithium nitrate in a hydrogen atmosphere. X-ray photoelectric spectroscopy (XPS) is used to analyze the sample composition and assess the purity of the triple phase boundary between the lithium and the BZY. Further exploration into the conductive properties of the material using impedance spectroscopy is proposed.

Josh Sinrud: Physics

Mentor: Hugo Schmidt -- Physics

Characterization of SOFC LSM cathodes using EIS

Solid Oxide Fuel Cells are very promising alternative energy devices. The fuels used in SOFCs are primarily hydrogen and oxygen. This makes for a very clean efficient alternative energy source due to the fact that water is ideally the only waste product. The abundance of hydrogen (in compounds) and oxygen also adds to the effectiveness that SOFCs have the potential for. A fuel cell is made up of three parts, the anode, electrolyte, and cathode. In order to determine the effectiveness of any part of the fuel cell, tests must be run to characterize whatever part is under examination. Specifically in this project, the examination of Lanthanum Strontium Manganite (LSM) as a cathode in fuel cells is performed. The test being used is electrochemical impedance spectroscopy (EIS) using a symmetric cell. The cell is created as an electrolyte supported cell and has a cathode applied on each side of the electrolyte. The EIS measures the cell's impedance over a range of frequencies at a

range of temperatures. This impedance reading can then be dissected and analyzed. A baseline test of a plain electrolyte can then be compared to the symmetric cell's impedance so that the LSM ink can be characterized.

Alec Skuntz: Chemistry & Biochemistry

Mentor: Brian Bothner -- Chemistry & Biochemistry

Investigation of Virus Capsid Protein Dynamics by Following Changes in Intrinsic Fluorescence

My project is focused on using a viral model system in order to explore the dynamic nature of proteins. I am using the plant virus Chlorotic Cowpea Mottle Virus (CCMV) for the study as its structure is well documented and it is composed of only capsid protein and genetic material. There are two types of this simple T=3 virus, the Wild Type and Salt Stabilized mutant form, as well as a few variable structural conformations brought on by pH and ionic strength. The swollen form of the virus forms in pH 7.5 and in absence of metal ions, the closed form appears in presence of divalent cations and in pH 4.5 or lower. I am using the intrinsic fluorescence of the tryptophan residue in order to follow the changes of the protein in these unique viral builds in order to propose stability of the particles. A chemical denaturant gradient will be used to initiate conformational changes and eventual denaturation in the virus types. Preliminary results show some expected trends in fluorescent lifetime waveforms, such as peak shifting as the gradient increases and some more unexpected data such as lifetime shifting back and forth; this might give some evidence towards a capsid intermediate structure. Proteins' function is derived from its structure, but the static structure is not the whole story. Exploring the dynamic side of protein interactions provides a better framework to understand their wide array of jobs and functions in the human body.

Benjamin Smith: Chemistry & Biochemistry

Mentor: Bern Kohler – Chemistry & Biochemistry

Kinetic Study of 2-Aminopurine at 77 K in Cryogenic Glass

Spectroscopic studies allow researchers to probe the dynamic nature of electrons in DNA and RNA. These studies investigate the femto-second ultrafast relaxation pathways of electrons from the excited state to the ground state electronic configuration. The electronic structure and relaxation pathway of a nucleotide in a liquid solvent and at room temperature is affected by solvation electronic properties. By cooling DNA and RNA to 77 Kelvin and forming an optically clear glass, it is possible to diminish solvation electronic effects of the liquid solvent on the electronic structure of DNA and RNA nucleotides. A DNA base analog to adenine is 2-aminopurine. When incorporated into single strand DNA its enhanced fluorescence is used as a probe for the dynamic nature of DNA. Its fluorescence properties are attributed to movement of the amino group on the sixth carbon of adenine, to the second carbon on 2-aminopurine. A stand was built to accommodate fluorescence measurements of 2-aminopurine at cryogenic temperatures in a time correlated single photon counting spectrometer. Two types of rigid glass, a 50:50 ethylene glycol and water mixture, and a 10M LiCl solution, were compared at 77 Kelvin. DNA and RNA nucleotides were incorporated into these optically clear glasses to determine any absorption differences between the two solutions. This project developed experimental procedures for fluorescence studies of DNA, RNA, and 2-aminopurine nucleotides at cryogenic temperatures.

Sarah Sproul: History & Philosophy

Mentor: Doug Downs -- English

Where the "Rest of the Story" starts

An exploration of how the "value" in writing mixed with media, passes original intent and becomes its own being. That is specifically how the combination of rhetorical value, media, and writing becomes more than the initial intended message and in extreme cases takes on a life of its own. With a focused look at the iconic Paul Harvey I intend to explore this idea by showing how the value writer's put into works, along with the value audiences assign and media are required for the shift from a piece of rhetoric into their own entity.

Lee Stunkard: Chemistry & Biochemistry

Mentor: Martin Lawrence, Brian Eilers -- Chemistry & Biochemistry

Structural Studies of Zic Transcription Factors

The progression of the neural plate becoming a neural tube, a precursor for the central nervous system, forms at the earliest stages of life. The zic protein family is important throughout this whole process. First, the neural plate has to form, thicken, and rise to form neural folds. The neural folds pinch in and fuse together to form the neural tube. Then the neural plate makes a cord-like structure that migrates inside of the embryo and hollows to form a tube. Genes are being turned on and off by transcription factors which orchestrates this neural development. The zic family serves an important role as transcription factors throughout neural development. The main goal of the project is to solve the crystal structure of the N-terminal domain of the zic1, zic2 and zic3 proteins. Structures for the zic family proteins have yet to be solved. Solving the structure of these proteins is important in determining their function throughout the neural development. To solve the structure of these zic proteins, large crystals will be needed for X-ray crystallography. To enter crystallization trials, three mg of purified protein are needed. Techniques used in purifying the zic proteins are Ni-NTA column, size exclusion chromatography and ion exchange chromatography. Thus far, some zic1, zic2 and zic3 proteins has been purified. The next step is to purify enough of each protein to enter the preliminary crystallization trials.

Hannah Susorney: Earth Sciences

Mentor: David Lageson -- Earth Sciences

Impact Crater Morphology on Mercury

The MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft has obtained extensive coverage of the topography of Mercury's northern hemisphere with the Mercury Laser Altimeter (MLA), and high-resolution images of the surface have been obtained with the Mercury Dual Imaging System (MDIS). By combining altimetry and images, several aspects of crater morphology can be quantified and compared across the surface of Mercury to further the understanding of crater formation and modification. Over 190 impact craters in Mercury's Northern hemisphere were studied. Their diameter, depth, wall height, central peak height and floor diameter were measured and compared for craters of differing relative ages. Impact crater depth was not observed to just be a function of relative age, but large variations in crater depth were observed in similarly sized and aged craters. These variations could be either a function of terrain differences on Mercury or possibly of impact velocity.

Matthew Taylor: Ecology

Mentor: Ian Van Coller -- Film & Photography

Original Wooden 4x5 Field View Camera

I was to design and build a 4x5 field view camera, supplemented by a photographic series of the decaying frontier. Through this project I hoped to further my understanding of how a camera is built and strengthen my knowledge of other photographic processes. Many rundown farms persist in Montana today; the farmhouses and other structures have entered a natural state of being and no longer serve their original purposes. The goal of my project was to take stylistic influences from the Farm Security Administration's depression-era images and create an original series of 4x5 color photographs. Ultimately, the project created modern photographs that depict the decaying homes, lands, and lifestyles of today's rundown and abandoned farms in a retro way. I accomplished most, but not all of my proposed goals. For instance, the 4x5 camera was completed; however, I did not finish the camera until late January, thus I was not able to take photographs this summer with the camera. To compensate, I did photograph with another smaller-format camera and created a small series on the decaying frontier. I intend to display the wooden hand-made camera along with four images I created with the other camera over the summer months of 2012. Personally, the photographic series of the decaying frontier is far from complete, but as it pertains to the USP grant, I was able to create a solid foundation for the continuation of my work.

Joe Thiel: Liberal Studies and Chemical Engineering

Mentor: Doug Downs -- English

Rhetoric and the Organization: Perspectives on Rhetorical Institutionalism

Recent management research has attempted to apply rhetorical theory to the study of organizations. One of the more promising applications, called rhetorical institutionalism, investigates, using a rhetorical approach, the ways in which organizations and institutions constrain and enable agency. This article investigates a model of rhetorical institutionalism developed by Green and Li in 2011 by drawing on interviews of a university president and an active student leader to gauge the effectiveness of the model in a university setting. It also elaborates on Green and Li's basic model, proposing ways in which modern managers act less as individual rhetors and more as crafters of a rhetorical situation.

Michelle Thomas: Chemistry & Biochemistry

Mentor: Martin Lawrence -- Chemistry & Biochemistry

Structural Studies of CRISPR/Cas Proteins of M. tuberculosis

Clustered Regularly Interspaced Short Palindromic Repeats (CRISPRs) and their neighboring CRISPR Associated or cas genes have recently been implicated in the newly discovered prokaryotic adaptive immune system known as CRISPR/Cas. CRISPR/Cas allows prokaryotes to fight off invading viruses. The goal of the Lawrence lab is to study the structure of the Cas proteins in this system to determine their function and mechanism of action. There are nine proteins involved in the CRISPR/Cas system of *M. tuberculosis*. The first step in determining the structure and function of a protein is to express the protein in *E. coli*. The *E. coli* cells are currently being grown in various media and temperatures in an effort to maximize expression of the *M. tuberculosis* proteins. These proteins are then being purified using various techniques including affinity and size exclusion chromatography. Once a protein has been successfully expressed and purified, an initial crystallization screen is performed to check many conditions for growth. These conditions are then optimized and X-ray crystallography techniques are used to examine the crystals and determine the structure of the protein. Knowledge of the structure of these proteins may lead to a method of disabling the proteins, making the bacterium susceptible to a naturally occurring bacteriophage. This technology could help counteract problems with the rise in antibiotic resistant strains of *M. tuberculosis*.

I am currently working on determining the structure of the Csm5 protein involved in the CRISPR/Cas system of *M. tuberculosis*.

Acknowledgements: Brian Eilers (Research Associate) - Chemistry & Biochemistry

Julian Thorne: Cell Biology & Neuroscience

Mentor: Frances Lefcort, Michael Babcock -- Cell Biology & Neuroscience, Psychology

Novel Object Recognition in IKAP Deficient Mice

The Fall semester of 2012 I conducted a Novel Object Recognition paradigm on IKAP deficient mice. This project has not yet been completed but I am currently testing test mice and am close to getting the paradigm to work correctly. The test is designed to assess object recognition memory and I can also reference some of the other experiments being conducted on the mice. I should have the paradigm working by the time of presentation and may even have some of the IKAP deficient mice tested by then.

Acknowledgements: Suzanna Powell, Katharine Kaminski (Graduate Students) - Psychology, Education

Bryan Vadheim: Agricultural Economics & Economics

Mentor: Mark Anderson, Claus Portner -- Agricultural Economics & Economics

Racial Discrimination among Competitors: Evidence from Beaned Batters in Major League Baseball

A large literature has exploited the richness in professional sports data to study racial discrimination in labor markets. The evidence suggests that race plays an important role in the evaluation and decision-making processes of owners, coaches, umpires, referees, and even consumers of sports memorabilia. However, the sports literature has yet to address the potential for racial discrimination among competitors. In fact, this relationship has received little attention from economists in general. We use data on every at-bat in Major League Baseball since 1947 to determine whether pitchers are more likely to bean a batter who is of an opposite race. We are not only able to

assess discrimination among competitors in an extremely competitive setting with repeated interactions, but we are also able to assess within-team discrimination by observing whether the decision to retaliate against your opponent is a function of the race of your bearded teammate. Lastly, given the period we study, we are able to address the degree to which discrimination has changed over time. In doing so, we can compare our estimates to other studies that have tracked the social evolution of discrimination in the United States.

Keenan Waeschle: Microbiology

Mentor: David Sands -- Plant Sciences & Plant Pathology

DNA Extraction from Backpacker Filters for Watershed Microbial Analysis

This project developed a way to extract and analyze genomic DNA from cells trapped on a commercially available water purification filter. Extractions were made by cutting filter sections into small pieces and then using a lysing solution of SDS buffer. Extractions were verified for DNA content by PCR using 16S bacterial DNA primers. Currently primers unique to the ice nucleation gene of *Pseudomonas syringae* are being tested to determine if certain types of bacteria can be specifically identified. More work should yield an exciting new method for watershed analysis.

