STUDENT UNDERGRADUATE RESEARCH FESTIVAL

Carroll College

APRIL 15, 2014
Acknowledgments

As we celebrate the third year of our Carroll College Student Undergraduate Research Festival, I would like to acknowledge the continued growth and success of the previous years. This year, 47 student presentations and posters will be showcased during the festival and feature a wide range of research subject matter. Thank you to our student presenters for without your continued commitment and dedication to your research and the festival, we would not be celebrating your accomplishments today. Thank you to the faculty members who nominate and mentor our students through their research experiences as well as provide our students the foundation for future accomplishments in their chosen careers. I would like to thank the collective efforts of: Dr. Brandon Sheafor and Dr. Jeannette Fregulia for their passion and enthusiasm to this Carroll tradition as well as their planning, guidance and commitment to the festival; Stuart Allyn our student representative; Ms. Sarah Windmueller, Ms. Dayle Williams and Ms. Katherine Martin for accommodating our needs for session space; Ms. Laura Ottoson once again for her creative and impeccable design and layout for this program; and Ms. Karen Bratlien for her coordination efforts with the event. This celebration of our students’ accomplishments exemplifies Carroll College’s motto, “Non Scholae Sed Vitae.”

—Catherine Day, Associate Dean of Academics
Stuart Allyn

Hot Pikas: Detection of inducible HSP70 as a measure of heat stress in mammalian tissue

Faculty sponsor: Brandon Sheafor

Presentation

The North American Pika, *Ochotona princeps*, is a keystone high altitude species whose populations have been declining and whose distributions have been receding to higher elevations in the Great Basin. The present study proposes that these population shifts may be occurring because *O. princeps* are thermally stressed, as indicated by high levels of the inducible form of Heat Shock Protein 70 (HSP70). *O. princeps* blood samples were collected from a range of elevations in Montana that are subjected to different ambient temperatures. Western Blot analysis was performed as a qualitative measure to detect the presence of HSP70 in various mammalian samples to prepare for examination of *O. princeps* samples. Western Blot analysis of thermally treated Human Embryonic Kidney (HEK293) showed higher expression of HSP70 than room temperature HEK293 cells. Western blots on various mammalian tissues revealed interference in visualization of blood plasma HSP that may be attributed to hindrance from similar sized protein such as albumin. Although this study does not provide tangible results on HSP70 levels across different elevations for *O. princeps*, it does offer useful mechanisms for studying proteins as indicators of thermal stress in mammals.
Rebecca Armstrong

The Effect of Critical Thinking Induced by Reading Prior to Cognitive Testing

Various aspects of individuals’ lives have an impact on their cognition and the scores that they obtain through cognitive examination. Long-term conditions such as culture, age, and location as well as shorter duration stimuli such as fatigue, familiarity and exercise have been shown to influence the outcome of cognitive testing. This study examined the effect of critical and casual reading on the immediate test scores of individuals. The exam scores of the individuals who were asked to concentrate on an excerpt used from critical thinking were expected to be higher than those who are told to simply read through a work. The scores of the control group were also expected to vary from those of the “reading” groups. Though results did not support hypothesis, further research concerning the effects of reading in both clinical and nonclinical settings is advised.

Reed Baker
Alaina Hall

“Genuine Concern”: On Tracy Morgan’s Improbable Recovery from a Flagrant Homophobic Foul

Tracy Morgan, best known for his naively narcissistic character “Tracy Jordan” on the sit-com 30 Rock, made national headlines in 2011 for his shocking homophobic remarks as part of a stand-up comedy routine in Nashville, Tennessee. In this paper we examine the incident itself from reports made by Kevin Rogers, an audience member at the routine in which Morgan discussed what he would do if he found out
his son were gay. We also examine public outcry against the incident including organized demands for an apology, Morgan's subsequent public and private apologies (he apologized to Rogers privately) including parodying the offense in an episode of 30 Rock, and additional reports following the apology. We find that Morgan's rant, although given in a stand-up routine where hyperbole is accepted, followed well-worn instantiations of homophobic ideology. We argue that Tracy Morgan's improbable recovery from the offense came about because: (a) his private and public apologies were deemed, by their respective audiences, as genuine; (b) his offense ultimately was deemed as unintended; and (c) he was connected to a 30 Rock alter-ego. We discuss this case in light of the importance of genuine dialogue in communication.