David Walsh: Physics

Mentor: Rufus Cone -- Physics

Controlling Inhomogeneity of Electromagnetic Fields for Quantum Information Science and Optical Signal Processing Applications

Electromagnetic fields are used to control and manipulate quantum mechanical properties of atoms in a range of emerging quantum and optical applications. When generating these fields in real-world systems, spatial variations and inhomogeneities inevitably arise. These deviations can significantly affect the behavior of quantum systems and their performance in devices. Consequently, it is crucial to understand and control field inhomogeneities to mitigate these undesired effects. Inhomogeneities in electromagnetic fields generated by practical devices were theoretically and experimentally investigated to determine their effects on quantum states in resonant optical materials. By means of software utilizing finite element analysis, Maxwell's equations were solved to model electromagnetic field distributions and predict inhomogeneities present in common system configurations. In particular, we studied the effects of electrode design, sample size, dielectric properties, and optical beam geometry on the distribution of Stark shifts experienced throughout macroscopic optical crystals. These results were compared to spectral hole burning measurements at cryogenic temperatures to separate intrinsic material properties from effects due to the experimental apparatus. Information gathered from this research allows us to determine optimal methods for applying and probing the effects of electromagnetic fields on materials used in quantum information and photonic signal processing applications.

Acknowledgements: Charles Thiel (Research Scientist) - Physics

Robert Warwood: Physics

Mentor: Joey Key -- Physics

Keep the Dream Alive

A viral video developed for the purpose of promoting the fields of Science, Technology, Engineering, and Mathematics (the STEM fields), with an emphasis on space science and engineering. Funded by the 2012 Hiscock Memorial Award, "Keep the Dream Alive" is a direct response to the wave of anti-intellectualism that has swept over the United States in recent years. It drives the importance of such fields to our very existence, and the dangers of letting them fall by the wayside.

Heather Weas: Modern Languages & Literatures
Mentor: Ada Giusti -- Modern Languages & Literatures
The Arab Spring in Morocco

For my project, I have been researching the political and cultural climate of Morocco before and after the political demonstrations that took place in early 2011. Political revolutions swept across North Africa in 2011, an event which has been dubbed the Arab Spring. I will be focusing on these effects and how it has specifically effected Morocco, the sole country in North Africa whose revolution did not end in bloodshed. King Mohammed VI listened to his people and let go of some of his power and transferred it to the people by adding a referendum to the constitution. First, I researched the details of the changes he made on the constitution and supplement literature in order to help create a curriculum for a French 400 level class, entitled "Moroccan Literature and Culture," which is currently being taught by Dr. Giusti. I am currently doing research that is geared towards the native Amazigh population in the region. The referendum which King Mohammed VI passed includes an article that recognizes Tamazight (the native Berber language) as a national language. By doing this, he brought to life an endangered language, culture, and identity that had been oppressed for decades by the Arab majority. Therefore, I am currently conducting the second part of my research by attending Dr. Giusti's class and will spend three weeks during spring break conducting interviews with local Imizaghen community members in a small village named Zawiya Ahansal in the High Atlas Mountains. While I am there, I will be conducting interviews with community members about the referendum to the constitution and gauge the impact it has had on the community. After this trip, I will compile my findings and do a final project that will define the Arab Spring in Morocco from an academic and real life comparison.

Katelyn Weber: Mathematical Sciences
Mentor: Lisa Davis, Tomas Gedeon -- Mathematical Sciences
Simulation and validation of a continuum model for bio-polymerization processes

Current research through the Mathematical Sciences Department at MSU aims to model the movement of the enzyme RNA polymerase (RNAP) as it travels along strands of DNA in the process of transcription. This is challenging due to the fact that RNAP does not move at a constant rate and the underlying density of RNAP can be high, meaning their movement can affect other nearby enzymes. Molecular biologists have found that polymerases actually pause periodically on a DNA strand, which can result in a "traffic jam" of these enzymes. Here, we propose the use of a partial differential equation model from traffic engineering to describe this complex behavior. We will compare this model to more complicated deterministic and stochastic models. Further, we will perform uncertainty analysis on the RNAP "crossing time," that is, the length of time it takes the enzyme to transcribe an entire strand of DNA, based on the uncertainty in enzyme density and randomness of pause locations and durations.

Acknowledgements: Jennifer Thorenson (Doctoral Student) - Mathematics

Jake Weimer: Agricultural Economics & Economics
Mentor: Carly Urban -- Agricultural Economics & Economics
The Pricing of Timberland: Economic and Ecological Implications

Private undeveloped timberland represents 430 million acres in the United States, one sixth of the national land area. Such an area cannot be overlooked economically or ecologically, but much is unclear about incentives facing forest owners. One main source of uncertainty is pricing of the land. Due to illiquidity and heterogeneity of the asset, pricing is often difficult, causing misallocation of resources in commodity production (timber), unpriced ecological services, and recreational or existence values. Forest land valuation has many important implications on incentives to land owners and thus land use changes. It is the goal of the author to use statistical methods to develop a land pricing model able to counter some of this heterogeneity in assets to deliver relevant price estimates for private forest land in the Inland Northwest region comprising northeastern Washington, northern Idaho, and northwestern Montana. This model would then have predictive power for alternatives facing land owners from timber-production, to sale as recreational property, to conservation easements from wildlife groups. These predictions can then be translated into policy implications for impoverished rural timber-based economies as well as more broad ecological concerns such as fragmentation.

Cody West: Cell Biology & Neuroscience

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

Neural Fold Protocadherin Role in Early Vertebrate Development

Protocadherins are a member of the cadherin family, named for their role in calcium dependent adhesion between cells. My research regards a specific type of protocadherin, called neural fold protocadherin (NFPC). At the beginning of neurulation of a *Xenopus laevis* embryo, NFPC is expressed on the tips of the neural folds and in non-neural ectoderm. It has been shown that if NFPC expression is knocked down by an anti-sense morpholino oligonucleotide, neural crest cells fail to specify. This is demonstrated by the lack of post-specification neural crest markers and by the lack of head cartilage later in development. Recently, I have been exploring the absence of specific neural crest specification markers such as slug, sox 9, and twist after an NFPC morpholino. Also, I have been working to construct a wnt-8/wnt-11 probe and sense mRNA so that I can investigate what role they play in the specification of neural crest.

Spencer White: Chemistry & Biochemistry

Mentor: John Peters -- Chemistry & Biochemistry

Development of Methods for Assessing Oxygen Tolerance of Hydrogenase Enzymes

Biological hydrogen production involves the reaction of protons and electrons to produce hydrogen gas and is catalyzed by oxygen sensitive enzymes termed hydrogenases. A promising approach utilizes photosynthetic organisms capable of harnessing solar energy to drive hydrogen production. The obstacle to doing this is that the enzymes that are active enough to be useful are also quite sensitive to damage by oxygen, which precludes their use in an oxygenic photosynthetic system. Currently, several approaches are being used to generate enzymes with mutations at strategic locations, which may produce oxygen tolerant hydrogenases. This presentation will focus on the development of methods to assess the oxygen tolerance of these enzymes. The approach involves conducting a methyl viologen oxidation/hydrogen production assay, a methylene blue reduction/hydrogen uptake assay, and a hydrogen-deuterium exchange assay in the presence of defined amounts of oxygen. Current progress has yielded some success in the methyl viologen and methylene blue assays, and preliminary testing is underway for the hydrogen-deuterium exchange assay. By a combination of these assays and spectroscopic approaches, accurate measures of the oxygen tolerance of variants of the hydrogenase can be assessed.

Acknowledgements: Kevin Swanson (Doctoral Student) - Biochemistry

Robert Wilke: Political Science

Mentor: Ada Giusti – Modern Languages & Literatures

The Capabilities Approach and Development in the High Atlas of Morocco

Amartya Sen's "capabilities approach" has become one of the leading theories of economic development because it recognizes the fact that there is more to human well-being than income. According to this approach the goal of development should be to increase peoples' capabilities to choose a life worth pursuing. The Atlas Cultural Foundation and Les Amis du Village d'Amezray are two non-governmental organizations (NGOs) that seek to improve the quality of life in Zaouiat Ahansal one of the poorest regions of Morocco. These two NGOs work to help with the development of this region "through locally determined development projects," a method which shows sensitivity to the particular problems of the region that go beyond economic poverty. This project examines development of this region and of Morocco in general through the lens of the capabilities approach. I also investigated whether the NGOs used it for creating their projects while doing work study on one of their projects. I found that although they were not familiar with the capabilities approach itself many of the projects reflect similar values to Amartya Sen's version of the approach.

Tara Will: Cell Biology & Neuroscience

Mentor: Darcy Hunter -- Gallatin Valley WIC

Managing Efficiency and Cost Effective Marketing: The Key to Public Health Program Involvement

Through the INBRE program at Montana State University I was paired to do my research project with WIC. While working at WIC I sought to identify methods to increase participancy and the most efficient method of marketing to the WIC income eligible population. WIC is the Special Supplemental Nutrition Program for Women, Infants and Children. This public health program is designed to improve health outcomes and influence lifetime nutrition and health behaviors in a targeted, at-risk population. My first goal as a researcher was to identify the rate of missed appointments that the Gallatin County WIC office experienced per day, particularly no-show misses versus cancellations. No show appointments dramatically decrease WIC staff efficiency, due to rescheduling issues interfering with the services of other clients as well as taking the appointment times of potential new clients. Cancellation rate increase was desired as early cancellation allows appointments that would be no shows to be filled, meeting other client's needs. Once it had been identified that numerous no-show appointments and lack of cancellations were in fact an issue affecting WIC efficiency and participancy, ways to improve attendance were sought. It was determined through discussion with current clients that appointment reminders in varying multimedia forms were desired and might improve attendance and cancellation rates in existing clients. WIC was already sending postcard reminders to clients but with this new information WIC was able to secure a grant through No Kid Hungry to implement a text message reminder service. Whether or not this significantly improves the rates of attendance and cancellation will not be able to be determined until after the program has been in effect for a longer period of time. I also sought to identify services that were most important to current participants and which might be most beneficial to market in WIC promotion. To identify this I tabulated data from a state issued survey regarding the overall satisfaction with services offered by WIC. I also developed a survey to be used at a later date identifying the forms of media most utilized by existing WIC clients. Overall, my aims in researching with WIC over this past year were to help increase efficiency and identify ways to increase WIC participation through increasing productivity and effective marketing.

Michael Wilson: History & Philosophy

Mentor: Holly Grether, Linda Sexon -- History & Philosophy

Out of the Iron Furnace: The introduction of the Yaweh Cult into Israel by the inhabitants of Egypt's Arabah mining colonies

My paper is an attempt to locate the introduction of the god Yahweh to Israel, ancient Judah's brother nation to the north. It follows the opinions of the popular Kenite Midianite hypothesis that suggest that Yahwism had its origin in the Kenites and Midianites of the Gulf of Aqaba region. While Judah is argued by some to be part of the Midianite family of tribes, the introduction of Yahwism in the north is left unexplained. My method for answering this question consists of interpreting the traditional sources using historical criticism, archeology, and comparative sociological studies of traditional societies. The conclusion reached is that the termination of Egypt's involvement in its Arabah mining colonies sparked the migration of peoples who introduced Yahwism to the central Palestinian highlands, ancient Israel. As a result, the tradition of Moses and the journey of he and his family though the wilderness are not based on events occurring approximately 1440 or 1250 BCE but events occurring approximately 1125, about a century later. This conclusion could affect judgments concerning the integrity of the preservation of the early history of Yahwism in Israel, the role of socially marginalized communities in shaping culture, and of course, the inspirational sources of the Yahwist cult.

Heidi Windauer: Cell Biology & Neuroscience

Mentor: Renee Harris -- Montana Office of Rural Health

Efficacy of Complete Street Policy in Rural Montana Communities

With public health concerns looming nationwide, communities have been seeking ways of improving myriad aspects of health ranging from increasing physical activity, improving mental health and making communities more connected. To improve these issues, as well as many others, communities have found that adopting a Complete Streets policy has proved effective. The purpose of this study is to examine the evidence-based research previously done to support this policy and to investigate the effectiveness of this policy in the four Montana communities

which have implemented such policies. After constructing a survey with questions regarding implementation, usage and overall effectiveness in improving the health of the community, and interviewing community officials who work in departments effected by this policy, the results will be compared to those of other communities nationwide. This investigation will help to determine the effectiveness of the Complete Streets policy in Montana where factors such as climate, low density and small rural communities might be incongruous with the research done in other areas. It is predicted that the results will show that the Complete Streets policy in Montana has had a positive effect on the public health of communities which have adopted it.

Lindsey Wolfe: Cell Biology & Neuroscience

Mentor: Frances Lefcort -- Cell Biology & Neuroscience

Investigating a Wnt1-cre CKO Mouse Model for Familial Dysautonomia

Familial Dysautonomia (FD) is a genetic disorder of the peripheral 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. To model FD, the Lefcort lab has engineered two lines of mice that express a conditional knockout (CKO) of the IKBKAP gene. One CKO targets Wnt1-cre expressing cells (neural crest derivatives) and results in all mice dying within 24 hours of birth. My project involves using immunohistochemical methodologies to investigate the causes of death in these mice. Areas of examination include the heart, nodose-petrosal ganglion complex, and the salivary glands. Gaining insight into how the absence of IKAP affects structural morphologies and nervous system development and function can help us to more fully understand the FD phenotype and how we can work to increase the length and quality of life for FD patients.

Matthew Williams: Cell Biology & Neuroscience

Mentor: Laura Larsson -- Nursing

Testing Internal Consistency of an Instrument for Measuring Knowledge, Risk-Perception, Risk Framing, Self-Efficacy, and Intentions In Relation To Dental Sealants on the Blackfeet Reservation

Background: American Indian populations in Montana suffer from poorer overall health compared to other groups. One area in particular that the AI community has suffered disproportionately is oral health. The number of cavities in children aged two to five has actually seen an increase over the last decade.

Purposes: Test the internal consistency of an instrument for measuring knowledge, risk-perception, intention, and self-efficacy of Blackfeet Community College students after viewing their assigned test message on dental sealants. The purpose is to narrow three types of risk-based messages to the two that will be displayed in two locations on the Blackfeet Reservation. The overall aim of the research is to increase dental sealants for 2 – 5 year-olds by 10%.

Method: Approximately 30 BCC students will be randomly assigned to one of three test message groups. The messages will be homogenous for length, cultural relevance, and the knowledge and self-efficacy elements. Only the risk information will be variable. The instrument used for measuring the framing effects of the messages will consist of a questionnaire administered after participants view the randomly assigned message. A Cronbach's alpha reliability statistic will be produced to evaluate the internal consistency of the instrument before its final implementation.

Donald Wright: Chemistry & Biochemistry

Mentor: Joan Broderick -- Chemistry & Biochemistry

Site-Directed Mutagenesis and Characterization of HydF

[FeFe]-hydrogenase enzymes play a major role in catalyzing reversible hydrogen oxidation and reduction reactions, a critical element of renewable hydrogen fuel production. The [FeFe]-hydrogenase (HydA) is activated via the maturases HydE, HydF, and HydG. Activation of HydA is achieved through the maturation and transfer of a decorated 2Fe cluster to assemble what is known as the "H-cluster." The subject of this study is the maturase HydF which serves as a scaffold for the synthesis of the unique 2Fe subcluster of the active site H-cluster. While significant efforts have been made to elucidate the structure and functional qualities of the scaffold protein, there exists an opportunity to expand this knowledge through the substitution of key amino acids, a process called site-directed mutagenesis. After completing the production of multiple variant proteins with different structural or

catalytic properties, biochemical and biophysical characterization will be performed to produce a better picture of the functional significance of the individual residues. This research is expected to provide valuable insight into the maturation of the precursor [2Fe-2S] cluster on HydF into the 2Fe subcluster of the H-cluster, a critical step in better understanding hydrogenase maturation.

Acknowledgements: Amanda Byer (Doctoral Student) - Biochemistry

COLLEGE OF NURSING

Korey Flynn: Nursing

Mentor: Lori Christenson -- Gallatin Valley Food Bank

Senior Citizens' Needs in Rural Areas

Over the past several months, dozens of senior citizens living in rural areas of Montana have been called and surveyed. All of these seniors are currently receiving assistance through senior groceries, a program providing food assistance for the elderly, through the Gallatin Valley Food Bank. The seniors have been asked to answer questions regarding issues such as food security, social support, nutrition, etc. These needs were then assessed and recorded using a social outcome matrix. This matrix made it possible to transcribe qualitative data into a quantitative form of measurement. These senior citizens were then rated on a scale with the highest category being "thriving" and the lower categories being "vulnerable" and "in-crisis" which would put the senior below the prevention line. This helped us recognize who would be put into a group that could qualify for more assistance. Senior citizens in rural areas have many difficulties maintaining a healthy life style due to many constraints both physically and financially.

Emilie Kuster: Nursing

Mentor: Laura Larsson -- Nursing

Using a Post-Card Method to Track Completed Healthcare Referrals: A Pilot Study

Background: Screenings conducted over five years at the Nurse's Desk at the Gallatin Valley Food Bank (GVFB) found that 318 (62.8%) participants had one to eight unmet referral needs ($x = 1.70$, $sd = 1.36$, range 0-8). Clients had higher blood pressure and more undiagnosed diabetes than the general population. Addressing the unmet referral needs and documenting completed referrals was identified as the next step in evaluating the effectiveness of the Nurse's Desk. Purpose/Aim: The purpose of the project was to pilot-test a method for documenting completed referrals. Method: GVFB clients indicated their preference for a post-card referral system over several other methods. The project is evaluating the return rate of 50 pre-paid post-cards being distributed to clients who 1) have an unmet referral need, and 2) are interested in being referred to healthcare resources in the community. Participating clients take the card to their appointment and the providers return the card to GVFB indicating a completed referral. Results: Fifteen cards have been issued with two returned over a seven month period. The project has more time before completion. The results will be used to evaluate the efficacy of post-card referrals and guide next steps for the Nurse's Desk.

Allison Nesselth: Nursing

Mentor: Laura Larsson -- Nursing

Industry Thoughts on Radon Resistant Construction Practices in Montana

Purpose: To conduct a national policy search on radon resistant new construction (RRNC) policy and test association of geographic risk with policy framework. Method: A policy inventory using LexisNexis Academic was conducted for radon related statutes, codes and regulations in each of the U.S. states. Results: An analysis of RRNC policies compared with geographic radon risk level and the resulting RRNC industry costs was done. An odds ratio (OR) analysis of the states was separated into high and low risk groups. States were further sorted on the presence or absence of existing RRNC policy. The odds were five times greater that states with more radon risk had implemented some level of RRNC compared to states with less radon risk ($\chi^2 = 2.34$, $OR = 5.00$, $95\% CI 1.2 - 19.3$, $p < .05$). The results indicate that policy initiatives are directionally positive and associated with geographic risk. Implications: Nursing roles address the environmental hazards that present risk for their patients and community. The policy inventory results indicated high-risk states are increasingly turning to RRNC as part of the solution to reducing radon-related lung cancer. This information may contribute to a thoughtful public health solution utilizing the building industry as partners.

MONTANA INBRE NETWORK STATEWIDE SYMPOSIUM PRESENTERS

Gina Bearfighter: Human Services (Fort Peck Community College)

Mentor: Christine Holler-Dinsmore -- Science

Stress Reduction among American Indians on the Fort Peck Reservation

American Indians are an underserved minority, and have higher suicide, diabetes rates and lower life expectancies than other ethnic groups. High poverty rates, suicide rates, chemical dependency rates, domestic violence, diabetes and death rates all contribute to individual stress on reservations. We hypothesized that combining exercise and education would decrease stress more than education (MBSR) alone would for tribal members of the Fort Peck Reservation. A MBSR alone group and an exercise and MBSR group received ten weeks of intervention. Pre and post treatment stress and mindfulness self-efficacy tests were administered. Our results showed no significant differences between the two groups maintained over a year. However, both groups showed significant decreases in stress and increases in mindfulness self-efficacy from pre-to post-tests. There was a significant difference between the combined experimental groups and the control group-mean changes. Results suggest that MBSR has potential to provide a non-pharmacological treatment for stress on the Ft. Peck Reservation. Given the relationship between many diseases and stress, the reduction of stress & the increase in mindfulness may lead to better health outcomes for both the individual and the community. It is imperative in continuance to investigate whether MBSR can reduce stress in this vulnerable population. *Acknowledgements: Angela Cole, Shanyna Long, Kendra Teague, Christine Holler-Dinsmore*

Xanthia Good Track: General Education (Fort Peck Community College)

Mentor: Winona Runsabove -- Education

Understanding Diabetes on the Fort Peck Reservation

The Fort Peck Diabetes program increases members annually. Understanding their process of education of diabetes and how the medications assigned to assist does more harm than to level the disease. An important topic for it runs in the families on Fort Peck reservation and our people in America. First, understanding the description of the stages of diabetes; pre-diabetes, type 1 diabetes, type 2 diabetes and child diabetes for the people of Fort Peck. Past and present medications have a lot of side effects; assists participants with one fixation but is damaging another. There is a question if the medication fits with the biology of the Fort Peck People. Though there are many factors into the treatment of diagnosed diabetes participants: education, health opportunities, homelessness, alcohol and drug addicts assist in the increase of numbers diagnosed. With the research, I hope to develop a positive preventative education tool to assist with the knowledge of Diabetes and medications to the youth. This might even give another person the courage to look and understand.

Tom Hoyt: Health and Human Performance (Blackfeet Community College)

Mentor: Theresa Pepion -- Health & Human Performance

The Effects of Exercise on Heart Disease

Heart disease is the leading cause of death among men and women in the United State today. Heart disease is the narrowing of blood vessels that supply the heart with blood and oxygen. Heart disease is caused by plaque buildup in the arteries. Lack of exercise and a poor diet are the main factors.

Mathew Janis: Environmental Science (Fort Peck Community College)

Mentor: Zara Berg -- Science

The Algae Project

One of the earth's most important natural resource, fuel is causing more problems than solving. The cost keeps rising into today's society and the methods of obtaining regular fuel are not the cleanest and slowly running out. The main objective of this project is to find a clean renewable energy source that can be grown here in our area using native algae species to be converted to a bio-diesel that can potentially power a car, bus, generator...etc. This

type of research is the first of its kind here at Fort Peck Community College and to the Fort Peck Reservation. In the past, with the water sources certain algae strains will grow. The next step of the research is mass production. Data show if there is enough algae to grow; there will be a large amount of bio-diesel to conclude our hypothesis. We hope our data will benefit the future researchers here at FPCC and aid in the process of someday establishing Fort Peck's very own bio-diesel refinery to sell an eco-friendly way to power your vehicle.

Charles Juneau: Health and Physical Fitness (Blackfeet Community College)

Mentor: Theresa Pepion -- Health and Physical Fitness

Cause and Effect of Heart Disease

My research is on the specific coronary artery disease which is heart disease for short. Coronary artery disease is the most common cause of death in the United States. Over a million people each year will have a heart attack and 25% will die before they get the hospital while or in the emergency department. Cancer is following heart disease on the most common cause of death on Americans. About 600,000 people die of heart disease in the United States every year. That is 1 in every 4 deaths. Heart disease affects not only one gender but affects both men and women. In 2009 more than half of the deaths due to heart disease were men. Coronary artery disease is also the most common type of heart disease, killing more than 385,000 people annually.

Marti Kennerly-LaPlante: Health & Human Performance (Blackfeet Community College)

Mentor: Theresa Pepion -- Health & Human Performance

Pros of being vaccinated for Meningitis

My interest in Meningitis is based on the couple of outbreaks within the last year on the Blackfeet Reservation. People need to be aware of Meningitis; such as the cause and the effect of contacting. Meningitis is caused by the inflammation and fluid in the membranes of the brain along with the spinal cord. There are five types of this disease: Bacterial, Viral, Parasitic, Fungal, and Non-infectious. The vaccine HAEMOPHLIS INFLUENZA TYPE B prevents meningitis in some cases. Individuals that should be vaccinated are infants, toddlers, the elderly and those with suppressed immune systems. Meningitis is fatal and life threatening in different cases. The cause may vary; bacteria, viruses, parasites being in or on contaminated food and water, Fungi which can be transmitted by touch or inhaling, different types of cancers, and certain drugs. In rare cases, head injuries and brain surgery can cause meningitis. As I read resources, they stated the same facts.