Reed Baker
Megan Towles

Ladies and Gentlemen, Boys and Girls, Dicks and Bitches: A Study of Gendered Slang

Faculty sponsor: Charlotte Jones    Presentation

In this study we replicate prominent prior research on sexual vocabulary as used by men and women. Prior research has found that men have larger and more diverse sexual vocabularies. For instance, Kutner and Brogan (1974) found that although it evolves over time among men and women, sexual language continues to subjugate women: Men listed more sexual terms including terms that portray females as sex objects and connote male dominance, while women listed about the same number of terms for men as they did for women, including sexual terms that hold innocuous connotations compared to terms listed by men. Subsequent studies by Gordon (1993) and Braun & Kitzinger (2001) have produced similar findings. In the current study we asked respondents to list as many terms as they could think of for a man, for a woman, and for sexual
intercourse. We found that men and women not only used a similar number of terms for a man, a woman and intercourse, but the most common terms are also similar. We discuss implications of these results related to equality between men and women in dialectical diversity and suggested trends in use of controversial language.

Mary Beall

The Globalization of Sexuality: Modern Discourses

Faculty sponsor: Charlotte Jones Presentation

The effect of globalization is not just seen in marketplaces and voting booths but is also present in classrooms, living rooms, and bedrooms. Clearly, globalization is a suffocating, omnipresent force. However, all too often discussion of globalization fails to contextualize human impacts, including sexuality. While the impact of globalization on human sexuality coincides with this discussion, largely muted is the history of sexuality prior to globalization, and this distorts the conversation. In this study I examine language employed by select religious and gay-liberation organizations. I have found that modern discourse on sexuality relates to the colonization of sexuality as it occurred centuries ago. I discuss similarities between discourses on colonialism and discourses on globalization, as well as the implications related to these similarities.

Jena Boehnke

Law & Order: SVU Applying Rape Myths to Victim Representation

Faculty sponsor: Charlotte Jones Presentation

This study analyzed the portrayal of rape victims in seasons eight through twelve of Law and Order: Special Victims Unit. This study sought to determine
how rape victims are framed in *Law and Order: Special Victims Unit* and how agenda setting is used to either perpetuate or cease the use of rape myths in the crime drama. Twenty-five episodes were qualitatively and quantitatively analyzed for framing devices, rape myths and agenda setting. Data and qualitative analysis indicated that rape victims are portrayed most often portrayed as white, single, middle class women, who meet American standards of beauty. This perpetuates the rape myth that there is a typical victim. However, other rape myths were not as prevalent. Overall rape victims were framed in either a positive or neutral way, this is an improvement upon previous research and indicates that the portrayal of rape victims on *Law and Order: Special Victims Unit* may be improving.

Jena Boehnke
Anne Duletski

**Self-Concept among College Students**

*Faculty sponsor: Charlotte Jones  Presentation*

In this study we replicate canonical symbolic interactionist research in order to explore similarities and differences between males and females in how they describe themselves. Symbolic interactionist research in this vein begins from the premise that how we describe ourselves—and the terms available to us in doing so—directly affects our self-perception. We explored self-descriptive terms by examining adjectives male and female college students used to describe themselves. Early research on this topic (e.g. Ziller, Martel & Morrison, 1977) found that men described themselves using more active adjectives than women, while women described themselves using more ornamental adjectives. In the current study we asked 39 students to describe themselves selecting 15 adjectives out of the 109 utilized by Ziller et al. (1977). We found that a high percentage of males and females described themselves as
friendly; however, females described themselves as happy less often than did males. Most significantly, and contrary to our expectation, the active/ornamental dialectic involving males and females outlined above did not emerge in responses to our survey. We discuss the implications of these findings for the evolution of self-perception among males and females.

Jena Boehnke
Anne Duletski

“Throw (Whose) Ass Out”?: The Prolonged Fallout from Michael Richards’ Racist Rant

Faculty sponsor: Charlotte Jones  Presentation

In 2006 Michael Richards, known for his iconic Cosmo Kramer character on the show 1990s sit-com Seinfeld, was performing a stand-up routine in West Hollywood’s The Laugh Factory. His routine took a turn when he used vile racist language toward and group of African-American and Hispanic members of the audience. In this paper we examine events surrounding Richards’ racist rant, including the texts and reports of the incident itself and of Richards’ subsequent public apologies, including an awkward and ill-received attempt to apologize immediately after the incident on the David Letterman Show and a 2012 apology on Seinfeld’s show Comedians in Cars Getting Coffee, which was better received. We find that Richards, in responding initially to perceived face threat with the often-parodied rant, found himself in the wrong face (see Goffman, 1967) and has not been able to regain face—or his foothold in the industry for that matter—even after several years. Viewing these events through the lens of Critical Theory, we discuss the possibility that Richards’ rant, while ugly and without redeeming quality, opened a space for public discourse about the connection between racist ideologies and racist language.
Eric Bond