Dustin LittleOwl, Elizabeth Other Medicine: Engineering (Little Big Horn College)

Mentor: Neva Tall Bear – Science

The Apàake Project at Little Big Horn College (West Nile Virus) on the Apsaalooke Reservation in MT

Purpose: The Apàake (WNV) project at Little Big Horn College collaborates with Dull Knife College, Fort Belknap College, Carroll College & Montana State University-Bozeman to determine the incidence of the WNV. Methods: The five sites across the Apsaalooke (Crow) Indian Reservation will be monitoring and identifying species of mosquitoes in the region (*Culex tarsalis* & *Culex Pipens*). Results: The five Apàake Project trap sites collected the mosquitoes (*Culex tarsalis* & *Culex Pipens*) to determine the potential for West Nile Virus infected in animals, birds, & humans. Conclusion: Found that there are more *Culex pipiens* at Site 2: Lodge Grass; Site 4: Pryor; 1: L.B.H.C.; Site 5: Wyola; Site 3: Fort Smith.

Brooklyn McGarry: Nursing (Fort Peck Community College)

Mentor: Zara Berg -- Science

Algae Project

Fort Peck Community College started algae research fall in 2011, which was to have sustainable algae that would grow at the college lab. The aim of this project is to demonstrate the technical and economically feasibility of integrated process for production of microalgae lipid for sustainable biodiesel fuel. The project will cover the whole process of microalgae lip extraction including species selection, culture system, construction and operation, possible growth conditions and cultural management for sustainable high lipids. The project builds on extensive experience in engineering and bio-fuels key participants. As part of the first economic feasibility study and

assessment of total greenhouse gas emissions (GHG) based on the results of the small scale studies. These primary economic and GHG emission assessments will be used as a decision making point on whether to continue to a large-scale phase of the project and optimize the process over. The project will be guided through by an ongoing analysis of the economic feasibility. The second stage will integrate all of the steps in the pilot scale.

Gail Oscar: Allied Health, Health and Human Performance (Blackfeet Community College)

Mentor: Theresa Pepion -- Health & Fitness

Diabetes is the #1 Killer among Native Americans

Diabetes disables both the young and old, because its affects are debilitating. All vital organs are damaged with uncontrolled diabetes. With the regular interventions such as exercise and good nutrition the disease can be minimal and reversed. With knowledge, hard work and visceral fat loss, diabetes can be controlled.

Cecilia Russell: Allied Health (Stone Child College)

Mentor: Larry Gomoll -- Biology, Allied Health

CHILL (Creating, Healthy, Informed, Lasting Lifestyles) at Stone Child College

CHILL (Creating Healthy, Informed, Lasting Lifestyles) was a program designed to help Stone Child College students, faculty and staff develop a healthy, informed, lasting lifestyle change. As a "pilot program," a small number of participants met on a weekly basis, over a six month period, to view student-developed presentations as well as commercial videos on the entire metabolic syndrome process (hypertension, obesity, hyperglycemia, hyperlipidemia, and hyperglyceridemia). The program began with participants being screened with a battery of laboratory tests which included an A1c (glycated hemoglobin test) and a lipid panel (all three cholesterols and triglycerides). These results, along with initial weight, height, BMI, blood pressure, and blood oxygen levels were recorded as a baseline for each participant. The basic stats were recorded each week and the laboratory tests were repeated at the end of the six month program. All results were recorded and analyzed. In addition to providing basic information about the importance of healthy lifestyle, a high-quality, healthy lunch was provided twice a month to all participants. This was done to show participants that they can eat healthy, at a reasonable cost, and that healthy food can be tasty.

Acknowledgements: Kyndyll McGarvey, Tashina Running Rabbit

Jeremy Sigo: Applied Art, Heavy Equipment (Fort Peck Community College)

Mentor: Winona Runsabove -- Education

Environmental Recycling of the Fort Peck Reservation

There is no easily accessible and comprehensive recycling program on the Fort Peck reservation. There is also a significant problem with, mostly recyclable, litter along the road ways as well as in the towns located on the reservation, as well as dumping in remote areas. This project uses an existing healthy waste management program as a template to plan initiation of a small scale recycling solution that will indicate the success of a larger operation on the reservation. When initiated, this project will make it easier and cheaper for residents to properly dispose of recyclable material. The study found that the best way to begin a recycling program is focusing on one or two materials, and to find a viable market. Finding a large storage area is also an integral step to a functioning program. Communal support is gauged through random sampling surveys and despite low interest levels can be boosted with an education and awareness media campaign.

Rika Sigo: Applied Art, Heavy Equipment (Fort Peck Community College)

Mentor: Winona Runsabove -- Education

Nutrition Education of the Fort Peck Reservation

The purpose of this study is to address the lack of adequate resources for residents of the Fort Peck Reservation for eating fresh, healthy foods and to encourage healthy eating habits through a community awareness campaign. A large portion of the Fort Peck Reservation has been classified by the United States Department of Agriculture (USDA) as a food desert. An awareness and education campaign was designed and implemented, concentrating on the two main towns on the reservation, Poplar and Wolf Point through surveys, media exposure, and promotional

events. The main objective was to find whether informing, promoting, and educating Fort Peck Residents would stimulate nutrition awareness and healthier food choices. Many residents were either lacking in an awareness of how much nutrition can affect health or were lacking in an up to date repertoire of information and education but were receptive to learning and demonstrated desire for better access to healthy and fresh foods.

Vincent Siragusa: Biological Sciences (Montana Tech of the University of Montana)

Mentor: Michael Masters -- Liberal Studies

Effects of Brain Volume on Myopia

The principal aim of this study was to investigate a possible relationship between brain volume and visual acuity, and to determine whether greater frontal and temporal lobe volume is correlated with increased myopic refractive error. Twenty six Regions of Interest (ROI) were chosen due to their anatomic association with the orbits. These ROIs, located in the frontal and temporal regions of the brain, were calculated using Brain Parser, which takes MRIs, spatially normalizes them, overlays the input image on a standardized brain atlas, and generates a label volume image that is segmented into 56 ROIs with volumes calculated for each. The 26 ROIs chosen for this study, as well as total frontal and temporal volume, were regressed against uncorrected visual acuity for 129 individuals (51% Female). Results indicated that no significant correlation exists between these variables for the entire sample, but when broken down by sex, females showed a strong positive correlation between vision and frontal ($p=0.000$), and temporal ($p=0.036$) total volumes. Males by contrast showed a slight negative correlation between these two variable, though it was not significant at ($\alpha = 0.05$). These results were not expected, and further research is required to better understand this sizable sex discrepancy.

Michelle Strain: Public Relations (Montana State University- Billings)

Mentor: Sarah Keller, Joy Honea, Marie Schaaf-Gallagher -- Communication and Theatre

Community-Based Media Project to Promote Suicide Awareness in Montana

This project was designed to evaluate the impact of a community-based media project (CBMP) on youth attitudes towards an awareness of suicide prevention resources. The intervention involved a youth theatre production designed to highlight suicide prevention resources and enable young people to discuss emotions related to suicide and depression. Photography and digital media workshops were held to promote healthy ways to express feelings of depression and suicidal ideation. *Acknowledgements: Miriam Veltman*

Anita Trice: Environmental Science (Fort Peck Community College)

Mentor: Winona Runsabove -- Education

Clean-up and Restorations of Tribal Lands

For many years there has been an on-going problem of open dumping of solid waste on Tribal lands and near our rivers and waterways. Through photos and Google Earth photos, three sites are targeted for definition, description, and water and soil contamination. Definition of these three sites to be determined Trust or Fee land might have certain policies or procedures. Understanding the description: land-fills, roll off sites, open dumping, and legacy dumping. Water and soil issues around the dumping sites effects the wild game and fishing need to be tested. Through educating people and communities about health and environmental issues pertaining to waste management, we hope to change their habits and outlook about the environmental issues. With this research it will assist in development of a restoration program/project design of our people and especially a focus for the youth. *Acknowledgements: Jacob First*

Maria Wind: Nursing (Fort Peck Community College)

Mentor: Winona Runsabove -- Education

What other preventive resources can assist the Fort Peck Communities to overcome the generational effects of alcoholism?

In the beginning, the focus was on finding out the definition of alcohol and the effects on the body for American Indians at the Fort Peck Reservation. During the research, there is a discovery where our ancestors were first exposed about alcohol and where the supply source came from on the reservation before American Indians

became legal to drink. There is data on long term health effects on alcoholics and their addictions. These are factors that come from the generations that will lead present and future addicts down a destructive path. Hopefully, this research will develop a better quality preventative program for current addicts to alcohol and have a better platform for future generations to come.

2013 Student Research Celebration
April 18, 2013

ALPHABETICAL LISTING OF STUDENTS

Student, Mentor, Project	Session	Poster #	Abst. Page #
Alex Adams: Mechanical & Industrial Engineering David Miller, Christopher Jenkins, Kevin Amende -- Mechanical & Industrial Engineering <i>Characterization and Optimization of Rotational Friction Welding for Small Stainless Steel Tubes</i>	am	19	31
David Aderholdt: Cell Biology & Neuroscience Christa Merzdorf -- Cell Biology & Neuroscience <i>Evaluation of the interaction of Zic1's interaction with Beta-Catenin in Xenopus Laevis embryos</i>	am	2	68
Tatsuya Akiyama, Katrina Jackson: Microbiology Mensur Dlakic -- Microbiology <i>Trimolecular Fluorescence Complementation (TriFC) for in vivo detection of RNA-protein interactions</i>	pm	80	36
Kyle Allemeier, Jacob Danczyk: Physics, Mechanical Engineering Hugo Schmidt, Paul Rugheimer -- Physics <i>Growing Barium Zirconate Films by Pulsed Laser Deposition for use in Low Temperature Solid Oxide Fuel Cells</i>	am	100	68
Susan Andrus: Sociology & Anthropology Danielle Hidalgo -- Sociology & Anthropology <i>Children are for Women and Sports are for Men: Gender and Heteronormativity in Local Print Advertising</i>	Sociology Topical	9:30am SUB C	68
Gabrielle Antonioli: Ecology Frances Lefcort -- Cell Biology & Neuroscience <i>Investigating the Role of FGF8 in Neural Crest Cell Dynamics During Formation of Dorsal Root Ganglia and Sympathetic Ganglia</i>	pm	95	69
Nikki Bailey: Agricultural Education Shannon Arnold -- Agricultural Education <i>Educating the Future of Agriculture: A Focus Group Analysis of the Programing Needs and Preferences of Montana Young and Beginning Farmers and Ranchers</i>	pm	74	25
Chanda Barber: English Linda Karrell -- English <i>A Convoluted Examination of a Historical Construction-Helen</i>	Literature Topical	4:20pm SUB C	69
Rhonda Barton: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Electronic Structural Information for Phosphorous Compounds and Complexes from X-ray Absorption Near-Edge Spectroscopy</i>	pm	82	36
Gina Bearfighter: Human Services (Fort Peck Community College) Christine Holler-Dinsmore -- Science <i>Stress Reduction among American Indians on the Fort Peck Reservation</i>	pm	118	104
Anish Babu Bharata: Computer Science Mike Wittie, Qing Yang -- Computer Science <i>IP2DC: Making Sense of Replica Selection Tools</i>	am	32	31

Student, Mentor, Project	Session	Poster #	Abst. Page #
Erin Birdinground: Sociology & Anthropology Tamela Eitle, David Eitle -- Sociology & Anthropology <i>Stress Exposure and Adolescent Pregnancy</i>	pm	48	69
Alissa Bleem: Chemical & Biological Engineering Ross Carlson, Jeffrey Heys -- Chemical & Biological Engineering <i>Response Surface Analysis of Acetate Inhibitor in Escherichia coli</i>	am	40	52
Elisa Boyd: Plant Sciences & Plant Pathology Jennifer Britton -- Plant Sciences & Plant Pathology <i>The Tenor of Heritage Tree Programs: Policy and Perception in the Rocky Mountain/Interior Plains Province</i>	am	125	--
Justin Brewer: Cell Biology & Neuroscience Christa Merzdorf, Dan Van Antwerp -- Cell Biology & Neuroscience <i>Isolation and Cloning of zic Genes from Chick</i>	am	82	69
Elizabeth Browning: English Michael Sexson -- English <i>Learning (Dis)abilities: Viewing the Imaginative World Through Dyslexic and Synaesthetic Processes</i>	pm	92	70
Laura Brutscher: Center for Biofilm Engineering Garth James, Elinor Pulcini -- Center for Biofilm Engineering <i>Bacterial Composition of Chronic Wounds</i>	pm	64	41
Belinda Buck: Sociology & Anthropology Danielle Hidalgo -- Sociology & Anthropology <i>Christianity and Sexuality: A study of how to "do Christianity" in an Evangelical Church</i>	Sociology Topical	9:45am SUB C	70
Katie Burbank: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Comprehensive Evaluation of Uranyl Coordination Chemistry with a Quinol-type Cofactor</i>	am	123	36
Matthew Calverley: Immunology & Infectious Diseases Allen Harmsen -- Immunology & Infectious Diseases <i>The Facultative Intracellular Pathogen Cryptococcus neoformans is Susceptible to in vivo Clearance by Alveolar Macrophages</i>	pm	56	25
Noelle Carpenter: Agricultural Economics & Economics Carly Urban, Mark Anderson -- Agricultural Economics & Economics <i>The Effects of Alcohol Taxes in Montana on State GDP Per Capita</i>	am	27	70
Colin Cashin: Film & Photography Cindy Stillwell -- Film & Photography <i>Paradox</i>	pm	128	47
Paul Castle: Cell Biology & Neuroscience John Miller, Brian Bothner -- Cell Biology & Neuroscience, Chemistry & Biochemistry <i>Determining the Concentration of Ethylene Thiourea in Various Local and Regional Beers</i>	am	46	70
Kathleen Chamberlin: Business Phenocia Bauerle -- Office of Diversity Awareness <i>Improving Campus Inclusivity: An Assessment of Minority Student Needs</i>	am	116	50
Kelly Christensen: Microbiology Christa Merzdorf -- Cell Biology & Neuroscience <i>Species Diversity Studies on the Developmental Expression of Aquaporin 3</i>	pm	66	71

Student, Mentor, Project	Session	Poster #	Abst. Page #
Cameron Clevidence: Ecology Alexis Pike -- Film & Photography <i>Ecological Winter</i>	am	Framed Art B	71
Jesse Cook: Chemistry & Biochemistry Mary Cloniger -- Chemistry & Biochemistry <i>Effects of Lactose Functionalized PAMAM Dendrimers on Cancer Cell Aggregation</i>	am	105	71
Amanda Crandall: Psychology Wesley Lynch -- Psychology <i>Early predictors of Obesity: A Retrospective Analysis of College-Age Students</i>	am	54	37
James Cwick: Microbiology Jovanka Voyich-Kane, Michele Hardy -- Immunology & Infectious Diseases <i>The Effect of Glycyrrhizin and its Derivative 18β-Glycyrrhetic Acid on Clinically Prominent Bacteria</i>	am	3	71
Matthew Danczyk: Mechanical & Industrial Engineering Sarah Codd, Joseph Seymour -- Mechanical & Industrial Engineering, Chemical & Biological Engineering <i>Two-Phase Immiscible Flow Through a Porous Medium</i>	pm	21	52
Dominique David: Earth Sciences Wayne Stein, Lisa Lone Fight -- Native American Studies, Land Resources & Environmental Sciences <i>Indigenous Science Knowledge Inherent in Native Language Place Names</i>	am	117	72
Alexandra Davis: Liberal Studies Ada Giusti -- Modern Languages & Literatures <i>The Free People of Morocco</i>	pm	37	72
Steven Davis: Chemical & Biological Engineering Ross Carlson -- Chemical & Biological Engineering <i>Syntrophic Cyanobacteria and E. coli Consortia</i>	pm	37	52
Christine de Caussin: Ecology Robert Garrott -- Ecology <i>Beaver in the Upper Madison Beaver Management Area Outside of West Yellowstone, Montana</i>	pm	77	72
Eric Dietrich, Varsha Rao: Civil Engineering Anne Camper, John Doyle, Mari Eggers, Tami Old Coyote -- Center for Biofilm Engineering Crow Environmental Health Steering Committee, Little Big Horn College <i>Service Learning to Address Drinking Water Quality through Community-Based Participatory Research on the Crow Reservation</i>	am	62	67
Gregory Doctor: Cell Biology & Neuroscience Christa Merzdorf, Dan VanAntwerp -- Cell Biology & Neuroscience <i>Investigating the Roles of zic1-zic5 in aqp-3b Expression in Xenopus laevis</i>	pm	54	73
Jordan Dood: Chemistry & Biochemistry Bern Kohler, Jinquan Chen, Tom Zhang -- Chemistry & Biochemistry <i>Protonation and Ion Binding of Adenosine Oligomers</i>	am	104	73
Parker Dunn: English Gretchen Minton -- English <i>Performance History of Shakespeare's "Much Ado About Nothing" and its Influence on Critical Thought</i>	am	40	73
William Dupree: Physics Bennet Link -- Physics <i>Hydro Static Equilibrium, the study of the Lane Emden and TOV Equations</i>	am	3	74

Student, Mentor, Project	Session	Poster #	Abst. Page #
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	3	74
Margerie Durban: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Moroccan Local Soap Project</i>	pm	69	74
Mandi Durch: Chemical & Biological Engineering Garth James, Laura Boegli -- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Analysis of efficacy for various solutions for Negative Pressure Wound Therapy with Instillation against S. aureus biofilms</i>	pm	63	53
Margaret Eggers, Dayle Felicia: Microbiology Anne Camper, Tim Ford (University of New England) -- Center for Biofilm Engineering <i>Using Community Based Risk Assessment to Address Health Risks from Waterborne Contaminants on the Crow Reservation</i>	pm	115	37
Kevin Ellingwood: Chemical & Biological Engineering Paul Gannon, Preston White -- Chemical & Biological Engineering <i>Zinc Air Batteries and their Obstacles and Applications to Society</i>	pm	38	53
Nathaniel Ellis: Plant Sciences & Plant Pathology Norman Weeden -- Plant Sciences & Plant Pathology <i>Using marker genes to aid in the development of a new crop type of pea and in the genetic mapping of pod trait genes in pea (Pisum sativum)</i>	pm	47	43
Jude Eziashi: Chemical & Biological Engineering Paul Gannon, Roberta Amendola -- Chemical & Biological Engineering <i>Measuring Cr volatility from ferritic stainless steels: Novel and conventional methods compared</i>	am	33	53
Yida Fang: Civil Engineering Xianming Shi -- Western Transportation Institute <i>Best Practices to Protect DOT Equipment from the Corrosive Effect of Chemical Deicers</i>	am	51	54
Elesia Fasching: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Does the WIC program reduce infant birth weights?</i>	pm	31	74
Michael Fast Buffalo Horse: Education Jioanna Carjuzaa -- Education <i>Tribal Language Revitalization in Montana</i>	am	41	51
Blaine Ferris: Electrical & Computer Engineering Todd Kaiser -- Electrical & Computer Engineering <i>Flexible Radiation Monitoring Strip with Particle Identification for use in a Wearable Sensor Network</i>	am	99	54
Kevin Ferris: Mathematical Sciences Jim Robison-Cox -- Mathematical Sciences <i>How to Build a Better Baseball Team</i>	pm	51	75
Korey Flynn: Nursing Lori Christenson -- Gallatin Valley Food Bank <i>Senior Citizens' Needs in Rural Areas</i>	pm	123	103

Student, Mentor, Project	Session	Poster #	Abst. Page #
S. Kathleen Fogg: Ecology Billie Kerans, Ryan Lamb -- Ecology <i>Effects of M. cerebralis on the competitive ability of T. tubifex</i>	am	13	75
Elizabeth Forbes: Physics Joseph Shaw, Nathan Pust -- Electrical & Computer Engineering <i>Effects of Wildfire Smoke on the Optical Polarization of Skylight</i>	am	102	75
Colin Gaiser: Sociology & Anthropology Danielle Hidalgo -- Sociology & Anthropology <i>The Post-Debate Information Waltz: Online media interpretations and distortions of the 2012 presidential debates</i>	Sociology Topical	9:15am SUB C	76
Emma Garcia: Chemical & Biological Engineering Michelle Flenniken -- Plant Sciences & Plant Pathology <i>Viruses as Biomarkers for Honeybee Health</i>	pm	8	54
Kenneth Gaskill: Animal & Range Sciences Tom Geary -- Fort Keogh Ag Experiment Station <i>Bovine In Vitro Fertilization and Embryo Development using Nano-particle Depleted Spermatozoa</i>	am	1	43
Derek Gengenbacher: Computer Science Clemente Izurieta -- Computer Science <i>The Struggle For Success In Fantasy Baseball Is Over</i>	pm	5	55
Edward Gillig: Chemistry & Biochemistry Mary Cloninger -- Chemistry & Biochemistry <i>Dendrimers: Functionalization and Toxicity</i>	pm	6	76
Catherine Gilligan: Cell Biology & Neuroscience Laura Mentch -- Bridgercare <i>Assessment of MSU Student Knowledge of STIs and Local Resources</i>	am	10	76
Thomas Gladbach: Architecture Thomas Wood -- Architecture <i>Lifecycle Embodied Energy Analysis and Reduction Strategies for Residential Housing in the Rocky Mountain Region</i>	pm	12	47
Utkarsh Goel, Ajay Miyyapura: Computer Science Mike Wittie, Qing Yang -- Computer Science <i>MITATE: Mobile Internet Testbed for Application Traffic Experimentation</i>	am	20	32
Bryan Gonzalez: Sociology & Anthropology Laurence Carucci -- Sociology & Anthropology <i>Memory & Vatican II: Effects and memories of Vatican II on local Catholic communities</i>	pm	87	77
Xanthia Good Track: General (Fort Peck Community College) Winona Runsabove -- Education <i>Understanding Diabetes on the Fort Peck Reservation</i>	pm	112	104
Joshua Gosney: Chemical & Biological Engineering Jeffrey Heys -- Chemical & Biological Engineering <i>Force of Microbubbles in the Vascular System</i>	pm	101	55
Amy Graham: Immunology & Infectious Diseases Joshua Obar -- Immunology & Infectious Diseases <i>Infection and activation of mast cells by influenza A virus enhances viral-induced pathology</i>	am	4	26
Carly Grant: Microbiology Joshua Obar -- Immunology & Infectious Diseases <i>Induction of highly protective CD8+ T cells by Listeria monocytogenes</i>	am	5	77