**Work Which Was Done without Real Benefit: Recruitment for the German East Africa Campaign**

*Faculty sponsor: Jeanette Fregulia  Presentation*

This paper examines the recruitment of Africans for service in the colonial militaries in the German East African Front in the First World War. Britain and Germany both offered wealth and prestige in exchange for the military service of the Africans before the war. The British focused on select ethnic groups, while the Germans offered the wealth to individuals. When fighting in East Africa required more men, the Colonial powers were able to fill the ranks without changing how these men were compensated for their service. What significantly changed in Colonial militaries was the need for men to carry the armies' supplies in East Africa, where the roads could not handle motor vehicles and sleeping sickness would kill all of the draft animals that were brought into the area. In order to get the thousands of men needed to do this back breaking work for little pay, the Colonial powers sometimes relied on draconian measures not dissimilar to the slave trade. In all, during the war the Africans were drawn into European service in numbers that had a devastating effect on the African population because of that need for prestige.

Jay Bouchard

**Seeking True Religion: John Donne and his Crisis of Conversion**

*Faculty sponsor: Jeff Morris  Poster*

The paper explores the religious conversion of John Donne, a prominent poet of the English Renaissance. Though Donne was raised Catholic, in the early 17th century Anglicanism was made the official religion of England and Roman Catholicism became effectively illegal. The paper first presents
a biographic sketch of Donne’s upbringing and conversion to Anglicanism. The paper then moves to an explication of two of his poems: “Satire III” and “Holy Sonnet 18.” Relying on both the work of literary scholars and the content of these poems, the paper argues that though Donne converted to Anglicanism and became a priest, much of his poetry suggests he never fully abandoned the teachings and traditions of Roman Catholicism.

Nicole Broden

**Organometallics**

*Faculty sponsor: Colin Thomas*  
*Presentation*

This paper presents an investigation of greener alternative metals that promote 2+2+2 cyclotrimerizations of alkynes and/or nitriles. Synthetic and computational methods show potential for the non-toxic and abundant metal copper to catalyze such reactions; current progress and future research directions will be shown.

Dane Bullen

**Game Development: Does it matter which hammer I use?**

*Faculty sponsor: Steve Harper*  
*Presentation*

First, we will have a live demonstration of the game I built. But there are many different ways to make a video game. So, next the presentation will cover the lessons learned from porting a video game from Flash to C++/SFML, including: differences between Flash and C++ methodologies, memory management techniques, threads and process management, and a glimpse at OpenGL fragment shaders.
Caroline Cardenas

Exploring the Role of Adcy2 in AMPA Receptor Trafficking

Faculty sponsor: Stefanie Otto-Hitt  Presentation

Synaptic plasticity plays a key role in information storage in the brain and is thought to influence physiological functions such as learning, memory and addiction. Communication between pre- and postsynaptic neurons is the primary mechanism governing synaptic plasticity in the brain. Postsynaptic AMPA receptors (α-Amino-3-hydroxy-5-Methyl-4-isoxazol Propionic Acid; AMPARs), specifically those containing the GluA2 subunit, bind the excitatory neurotransmitter glutamate. This results in increased excitation of the postsynaptic neuron and the strengthening of synaptic connections. The goal of my research is to investigate GluA2-interacting proteins that control AMPA receptor trafficking at synapses and determine the physiological significance of these interactions. More specifically, I am investigating the role of Adenylate Cyclase 2 (ADCY2) in regulating GluA2-containing AMPARs at excitatory synapses.

Alyssa Carlson

Synthesis and Study of Conjugated Carbazole Derivatives for Potential Use in Organic Light Emitting Diodes (OLEDs)

Faculty sponsor: Caroline Pharr  Presentation

Organic light emitting diodes (OLEDs) are devices that use thin films of organic molecules to create light when electricity is applied. A full color display consists of red, green, and blue light emissions. Stable, long lived, red and green light emitting molecules have been successfully synthesized. Blue light emitting molecules have been synthesized, but suffer shorter lifetimes and less stability than
red and green light emitting molecules. My research is currently focused on synthesizing conjugated carbazole centered compounds with the hope of creating a stable blue light emitting molecule. The parent molecule consists of 2,7-dibromocarbazole which will be coupled with two terminal subunits, 1-(2',3',4',5'-tetraphenyl) phenyl-4-bromobenzene and 4-bromodiphenyl-acetylene (DPA). The DPA subunit was formed through a Sonogashira coupling of a phenylacetylene with an aryl halide. The DPA was then borylated via a Lithium-Halogen Exchange in order to be coupled to the central carbazole moiety. Current work involves producing diphenylacetylene, borylating it, and linking it to the carbazole through a Suzuki coupling reaction.