Student, Mentor, Project	Session	Poster #	Abst. Page #
Emily Gravens: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Synthesis and Characterization of Fe-S Particle Clusters in Clay</i>	am	6	77
Elliot Gray: Physics Dana Longcope -- Physics <i>Magnetic Helicity and Plasma Energy in Solar Corona</i>	am	98	77
Kyle Gray: Electrical & Computer Engineering Wataru Nakagawa -- Electrical & Computer Engineering <i>Improved Silicon Nanostructure Characterization System</i>	pm	59	55
Fermin Guerra: Immunology & Infectious Diseases Jovanka Voyich-Kane -- Immunology & Infectious Diseases <i>Interferon-gamma Production and Bactericidal Activity of Human Polymorphonuclear Neutrophils Exposed to S. aureus</i>	am	66	26
Adam Gunderson: Electrical & Computer Engineering David Klumpar, Larry Springer -- Physics <i>Simultaneous multi-point space weather measurements using the low cost EDSN CubeSat constellation</i>	pm	20	32
David Halat: Chemistry & Biochemistry Rob Walker -- Chemistry & Biochemistry <i>Optical Studies of Solid Oxide Fuel Cells (SOFCs) with in situ Vibrational Raman Spectroscopy</i>	pm	83	78
Kevin Hall: Sociology & Anthropology Tamela Eitle -- Sociology & Anthropology <i>Association of Depressive Symptomology and Adolescent Sexual Behavior</i>	am	90	78
Brandon Haller: Immunology & Infectious Diseases Jovanka Voyich-Kane -- Immunology & Infectious Diseases <i>Role of Leukocidin A/B in Staphylococcus aureus Virulence</i>	pm	55	78
Eric Halverson: Cell Biology & Neuroscience Amy Cory -- Greater Gallatin United Way <i>Constructing a Community Resource Guide for Families in Gallatin Valley</i>	am	73	79
William Hamel: Mechanical & Industrial Engineering William Schell -- Mechanical & Industrial Engineering <i>A Quantitative Approach Towards the Selection of Medical Tourism Destinations</i>	pm	22	56
Felicia Hamilton: English Linda Karell -- English <i>Fictionality and Factuality: Where is the Line?</i>	Literature Topical	4:00pm SUB C	
Elena Harriman: English Sarah Schmitt-Wilson -- Education <i>The Fallacy of 'The Smart Kid': Grit and Goal Orientation as Determinants for Academic Success</i>	pm	91	51
Christian Heck: Cell Biology & Neuroscience David Varricchio, Frankie Jackson -- Earth Sciences <i>Evaluating deformation in Spheroolithus dinosaur eggs from Zhejiang, China</i>	am	14	79
Halley Heintz: Art Dede Taylor -- Art <i>Spanish Baroque Fusion Paintings</i>	am	38	47
Eric Hester: Animal & Range Sciences Clayton Marlow -- Animal & Range Sciences <i>National Bison Range Rangeland Condition</i>	pm	75	44

Student, Mentor, Project	Session	Poster #	Abst. Page #
Lena Heuscher: Physics Joseph Shaw, Paul Nugent -- Electrical & Computer Engineering <i>MSU Heat Island Effect</i>	pm	62	80
Emmy Hill: Earth Sciences David Lageson -- Earth Sciences <i>A paleoecological analysis of corals in the Sun River Member of the Castle Reef Dolomite (Mississippian) at Swift Reservoir, Sawtooth Range, Northwest Montana</i>	pm	28	80
Luke Hines: Computer Science Clemente Izurieta -- Computer Science <i>Non Profit Business Solutions Interdisciplinary Project</i>	pm	57	56
Courtney Holland: Cell Biology & Neuroscience Phillip Sullivan -- Chemistry & Biochemistry <i>Comparison of Organic Photochromic Compounds' properties and BSA interaction</i>	am	64	80
Kasey Holland: Cell Biology & Neuroscience Ed Schmidt, Emily Talago -- Immunology & Infectious Disease <i>Hepatocyte Lineage and Liver Regeneration</i>	am	64	81
Shannon Holmes: Psychology Ada Giusti, Louise Ryder -- Modern Languages & Literatures, Psychology <i>Mental Health Support Nongovernmental Organizations in Morocco and the United States</i>	am	87	81
Eben Howard, Clint Cooper: Computer Science Mike Wittie, Qing Yang, Stephen Swinford -- Computer Science, Sociology & Anthropology <i>Cascading Impact of Lag on User Experience in Multiplayer Games</i>	pm	1	33
Tom Hoyt: Health and Human Performance (Blackfeet Community College) Theresa Pepion -- Health & Human Performance <i>The Effects of Exercise on Heart Disease</i>	pm	109	104
Meghan Huntoon: Psychology Jessi Smith -- Psychology <i>Understanding how chemistry helps can help: An experimental investigation of increasing women's motivation to pursue chemistry research</i>	pm	88	37
Kristen Ingman: Sociology & Anthropology Danielle Hidalgo -- Sociology & Anthropology <i>Gender in the Gym: Exploring the Ways Gender Inequality Manifests Itself in the Taylor Fitness Center and in Popular Fitness Magazines</i>	Sociology Topical	10:00am SUB C	81
Brennan Ireland: Physics Nico Yunes -- Physics <i>Numerical Computation of on Resonance EMRI Black Holes</i>	am	44	82
Abigail Ita: Film & Photography Nancy Mahoney, Theo Lipfert -- Sociology & Anthropology, Film & Photography <i>Curation Crisis</i>	am	60	48
Lauren Jackson: Business Perry Solheim -- Business <i>Perceptions of Accountants as Seen Through Media</i>	am	94	29
Lindsey Jackson, Catherine Johnson: Education Carrie Myers, Marilyn Lockhart -- Education <i>Teaching and Taking: Lessons learned about online classes from a developing instructor and student perspective</i>	pm	90	29

Student, Mentor, Project	Session	Poster #	Abst. Page #
Danica Jamison, Christina McRae-Holland: Health & Human Development, Agricultural Education Carmen Byker, Alison Harmon -- Health & Human Development <i>The 4-H Sustainability Project: Youth Discovering, Engaging, and Learning about Food Systems Sustainability</i>	pm	71	29
Mathew Janis: Environmental Science (Fort Peck Community College) Zara Berg -- Science <i>The Algae Project</i>	pm	104	104
Erica Jansma, Angie Ford: English Doug Downs -- English <i>An Inquiry of Distance: From Old Media to New Media</i>	Rhetoric Topical	2:00pm SUB C	38
Rachael Johnson: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Urbanization and Government Health Spending</i>	am	11	82
Charles Juneau: Health and Physical Fitness (Blackfeet Community College) Theresa Pepion -- Health & Physical Fitness <i>Cause and Effect of Heart Disease</i>	pm	110	105
Tony Junghans: Chemistry & Biochemistry Michele Hardy -- Immunology & Infectious Diseases <i>Purification and Characterization of Rotavirus NSP1</i>	pm	13	82
Aaron Jutila, Donald Zignego: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Physiologically stiff agarose as a 3D culture environment for primary human chondrocytes</i>	am	31	33
Jakob Kammeraad: Plant Sciences & Plant Pathology Chaofu Lu -- Plant Sciences & Plant Pathology <i>Characterization of Camelina sativa T-DNA mutants</i>	am	83	44
Marti Kennerly-LaPlante: Health and Human Performance (Blackfeet Community College) Theresa Pepion -- Health & Human Performance <i>Pros of being vaccinated for Meningitis</i>	pm	119	105
Katherine Kent: Chemical & Biological Engineering Jennifer Brown -- Chemical & Biological Engineering <i>Rheological Response of Dilute and Semi-dilute Polymer-particle Dispersions</i>	am	24	56
Christopher Kloth: History & Philosophy Sara Waller -- History & Philosophy <i>Suburban Coyote and Feral Cat Vocalization</i>	pm	85	83
Jackson Knoll: Physics Charles Kankelborg -- Physics <i>Optical Testing of Concave Diffraction Gratings for MOSES</i>	am	37	83
Gunduz Sinem Kocabas, Cansu Gumus: Land Resources & Environmental Sciences Cathy Zabinski -- Land Resources & Environmental Sciences <i>Comparison of Wind Energy in Turkey and Montana</i>	pm	11	44
Craig Kozeluh: Cell Biology & Neuroscience Steve Stowers -- Cell Biology & Neuroscience <i>Optogenetic Circuit Mapping In Drosophila Larvae</i>	pm	67	83

Student, Mentor, Project	Session	Poster #	Abst. Page #
Priyanka Kudalkar: Land Resources & Environmental Sciences John Priscu -- Land Resources & Environmental Sciences <i>Role of Fungi and Cyanobacteria in Nutrient Cycling in the Ice Ecosystem and its Functions</i>	am	52	26
Emilie Kuster: Nursing Laura Larsson -- Nursing <i>Using a Post-Card Method to Track Completed Healthcare Referrals: A Pilot Study</i>	pm	124	103
Ben LaFrance: Chemistry & Biochemistry Trevor Douglas -- Chemistry & Biochemistry <i>Hierarchical Assembly of Protein Cage Nanoparticles: A P22 Super-lattice</i>	pm	15	84
Jordan Larsen: Film & Photography Jenny Hatchadorian -- Film & Photography <i>So Sad To Say</i>	am	126	48
Christian Larson: Land Resources & Environmental Sciences Lisa Rew -- Land Resources & Environmental Sciences <i>Gallatin National Forest Road Decommissioning Study: Comparing vegetation between three different road treatments.</i>	pm	76	45
Arrika LaSalle: Chemical & Biological Engineering Edward Dratz, Duane Mooney, Mike Davenport -- Chemistry & Biochemistry <i>Automated Protein Extraction and Analysis</i>	am	77	57
McLain Leonard: Chemical & Biological Engineering Paul Gannon -- Chemical & Biological Engineering <i>Performance Of Electroless Nickel Plating On 441 Stainless Steel For SOFC Interconnect Applications</i>	am	25	57
Donald Liles: Education Carrie Myers -- Education <i>Heuristics in the Role of Self-Regulated Learning</i>	am	91	30
Dustin Littleowl, Elizabeth Other Medicine: Engineering Neva Tall Bear -- Science <i>The Apàake Project at Little Big Horn College (West Nile Virus) on the Apsaalooke Reservation in MT</i>	pm	114	105
Gavin Lommatsch: Electrical & Computer Engineering Nathan Pust, Joseph Shaw -- Electrical & Computer Engineering <i>Characterizing Light Polarization in the Near Infrared</i>	am	17	57
Rachael Luhr: Computer Science Clemente Izurieta -- Computer Science <i>Visualizing the Flow of Multiple Currencies in Flux Networks</i>	am	53	58
Chris Lustgraaf: Psychology Jessi Smith -- Psychology <i>Evolution and the Social Environment: Which is the Greater Influence on Liking?</i>	am	93	38
Tiphani Lynn: Cell Biology & Neuroscience Rafal Angryk, Charles Gray -- Computer Science, Cell Biology & Neuroscience <i>Finding repeated patterns in time series data: applications to the study of neural oscillations</i>	am	22	38
Ian Macdonald, Rob Mackin: Cell Biology & Neuroscience Steve Stowers -- Cell Biology & Neuroscience <i>Optimization of GRASP</i>	am	21	84
Patrick Madden: Chemistry & Biochemistry Trevor Douglas -- Chemistry & Biochemistry <i>Investigating the P22-Dec protein system as an influenza vaccine platform</i>	pm	14	84

Student, Mentor, Project	Session	Poster #	Abst. Page #
Cahill Maffei: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>The Effect of Reservation Casinos on Community Welfare</i>	pm	33	45
Kelsey March: Cell Biology & Neuroscience Thomas Hughes -- Cell Biology & Neuroscience <i>Light: The New Drug</i>	am	23	85
Brooks Marshall: Chemistry & Biochemistry Timothy Minton, George Schatz -- Chemistry & Biochemistry Northwestern University <i>Reactions of Oxygen with Small Carbon Clusters</i>	am	49	38
Calin Mauch: Film & Photography Ian van Coller -- Film & Photography <i>The Big Open</i>	am	Framed Art A	48
Jordan Maxwell: Physics Dave Klumpar -- Physics <i>Separations of Cube-Satellites in Orbit</i>	pm	19	85
Erin McDonald: Electrical & Computer Engineering Hashem Nehrir -- Electrical & Computer Engineering <i>Electricity Use in Rural Kenya and the Economic Potential for Alternative Energy Source Implementation</i>	am	103	58
Daniel McDonald: Chemical & Biological Engineering Brent Peyton -- Center for Biofilm Engineering <i>Microbial Characterization and Health of Biofilters in a Large-scale Fish Hatchery</i>	pm	36	58
Brooklyn McGarry: Nursing (Fort Peck Community College) Zara Berg -- Science <i>Algae Project</i>	pm	105	105
John McGlenn: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>The Affects Community Water Fluoridation has on Dental Hygiene</i>	pm	29	85
Jaimie McNabb: Psychology Michelle Meade -- Psychology <i>The Effect of Perceptual Elaboration and Re-Study on False Memory in the Social Contagion of Memory Paradigm</i>	pm	49	39
Isabel Milkovich: English Gretchen Minton -- English <i>Javert's Revenge: Ethical Suicide in Les Misérables</i>	am	39	86
Tanner Moe: Sociology & Anthropology Tamela Eitle, David Eitle -- Sociology & Anthropology <i>Parental Bond, Gender and Adolescent Coping Skills</i>	am	71	86
Rebekah Mohr: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Racial Bias in Lending Markets</i>	am	28	86
Danielle Mullens: Film & Photography Christina Anderson -- Film & Photography <i>Thin Masquerade</i>	am	Framed Art C	48
Jacob Munson-McGee: Microbiology Mark Young -- Microbiology <i>Diversity of CRISPR spacer sequences from Archaea-dominated hot springs</i>	pm	98	39

Student, Mentor, Project	Session	Poster #	Abst. Page #
Lindsay Murdock: Sociology & Anthropology Danielle Hidalgo -- Sociology & Anthropology <i>The Female President: The Redefinition of Gender Roles in Higher Education</i>	Sociology Topical	9:00am SUB C	87
Nathan Murphy: Chemical & Biological Engineering Brent Peyton -- Chemical & Biological Engineering <i>Cryopreservation and Staining Methods to Determine Cell Viability</i>	pm	34	59
Vanessa Murray: Chemistry & Biochemistry Timothy Minton -- Chemistry & Biochemistry <i>Hyperthermal Scattering of Atomic Oxygen and Argon from a Hot Carbon Surface</i>	am	7	39
Vanessa Naive: Film & Photography Dennis Aig, Tom Watson, Stephanie Campbell -- Film & Photography <i>Little Princess</i>	pm	Framed Art C	49
Gourav Krishna Nandi: Mathematical Sciences Robert Szilagyi -- Chemistry & Biochemistry <i>The Retrosynthesis of Amino Acids with Relevance to Prebiotic Transformations</i>	pm	68	87
Molly Neale: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>How Shall I Send Thee?</i>	pm	32	87
Allison Nesseth: Nursing Laura Larsson -- Nursing <i>Industry Thoughts on Radon Resistant Construction Practices in Montana</i>	am	8	103
Hannah Newhouse: Chemical & Biological Engineering Brent Peyton -- Chemical & Biological Engineering <i>Strain identification and unialgal determination of Yellowstone green algae cultures using 454-pyrosequencing</i>	pm	44	59
Kristen Newman: American Studies Robert Rydell -- History & Philosophy <i>Does America Have a Totem Animal? Exploring the Cultural Impact of Dinosaur Sculpture Gardens</i>	pm	86	87
Jared Nigg: Microbiology Gary Strobel -- Plant Sciences & Plant Pathology <i>Biofuel from a Fungus: Activating 1,8-Cineole Production in an Endophytic Fungus</i>	pm	97	88
Sarah Ohlen: Cell Biology & Neuroscience Frances Lefcort, Martha Chaverra, Lynn George -- Cell Biology & Neuroscience <i>Neurovascular Interaction in the Peripheral Nervous System</i>	pm	96	42
Matthew Olson: Chemical & Biological Engineering Ron June -- Mechanical & Industrial Engineering <i>Improved Quantification of Cartilage Degeneration in Osteoarthritis</i>	am	58	59
Gail Oscar: Allied Health, Health and Human Performance (Blackfeet Community College) Theresa Pepion -- Health & Fitness <i>Diabetes is the #1 Killer among Native Americans</i>	pm	111	106
Marisa O'Sullivan: English Linda Karell -- English <i>Female Insanity in Literature</i>	Literature Topical	5:00pm SUB C	88
James Pallardy: Mechanical & Industrial Engineering Doug Cairns -- Mechanical & Industrial Engineering <i>Composite WindTurbine Blade Flaw Characterization</i>	am	45	60

Student, Mentor, Project	Session	Poster #	Abst. Page #
Kyle Palmer: Chemical & Biological Engineering Brian Bothner -- Chemistry & Biochemistry <i>Analysis of Fatty Acid Methyl Esters from Sulfolobus during Viral Infection</i>	pm	35	60
Elle Pankratz: Chemical & Biological Engineering Brent Peyton -- Chemical & Biological Engineering <i>Growth Kinetic Studies on Cellulose Substrates by Ascocoryne sarcoides</i>	pm	43	60
Jake Parker: Physics Charles Kankelborg -- Physics <i>Radiometric Calibration of the MOSES Rocket Payload</i>	am	18	88
William Pauli: Plant Sciences & Plant Pathology Thomas Blake -- Plant Sciences & Plant Pathology <i>Large, Multiyear Field Trials Identify Novel Barley Alleles</i>	am	69	26
Todd Pedersen: Chemical & Biological Engineering Brent Peyton, Rob Gardner -- Chemical & Biological Engineering, Center for Biofilm Engineering <i>Analysis of TAG accumulation with the use of alternative grades of bicarbonate and alternative bicarbonate salts.</i>	am	57	61
Chelsey Pengra: Sociology & Anthropology Tamela Eitle, David Eitle -- Sociology & Anthropology <i>Parental Bonding and Teen Polysubstance Use</i>	am	72	88
Natasha Pettinger: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Photoreduction of Aqueous Cerium(IV)</i>	pm	81	89
Stephan 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>	am	48	89
Ashley Powell: Agricultural Education Shanon Arnold -- Agricultural Education <i>Adapting Leadership Theories to Develop Agriculture and Natural Resources Adult Leadership Programs</i>	am	117	27
Ashley Powell: Agricultural Education Carl Igo -- Agricultural Education <i>An Examination of Self-Perceived Temperament Styles and Its Relation to the Retention of First-Time, Full-Time Freshmen in a College of Agriculture</i>	pm	72	27
Jesse Powell: English Doug Downs -- English <i>The Elementary Emergence of Rhetoric within Questions</i>	Rhetoric Topical	2:20pm SUB C	89
Virginia Price: Physics Charles Kankelborg, Philip Judge -- Physics <i>Calibration and testing of an EUV hollow cathode light source</i>	am	43	90
Matt Queen: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Electronic Structure of [Ni(II)S₄] Complexes from S K-edge X-ray Absorption Spectroscopy</i>	am	122	40
Paul Quigley: Film & Photography Tom Watson -- Film & Photography <i>The Making of a Green Screen Production</i>	pm	129	49

Student, Mentor, Project	Session	Poster #	Abst. Page #
Marnee Rand: Political Science David Parker -- Political Science <i>IRS Intimidation and Deep Water Horizon: How Contingent Oversight Theory Explains the Politics of Congressional Investigations</i>	am	59	90
Varsha Rao: Chemical & Biological Engineering Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Molecular Weight Characterization of Alginate Solutions</i>	am	63	61
Al Rashid: Mechanical & Industrial Engineering Ron June, Ahsan Mian -- Mechanical & Industrial Engineering <i>Fabrication, Calibration and Testing of Capacitive Type Pressure Sensor for Real time Measurement of Knee Pressure Distribution of Rodents</i>	pm	41	33
Elizabeth Redman: Health & Human Development Alison Harmon, Carmen Byker, Tony Hartshorn -- Health & Human Development, Land Resources & Environmental Sciences <i>On-campus composting: A pilot study</i>	am	29	30
Brian Redman: Electrical & Computer Engineering Joseph Shaw, Paul Nugent -- Electrical & Computer Engineering <i>Testing a Low-cost All-Sky Infrared Cloud Imager</i>	pm	61	61
Derek Reimanis: Computer Science Clemente Izurieta -- Computer Science <i>Developing the Input/Output Module of a Multi-Disciplinary System Modeling Framework</i>	am	36	34
Jacob Remington: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Probing the Structural Dynamics of Single Stranded DNA Labeled with 2-Aminopurine Using Simulated Annealing to Analyze Time-Resolved Fluorescence Measurements</i>	am	56	90
Amanda Richards: Microbiology Michael Franklin -- Microbiology <i>Fluorescent Imaging of Pseudomonas aeruginosa Biofilms</i>	am	76	90
David Riesland: Electrical & Computer Engineering Joseph Shaw, Nathan Pust, Paul Nugent -- Electrical & Computer Engineering <i>Developing a multi-wavelength optical aurora detector</i>	am	16	62
Sarah Riordan: Architecture Ralph Johnson -- Architecture <i>Research on Wastewater Systems in the Gallatin Valley and a proposed Living Machine Alternative</i>	pm	9	49
Andrew Rivers: Psychology Ian Handley, Keith Hutchison, Michelle Meade -- Psychology <i>Shifting Goals for Unconscious Thinkers: Reevaluation as Theoretical Test of Unconscious Thought Theory</i>	am	55	40
Mike Roddewig: Electrical & Computer Engineering Joseph Shaw -- Electrical & Computer Engineering <i>Infrared cloud imager measurements at Barrow, Alaska</i>	am	101	34
Bronwyn Rolph: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Moroccan Literature and Stories</i>	am	75	91

Student, Mentor, Project	Session	Poster #	Abst. Page #
Tom Rose: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Mouse/Rat Knee Static Loading Test Apparatus</i>	am	97	34
Daniel Ross: Earth Sciences David Lageson -- Earth Sciences <i>Structural Geology of the North Half of the Swift Reservoir Culmination</i>	am	15	40
Katie Rowe: Immunology & Infectious Diseases Jovanka Voyich-Kane, Tyler Nygaard, Shannon Moreaux -- Immunology & Infectious Diseases, Animal & Range Sciences <i>Characterization of Staphylococcus aureus Virulence Factors isolated in Equine Populations</i>	am	78	45
Griffith Ruehl: Chemical & Biological Engineering Stephen Sofie -- Mechanical & Industrial Engineering <i>Synthesis of multivalent perovskite and scheelite structures for use as solid oxide fuel cell anodes</i>	am	26	62
Cecilia Russell: Allied Health (Stone Child College) Larry Gomoll -- Biology, Allied Health <i>CHILL (Creating, Healthy, Informed, Lasting Lifestyles) at Stone Child College</i>	pm	122	106
Jesse Ruzicka: Chemistry & Biochemistry Robert Walker -- Chemistry & Biochemistry <i>The Effect of Surfactants on Lipid Membrane Structure and Stability</i>	am	79	91
Skyler Rydberg: Electrical & Computer Engineering Wataru Nakagawa -- Electrical & Computer Engineering <i>Design and Fabrication of Optical Waveplates Using Silicon Nanostructures</i>	pm	17	62
Saurab Sainju: Cell Biology & Neuroscience Mike Vogel -- MSU Extension <i>Healthy Kids Make Healthy Homes</i>	am	30	91
Alyssa Sandner: Ecology Michele Hardy -- Immunology & Infectious Diseases <i>Site Directed Mutagenesis as a Strategy to Understand Viral Protein: Cell Protein Interactions</i>	pm	65	92
Jennifer Sanford: Music Jason Bolte -- Music <i>Spectral Diffraction</i>	pm	126	49
Jennifer Sanford: Music Jason Bolte -- Music <i>Spirit World</i>	pm	126	50
Audrey Schadt: Cell Biology & Neuroscience Renee Harris, Julia Middleton -- Montana Office of Rural Health <i>Worksite Wellness in Montana Critical Access Hospitals: Importance and Implementation</i>	am	89	92
George Schaible: Plant Sciences & Plant Pathology Gary Strobel -- Plant Sciences & Plant Pathology <i>Gene mining for the 1,8-Cineole synthase enzyme in the biosynthetic pathway of cineole production within the fungal species Annulohyphoxylon sp.</i>	am	70	46
Emily Jo Schwaller: English Doug Downs -- English <i>E-mailing and Its Effects on Construction of Professional Identity in Workplace Communication</i>	pm	93	92