Hannah Conroy

Female Body Modification through Physical Manipulation: A Comparison of Foot-binding and Corsets

Faculty sponsor: Jeanette Fregulia  Presentation

Due to the advancement of Gender History in the past fifty years and the contributions of many scholars, historians have been presented with an opportunity to explore an often over-looked area, the physical manipulation of women’s bodies. Although many historians have researched the various means by which the female form is shaped by the cultural and societal norms, few connections have been made between these two well-known and well-researched areas. The first, foot-binding, was practiced by women for one thousand years in China and the remnants of its impacts resonate today in women who lived through having their feet bound. The second, corsets, were tightly-laced garments worn by middle- and upper-class women in Europe from as early as the fifteenth century until the present. These forms of manipulation share a connection that other scholars have largely ignored.
This paper argues that both Europe and East Asia have fetishized parts of the female body through physical modifications and that the scholarship has remained largely silent on this explicit connection. This research is important in the modern era because women around the world continue to alter their bodies in increasingly controversial and radical ways.

Hannah Conroy

The Forgotten War: Official and Silenced Discourses of Korean “Comfort Women”

Faculty sponsors: Charlotte Jones
& Doreen Kutufam

Between November 1905 and September 1945, Japan annexed and occupied many countries, the first being Korea. During the following forty years, Japan invaded China, Manchuria, the Philippines, the northern part of Vietnam, and much of Malaysia. According to government records, testimonies, and previous research, it is estimated that 200,000 women were forced into sexual slavery as “Comfort Women” in brothels, which were created and used by the Japanese military all over their occupied territories. Many survivors have indicated that they were forced into sexual slavery, even forcibly taken from their homes as young girls. The Japanese government has refused to admit that it played an official role. In 2012, Japanese Prime Minister Shinzō Abe claimed that the women involved were volunteers. As of now, there are very few “Comfort Women” still alive.
Samuel Cotnoir

Seatbelt Usage Among Drug and Alcohol Impaired Drivers in the Bakken Oil Fields compared to greater Montana

Faculty sponsor: Jennifer Lowell Poster

Montana has the highest rate of deaths due to impaired driving in the nation and the fifth lowest rate of seatbelt utilization. This study seeks to examine the relationship between these two issues in urban, rural, and Bakken oil field-region Montana counties. Crash data for the years 2008 and 2012 were collected from the Montana Department of Transportation (MDT). These data were separated by year as well as category based on drug or alcohol and seatbelts use. Risk ratios were calculated and compared by year and county. There was a strong association between the use of drugs or alcohol before driving and the failure to wear a seatbelt. Rates were highest among drivers in the Bakken region of Montana, followed by those in rural and urban Montana counties. The results of this study can be used as evidence of the need for increased funding for local police officers in rural Montana, as well as in the Bakken region of Montana. Additionally, the implementation of a primary seatbelt law in Montana would be beneficial. The implementation of both of these policies could help to alleviate the lack of seatbelt utilization among drug and alcohol impaired drivers in Montana.
Emily Dean

**German Prisoners of War during WWII: The Civilian and Prisoner Experience in the Bitterroot Valley**

*Faculty sponsor: Jeanette Fregulia  Presentation*

Local histories offer a useful lens through which to analyze the experiences of historical actors that are often ignored in studies of major events. For this reason, local histories provide a useful corrective to our understanding of how individuals, families, and communities met the challenges of wartime realities, such as the US Homefront during WWII. This study re-examines, on a local level, the lived experiences of some of those effected by the US prisoner of war program during WWII. Prisoner of war camps constructed by the United State military during World War II spotted the rural American landscape for the duration of the war. One such camp, Tucker’s Crossing, located in Corvallis, Montana, in the Bitterroot Valley, housed German POWs who provided much needed labor for local sugar beet farms and helped revitalize the local economy. This micro-analysis helps explain the daily experiences of both prisoners and Montana citizens leading to a better understanding of their collective experiences.

Alexander Gaiser

**Making History: The changing characterization of Saddam Hussein in The New York Times**

*Faculty sponsor: Jeanette Fregulia  Presentation*

From 1969 until his death in 2003, Saddam Hussein had an evolving role in the US media, particularly the *The New York Times*. In this publication, depictions of the former Iraqi leader fluctuated between positive and negative extremes. As one of the leading newspapers in the United States, the *The New York Times* played and continues to play a significant role
in shaping public opinion. Thus, it is important to understand how it portrays major public figures and events. By viewing the portrayal of Saddam Hussein we find that *The New York Times* was far from an objective observer. Rather than report events from an objective and critical perspective, *The New York Times* instead reinforced opinions consistent with those of the United States Government. The paper rarely challenged government policy. By viewing *The New York Times*' coverage of Saddam Hussein, we better understand how it shaped public opinion.

Kaya Garringer

**Relative Utility of Different Lengths of the Mitochondrial 16S rDNA Gene in Population Genetics of the Tick Species, *Dermacentor andersoni*.**

*Faculty sponsor: Jennifer Geiger  Presentation*

The hard tick species, *Dermacentor andersoni*, is an important vector of zoonotic disease in the state of Montana. The purpose of this study was to compare different lengths of parts of the mitochondrial 16S rDNA gene to determine which provides the most useful information for the genetic analysis of *D. andersoni* ticks in Montana. Two primer sets were used to PCR amplify a portion of the mitochondrial 16S rDNA gene from DNA obtained from 40 *D. andersoni* ticks from a single population near Helena, Montana. Resulting sequences from PCR products were then analyzed for quality, amount of genetic variability and suitability for use in future population genetic studies. Some results are pending.
Carly Garrison

“Ha ha ha, very funny”:
An Ethnographic Study of
Conversational Humor among
College Students

Faculty sponsor: Alan Hansen

Presentation

Based on observational data collected in a language and culture class, we analyzed instances of teasing, joking, irony and banter in everyday settings in which these forms of talk play a part. Focusing on interpretive and functional aspects of conversational humor, we found that maintaining a play frame entails careful collaboration on the part of participants, including but not limited to group fantasizing. We also found that participants’ collaboration in seemingly superficial episodes of conversational humor accomplishes a host of relational functions. We recommend that future research examine the role of intellect in building upon the play frame through banter, group fantasizing, and other means. We see this study as one study in a large corpus of research in which conversational humor is a primary means of working, testing and stretching relationships.

Carly Garrison
Allie Reynolds

#nazitailor: Russell Brand, Hugo Boss and Contemporary Social Criticism

Faculty sponsor: Charlotte Jones

Presentation

In September 2013, comedic actor Russell Brand received a GQ Man of the Year award, “Oracle of the Year.” In accepting his award, Brand poked fun at Hugo Boss, the award show’s sponsor, for its founder’s known connection to the Nazi party in 1930s and 1940s Germany. Substantial controversy followed in which Brand was kept from the show’s
after-party by Hugo Boss personnel. Shortly after, a Twitter exchange between an editor of *GQ* and Brand was circulated: The editor criticized Brand, and Brand returned additional criticism against Hugo Boss and ended the exchange with “#nazitailor.” The exchange was retweeted more than 3,300 times. Brand subsequently wrote an article in *The Guardian* in which he put his remarks into context but did not apologize. *GQ* subsequently removed from its website mention of Brand receiving the award.

In this paper, we examine the events surrounding Brand’s critique, backlash by *GQ* and others, and his subsequent critiques of Hugo Boss through social and traditional media. Examining these events through a critical lens, we discuss ways in which Brand adopts, through humor, the role of social critic in order to deconstruct the history and role of Hugo Boss.

Sabrina Harding

**The Fluid Stage: Design into Reality**

*Faculty sponsor: Chuck Driscoll  Presentation*

One stage, a world of opportunity. In ten minutes, I will attempt to compare the three wildly different sets I have designed for the Carroll College stage in the last year: *Clue! The Musical*, *The Other Room*, and *Lysistrata*. I will discuss the varying aspects of the stage that I focused on in each, as well as the research and tone considerations that accompanied the contrasting designs. I will also touch on the collaboration challenges and benefits that result from the input and needs of the design team, including the director’s vision, the carpenter’s resources, the painter’s creative flare, and costumer’s color pallets. I will show the evolution of the designs from my initial sketches to the final products, and present pictures of the productions to show the designs in relationship to the actors.
Jillian Harmon

The Maintenance of Tumor HLA-A2 Expression in Differing Culture Environments

Faculty sponsor: Brandon Sheafor  Presentation

Adoptive T cell immunotherapy is an emerging field in the research of cancer treatment. Yet despite the scientific expansion of knowledge in this area, obstacles have arisen that hinder the rapid progression of this field. Tumor cells have developed evasion mechanisms that impede effective recognition of cancerous cells by the immune system, specifically by cytotoxic T cells. The downregulation of human leukocyte antigen A2 displayed on surface major histocompatibility complex class I (MHC – I) is such a tumor evasion technique. The objective of this study was to assess the maintenance of MHC – I surface expression on ex vivo tumors in different culturing medias. Three tumor cell lines (one p53 knockout and two ex vivo) were cultured in DMEM and RPMI for eight weeks. Twice per week, the cell lines were sampled, stained, and analyzed through flow cytometry for the percent of HLA-A2 surface expression. It was found that despite a general downregulation of HLA-A2 in all tumor cell lines, the DMEM media maintained HLA-A2 expression in a more consistent manner. In the future, more research should be performed to further investigate the reasons behind DMEM preference, as well as the mechanisms of HLA-A2 downregulation.