Student, Mentor, Project	Session	Poster #	Abst. Page #
Emel Sen: Center for Biofilm Engineering Brent Peyton -- Center for Biofilm Engineering <i>Microbial Community Dynamics In Open Pond Algal Biofuel Systems</i>	pm	45	62
Tia Sharp: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>Creating Basic English and French Lessons and Conversation Plans</i>	am	86	93
Matthew Sherick: Chemical & Biological Engineering Joseph Seymour, Jennifer Brown, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>An Examination of Reaction Front Dynamics and Microscale Structure Formation in Diffusive Microbial Alginate Gelation using Magnetic Resonance</i>	pm	39	63
Charity Shumaker: English Linda Karell -- English <i>Fairy Tales and The Construction of The Feminine Identity</i>	Literature Topical	4:40pm SUB C	93
Jeremy Sigo: Applied Art, Heavy Equipment (Fort Peck Community College) Winona Runsabove -- Education <i>Environmental Recycling of the Fort Peck Reservation</i>	pm	108	106
Rika Sigo: Applied Art, Heavy Equipment (Fort Peck Community College) Winona Runsabove -- Education <i>Nutrition Education of the Fort Peck Reservation</i>	pm	108	106
Jacob Simon: Physics Hugo Schmidt -- Physics <i>Exploration of Lithium Coated Yttrium Doped Bar-ium Zirconate as Material for Solid Oxide Fuel Cells</i>	am	35	93
Josh Sinrud: Physics Hugo Schmidt -- Physics <i>Characterization of SOFC LSM cathodes using EIS</i>	am	68	93
Vincent Siragusa: Biological Sciences (Montana Tech of the University of Montana) Michael Masters -- Liberal Studies <i>Effects of Brain Volume on Myopia</i>	pm	106	107
Alec Skuntz: Chemistry & Biochemistry Brian Bothner -- Chemistry & Biochemistry <i>Investigation of Virus Capsid Protein Dynamics by Following Changes in Intrinsic Fluorescence</i>	pm	102	94
Benjamin Smith: Chemistry & Biochemistry Bern Kohler -- Chemistry & Biochemistry <i>Kinetic Study of 2-Aminopurine at 77 K in Cryogenic Glass</i>	am	80	94
Justin Spengler: Chemical & Biological Engineering Ross Carlson -- Center for Biofilm Engineering <i>Community-level metabolic network analysis of a cross-fed consortia</i>	pm	42	34
Sarah Sproul: History & Philosophy Doug Downs -- English <i>Where the "Rest of the Story" starts</i>	Rhetoric Topical	3:00pm SUB C	94
Sean Stettner: Chemical & Biological Engineering Seth Walk -- Microbiology <i>Multilocus Sequence Typing (MLST) of carbapenemase-producing Klebsiella pneumonia isolates from symptomatic patients</i>	pm	103	63

Student, Mentor, Project	Session	Poster #	Abst. Page #
Tammy Stewart: Education Carrie Myers, Scott Myers -- Education, Sociology & Anthropology <i>Evaluation of Teaching and Pedagogical Strategies in Higher Education: Do Institutional Policies Influence Faculty Practices?</i>	pm	89	30
Michelle Strain: Public Relations (Montana State University- Billings) Sarah Keller, Joy Honea, Marie Schaaf-Gallagher -- Communication & Theatre <i>Community-Based Media Project to Promote Suicide Awareness in Montana</i>	pm	121	107
Andrew Stulz, Tyson Abel, Byron Groh: Architecture Ralph Johnson -- Architecture <i>Design Prospectus for the Reuse of the Aboandoned Safeway Building</i>	pm	10	50
Lee Stunkard: Chemistry & Biochemistry Martin Lawrence, Brian Eilers -- Chemistry & Biochemistry <i>Structural Studies of Zic Transcription Factors</i>	pm	84	95
Luyun Su: Chemical & Biological Engineering Chaofu Lu -- Plant Sciences & Plant Pathology <i>Overexpression of PDCT Enzyem in Camelina Seeds</i>	pm	46	64
Hannah Susorney: Earth Sciences David Lageson -- Earth Sciences <i>Impact Crater Morphology on Mercury</i>	pm	27	95
Matthew Taylor: Ecology Ian Van Coller -- Film & Photography <i>Original Wooden 4x5 Field View Camera</i>	pm	Framed Art A	95
Joe Thiel: Liberal Studies and Chemical Engineering Doug Downs -- English <i>Rhetoric and the Organization: Perspectives on Rhetorical Institutionalism</i>	Rhetoric Topical	2:40pm SUB C	96
Michelle Thomas: Chemistry & Biochemistry Martin Lawrence -- Chemistry & Biochemistry <i>Structural Studies of CRISPR/Cas Proteins of M. tuberculosis</i>	pm	7	96
Julian Thorne: Cell Biology & Neuroscience Frances Lefcort, Michael Babcock -- Cell Biology & Neuroscience, Psychology <i>Novel Object Recognition in IKAP Deficient Mice</i>	am	65	96
Katie Tierney: Animal & Range Sciences Bret Olson, Jeffrey Mosley, Andrea Litt -- Animal & Range Sciences, Ecology <i>Effects of training on cattle grazing spotted knapweed and Canada thistle.</i>	pm	73	27
Dayla Topp: Center for Biofilm Engineering Ellen Lauchnor, Robin Gerlach, Adrienne Phillips -- Center for Biofilm Engineering <i>Application of a Michaelis-Menten Based Kinetics Model on Ureolysis by Sporosarcina pasteurii</i>	pm	26	64
Bradley Towey: Chemistry & Biochemistry Robert Szilagyi -- Chemistry & Biochemistry <i>Quantification of S mixing of dithiocarbamate ligands in transition metal complexes</i>	am	34	40
Anita Trice: Environmental Science (Fort Peck Community College) Winona Runsabove -- Education <i>Clean-up and Restorations of Tribal Lands</i>	pm	107	107
Bryan Vadheim: Agricultural Economics & Economics Mark Anderson, Claus Portner -- Agricultural Economics & Economics <i>Racial Discrimination among Competitors: Evidence from Beaned Batters in Major League Baseball</i>	pm	52	96

Student, Mentor, Project	Session	Poster #	Abst. Page #
Ryan Victor, Andrew Rivers: Psychology Ian Handley, Jessi Smith -- Psychology <i>After the Ink Dries: The Impact of Retracted Images on Attitudes Toward Past News Events and People</i>	pm	50	41
Keenan Waeschle: Microbiology David Sands -- Plant Sciences & Plant Pathology <i>DNA Extraction from Backpacker Filters for Watershed Microbial Analysis</i>	pm	99	97
Daniel Wagar: Computer Science Clemente Izurieta -- Computer Science <i>Machine Translation Software for Undocumented Languages</i>	pm	2	64
David Walsh: Physics Rufus Cone -- Physics <i>Controlling Inhomogeneity of Electromagnetic Fields for Quantum Information Science and Optical Signal Processing Applications</i>	pm	58	97
Logan Warberg, Alison Figueira: Computer Science Hunter Lloyd -- Computer Science <i>Computer System Review and Design for NASA Lunabotics 2013</i>	am	127	65
Ross Wardrop: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>Two shades of green: Does charging consumers a deposit on recyclable beverage containers influence their recycling attitudes more broadly?</i>	pm	30	46
Katherine Warthen: Chemical & Biological Engineering Ellen Lauchnor, Robin Gerlach -- Center for Biofilm Engineering <i>Laboratory Flow System of the Human Urinary System</i>	pm	25	65
Robert Warwood: Physics Joey Key -- Physics <i>Keep the Dream Alive</i>	am	95	97
Heather Weas: Modern Languages & Literatures Ada Giusti -- Modern Languages & Literatures <i>The Arab Spring in Morocco</i>	pm	70	98
Katelyn Weber: Mathematical Sciences Lisa Davis, Tomas Gedeon -- Mathematical Sciences <i>Simulation and validation of a continuum model for bio-polymerization processes</i>	am	67	98
Jake Weimer: Agricultural Economics & Economics Carly Urban -- Agricultural Economics & Economics <i>The Pricing of Timberland: Economic and Ecological Implications</i>	am	12	98
Cody West: Cell Biology & Neuroscience Roger Bradley, Dana Rashid -- Cell Biology & Neuroscience <i>Neural Fold Protocadherin Role in Early Vertebrate Development</i>	am	124	99
Christopher White: Chemical & Biological Engineering Joseph Seymour, Sarah Codd -- Chemical & Biological Engineering, Mechanical & Industrial Engineering <i>Self Diffusion Coefficient Model Development of HPMCAS Polymer Solutions and Gels with PGSE NMR</i>	am	47	65
Spencer White: Chemistry & Biochemistry John Peters -- Chemistry & Biochemistry <i>Development of Methods for Assessing Oxygen Tolerance of Hydrogenase Enzymes</i>	pm	100	99

Student, Mentor, Project	Session	Poster #	Abst. Page #
Shavonn Whiten: Land Resources & Environmental Sciences Robert Peterson -- Land Resources & Environmental Sciences <i>The Influence of Temperature on the Susceptibility of Aedes aegypti and Drosophila melanogaster to the Insecticide Permethrin</i>	pm	78	28
Erika Whitney: Plant Sciences & Plant Pathology Matthew Fields -- Microbiology <i>Isolation and Characterization of a Novel, Benthic Diatom for Potential Bio-oil Production from Yellowstone National Park</i>	am	85	46
Geoffrey Wicks: Physics Aleksander Rebane, Mikhail Drobizhev -- Physics <i>A systematic evaluation of dipole moment generation in heavy-atom substituted chromophores through the use of two photon absorption</i>	am	96	41
Robert Wilke: Political Science Ada Giusti -- Modern Languages & Literatures <i>The Capabilities Approach and Development in the High Atlas of Morocco</i>	am	74	99
Tara Will: Cell Biology & Neuroscience Darcy Hunter -- Gallatin Valley WIC <i>Managing Efficiency and Cost Effective Marketing: The Key to Public Health Program Involvement</i>	am	88	100
Matthew Williams: Cell Biology & Neuroscience Laura Larsson -- Nursing <i>Testing Internal Consistency of an Instrument for Measuring Knowledge, Risk-Perception, Risk Framing, Self-Efficacy, and Intentions In Relation To Dental Sealants on the Blackfeet Reservation</i>	am	9	101
Michael Wilson: History & Philosophy Holly Grether, Linda Sexon -- History & Philosophy <i>Out of the Iron Furnace: The introduction of the Yaweh Cult into Israel by the inhabitants of Egypt's Arabah mining colonies</i>	am	42	100
Cailin Wilson: Mechanical & Industrial Engineering Joel Cahoon -- Civil Engineering <i>Effects of Bubbly Flow on Acoustic Doppler Velocimeter</i>	pm	23	66
Maria Wind: Nursing (Fort Peck Community College) Winona Runsabove -- Education <i>What other preventive resources can assist the Fort Peck Communities to overcome the generational effects of alcoholism?</i>	pm	120	107
Heidi Windauer: Cell Biology & Neuroscience Renee Harris -- Montana Office of Rural Health <i>Efficacy of Complete Street Policy in Rural Montana Communities</i>	am	61	100
Lindsey Wolfe: Cell Biology & Neuroscience Frances Lefcort -- Cell Biology & Neuroscience <i>Investigating a Wnt1-cre CKO Mouse Model for Familial Dysautonomia</i>	am	94	101
Micah Workman: Computer Science Clemente Izurieta -- Computer Science <i>Automated Theorem Prover</i>	pm	16	66
Donald Wright: Chemistry & Biochemistry Joan Broderick -- Chemistry & Biochemistry <i>Site-Directed Mutagenesis and Characterization of HydF</i>	am	81	101

Student, Mentor, Project	Session	Poster #	Abst. Page #
Kim Yates: Education Michael Brody -- Education <i>Connecting Kids To Nature: A Multi-case Study of Garden Based Learning in Southwest Montana</i>	am	92	31
Colin Young: Electrical & Computer Engineering Hashem Nehrir -- Electrical & Computer Engineering <i>Design and Development of a Solar Photovoltaic Power Generation System for Educational Purposes at Montana State University</i>	pm	18	35
Kaysha Young, Erica Pimley, Kelly Borden: Mechanical & Industrial Engineering, Exercise Science Laura Stanley -- Mechanical & Industrial Engineering <i>Are Teen Drivers Aware of the Top Five Dangers Affecting their Safety?</i>	pm	18	66
Hauwa Yusuf: Computer Science Clemente Izurieta -- Computer Science <i>EAS: Efficient and Applicable Statistics</i>	pm	60	66
Neerja Zambare: Chemical & Biological Engineering Robin Gerlach, Ellen Lauchnor -- Center for Biofilm Engineering <i>Biofilm Induced Biomineralization in a Radial Flow Reactor</i>	pm	24	67
Donald Zignego, Aaron Jutila: Mechanical & Industrial Engineering Ron June -- Mechanical & Industrial Engineering <i>Strain-field evaluation in 3D physiologically-stiff agarose hydrogels using confocal microscopy</i>	am	50	35
Oliwia Zurek: Immunology & Infectious Diseases Jovanka Voyich-Kane -- Immunology & Infectious Diseases <i>What, Where and How: The Influence of the Innate Immune System on Staphylococcus aureus Virulence</i>	pm	79	28