Alaina Hull
Matelyn Joseph

Sex Role Stereotypes and Self-Evaluation

Faculty sponsor: Charlotte Jones  Presentation

As do stereotypes related to other categories, gender stereotypes persist despite compelling evidence that
we would do better without them—in this case, the numerous studies that androgynous people (who possess both masculine and feminine traits) experience greater self-esteem and more success (Siann, 2013). In this study we examine the role of persistent gender stereotypes in self-identification, using a variation of the Personal Attributes Questionnaire (PAQ) developed by Broverman et al. (1972). At total of 53 respondents rated 41 attributes in according to a “typical male college student,” a “typical female college student” and of her/himself. We found that that although sex role stereotypes persist, they do not in all instances correlate to individual self-concepts. Thus although many gender stereotypes (e.g. that males never cry) appear to persist, these stereotypes do not appear to relate as strongly to self-identification as in Broverman et al. (1972). We discuss implications of this finding, including the possibility that we look beyond stereotypes in self-identifying.

Tyler Jacobsen

Topographical Variables Influencing Dermacentor andersoni Distribution in Montana

Faculty sponsor: Grant Hokit

Presentation

The Rocky Mountain wood tick, Dermacentor andersoni, is a known arthropod vector for Rocky Mountain spotted fever, Colorado Tick Fever, and Tularemia. This tick is very prevalent in the western part of the United States. The adult ticks ingest blood meals from large mammals and can easily spread disease to humans. Using an Infectious Disease Ecology approach we developed a drag sampling protocol for these ticks to quantify and survey their population distribution. We sampled 77 tick sites on the upper Missouri drainage in western central and southwestern Montana. The variables of interest were slope aspect and elevation. We found no correlation between the distribution of ticks and elevation but there was statistical difference in tick distribution due to slope aspect. Ticks were more
frequently found and in greater number on south and east facing slopes than north and west facing slopes.

Ian Kessler

**An Exploration of Quadratic Residues in Finite Fields**

*Faculty sponsor: Tim Melvin* Presentation

Quadratic residues of finite fields can be used in many areas including computer security. If an element in a given number field can be expressed as a product of two equal elements that are also in the field, then this element is a quadratic residue of that field. In other words, 4 is a quadratic residue in the rational numbers, because $4 = 2 \cdot 2$ (this is the same as saying $\sqrt{4}$ is a rational number). For the field of rational numbers, the quadratic residues are the ratios of perfect squares. For the field of real numbers, the quadratic residues are the nonnegative numbers. In this talk we will explore quadratic residues of certain finite fields, which are fields with a finite number of elements.

Myunghoon Kim

**Synthesis and study of a novel family of conjugated organic compounds with potential applications in organic light-emitting diodes (OLEDs)**

*Faculty sponsor: Caroline Pharr* Poster

Organic Light-Emitting Diodes (OLEDs) have been of great interest in various technological applications. Currently, there have been many successful syntheses of stable organic compounds capable of emitting red and green light. However, synthesis of stable blue light emitting compounds has proven
to be challenging. In order to display the full color spectrum, red, green, and blue light emitters are required. Synthesis of a novel family of carbazole centered molecules is in progress with the hopes of creating a stable blue light emitter. The parent compound is comprised of three subunit molecules, which to date have been synthesized: 4-bromo-diphenylacetylene, 2,7-dibromocarbazole, and 1-(2',3',4',5'-tetraphenyl) phenyl-4-bromobenzene (Dendron). An aryl borylation reaction followed by a Suzuki cross-coupling reaction is being carried out to link the subunit molecules together and yield the parent compound of interest. Upon synthesis of the parent molecule, its properties will be studied via UV-vis, fluorescence spectroscopy and cyclic voltammetry. Light emission will be studied and tested in solution and in thin film form before and after exposure to heat and air.

Joseph King

**Burning Down the Cost**

*Faculty sponsor: Eric Sullivan*  
*Presentation*

The cost of wildfires has been climbing drastically. In 2012, the total estimated cost for Montana wildfire suppression was $113.5 million. My challenge was to see if it was mathematically possible to minimize wildfire cost while ensuring that a fire is sufficiently suppressed. A linear program (LP) was designed to minimize suppression costs while allocating the required hand, air, and equipment crews to specific stages of a wildfire. Two scenarios are implemented into the linear program, where optimal solutions are found. First, a one wildfire scenario is simulated. Secondly, the most extreme fires of Montana’s 2012 wildfire season are simulated. Finally, the LP’s optimal results are compared and analyzed with the actual 2012 fire results. Based off of the model’s outcomes, it was found that dispatch centers with more available equipment had a lower suppression cost. Although the model achieves to meet management requirements, it doesn’t account for intangible factors that go into decision making. In conclusion,
ACCOUNT FOR INTANGIBLE FACTORS THE linear program provides an optimal solution for wildfire decision management, and under given constraints will efficiently determine the lowest cost while meeting suppression requirements.

Shelby Kramer

Exploring the Role of Olfm1 in the Trafficking of GluR2-containing AMPA Receptors

Faculty sponsor: Stefanie Otto-Hitt Presentation

The interactions between post-synaptic receptors and pre-synaptic molecules are responsible for coordinating numerous human activities such as thought, behavior, memory, learning and homeostasis. Important excitatory post-synaptic receptors that alter strength of connections between pre- and post-synaptic neurons are α-Amino-3-hydroxy-5-Methylisoxazole-4-Propanoic Acid (AMPA) receptors (AMPARs). Understanding the molecular mechanisms that govern AMPAR trafficking to synapses and effects on synaptic plasticity are critical to understanding disease and normal neurological pathologies. The purpose of this research was to identify GluA2-interacting proteins that play important roles in AMPAR trafficking and to characterize the functional significance of AMPARs. The transmembrane protein Olfactomedin 1 (Olfm1) isoform 1, also called Noelin 1, was studied to determine the role that it plays in AMPAR trafficking at synapses. Unfortunately, cloning complications prevented a definitive conclusion on the nature of Olfm1’s role in AMPAR trafficking.
Hand Hygiene: The effectiveness of one hospital’s intervention and a discussion of the limitations of observational hand hygiene studies

Faculty sponsor: Jennifer Lowell

Healthcare-associated infections affect over a million people in the US each year, costing patients and hospitals large amounts of resources and time. Hand hygiene is one of the most effective ways to prevent the spread of these costly infections. However, hand hygiene compliance rates among healthcare workers remain startling low. Many institutions have been searching for interventions that will increase the compliance rates of their healthcare staff. Successful interventions found in the literature include more and better access to hand hygiene resources, the installation of visual reminders, the implementation of campaigns modeled from the World Health Organization (WHO), and other similar measures.

A rural 99-bed hospital (Hospital A) in Montana designed a hand hygiene intervention that included the installation of additional alcohol-based hand rub dispensers with visual reminders to one 18-bed unit (Unit 1). The hand hygiene compliance rates were covertly observed pre- and post-intervention. The pre-intervention hand hygiene compliance rate was 46.7% for nurses entering patient rooms and 68.8% compliance upon exiting patient rooms. The post-intervention rates were lower than expected, at only 28.1% upon entering patient room and 42.6% upon exiting. The Unit 1 nurses were surveyed following the intervention to assess their attitudes toward the changes. The survey results indicated that the nurses had responded positively to the intervention and believed that their hand hygiene compliance had increased. This thesis aims to analyze the data obtained from this hospital’s study, as well as discuss the numerous limitations of observational hand hygiene studies. Future research recommendations will be discussed as well.
Dana Miller
Amanda Page

Boldly Where None Have Gone Before? Gratuitousness and Objectification in Star Trek Into Darkness

Faculty sponsor: Charlotte Jones Presentation

In 2013, the popular science-fiction franchise Star Trek premiered a sequel to the successful reboot of the series. At issue was a scene in which the character Carol Marcus (played by Alice Eve) is shown in the presence of Captain Kirk, in her bra and underwear. Shortly after the film was released, producer Damon Lindelof took to Twitter to apparently apologize for the scene, stating they should have taken it out of the film. Amid controversy about the gratuitousness versus utility of the scene, the film’s director made light of the controversy on the talk show Conan, by showing a scene of a shirtless Benedict Cumberbatch (who played Khan), although this scene was not part of the film. In this paper we examine initial critique and defense of the scene as well as Lindelof’s apologetic and defensive tweets and other discourse by producers, critics and fans of the film. Viewing these events through a cultural lens, we examine treatment of Cumberbatch’s and Eve’s respective scenes by producers, actors, critics and fans of the film. We argue that, while there are variations on the theme, the events examined here reproduce in interesting ways the objectification of women in American media.
Austin Nearpass

Biochemical Markers for Thermal Stress in North American Pikas (Ochotona princeps)

Faculty sponsor: Brandon Sheafor Presentation

North American pikas (Ochotona princeps) are a high altitude keystone species that are indicative of that ecosystem’s condition. Over the last decade, numerous populations of pikas have declined or disappeared. Because pikas are exceptionally sensitive to high ambient temperatures, it has been suggested that these declines are due to thermal stress imposed by climate change. Thermal stress has been shown to cause oxidative stress through an increased cellular concentration of oxygen radicals. Therefore, levels of oxidative stress markers are strong indicators of thermal stress. In order to quantify the degree of thermal stress placed on pika populations, fecal and plasma samples were assayed for a number of biochemical markers over a range of altitudes and ambient temperatures. Fecal corticosterone levels were assayed as a marker for long term stress. Oxidative stress markers, including thiobarbituric acid reactive substances (TBARS), 8-hydroxy-2-deoxy guanosine (8-OH-dG) and glutathione peroxidase (GPX), were used to assess disparities in oxidative stress among pika populations. Tests have shown correlation between low elevation pikas having higher corticosterone levels early in the trapping season but no other correlations have been found. More testing and samples are required to determine if any other relationship can be established.
Katie Newton

**Comparison of West Nile Virus exposure in horses and infection rates in the mosquito *Culex tarsalis* in Montana**

*Faculty sponsor: Sam Alvey  Presentation*

In this study, infection rates of West Nile Virus (WNV) in the vector *Culex tarsalis* and exposure of the virus via antibody presence in horses were compared. This research was performed to determine which method is more efficient at detecting the virus, thus contributing to viral public risk assessment for the state of Montana. Mosquitoes and horse blood came from similar locations, including Blaine and Lewis and Clark counties. Mosquitoes were trapped throughout the summer using carbon dioxide baited CDC light traps and homogenized before RNA was extracted and finally tested for WNV with RT-PCR. Horse sera were extracted in mid-September and tested for WNV antibodies using IgG ELISA, where positive results indicate viral exposure. Pools of mosquitoes that tested positive by RT-PCR were analyzed with an Excel program for infection rate calculations and compared to numbers of positive horse sera. Mosquito infection rates were higher than horses detected positive by ELISA.

Michael O’Connell

**Knowledge, Attitudes and Experiences Regarding Mental Health Care Among Helena Neighborhood Residents**

*Faculty sponsor: Jamie Dolan  Presentation*

Our social research class performed a door-to-door survey in two separate neighborhoods in Helena—Butte Avenue and Jackson Avenue—about their perceptions of mental health. Included in those
perceptions were whether they knew someone with a mental health issue, how important mental health care is, and whether Helena needs a mental health crisis center. We found that while 90% of residents are comfortable with a mental health crisis center in Helena, only 73% are comfortable with it in their part of town. This is curious considering 43% of people are concerned about a mental health crisis center being in their neighborhood.

Amanda Page
Tevin Stutzman

Gender Studies: Perspectives on How Gender Shapes Our Own Schemas

Faculty sponsor: Charlotte Jones  Presentation

In today’s society it is both widely assumed and apparent that there have been great strides toward gender equality. However, these strides might not translate to equality, that is androgyny, in language. In this paper will explore perceptions of sexuality in American English by replicating prior research (e.g. Borden, 1970) on the association of words with a particular gender. Borden’s results indicate that perceived masculine words both outnumber perceived feminine words and occur more frequently in the English language. We created and conducted a survey of 39 male and 39 female college students. Following Borden (1970), we asked the students to rate on a gender scale the 100 most-used nouns in the English language. We found that many of the same words Borden identified as gendered are still viewed in a similar gendered light. We discuss the implications of this finding related to the connection between strides in gender equality on one hand and continued gendering of the very words that we speak on the other.
Taylor Peliska

**Situatedness and Art: Maurice Merleau-Ponty on Perception, Aesthetics, and the Embodiment of Being**

*Faculty sponsor: Elvira Roncalli*  
*Presentation*

French philosopher Maurice Merleau-Ponty is one of the 20th century’s greatest thinkers. Merleau-Ponty’s main philosophical concern is understanding how humans experience and perceive the world around them. He grounds his thought in phenomenological inquiry and existential ontology, providing a rich understanding of what it means to be a human living in the world. In his examination of the human situation in the world, Merleau-Ponty draws from art, in particular the work of French painter, Paul Cézanne, in outlining a theory of aesthetics that brings to light our being in the world as an embodied individual who is immersed in it, not outside of it. In my paper I explore the various implications of Merleau-Ponty’s philosophy, paying specific attention to his aesthetic theory and how this perspective unveils a new understanding of what it means to be human living and existing in the world.

Carey Phelan

**Nurses’ Commitment and Motivation to Improved Personal Health: The Role of Hospital Administration**

*Faculty sponsor: Jennifer Elison*  
*Presentation*

Obesity leads to increased morbidity and mortality, while decreasing the quality of life of individuals and adding enormous fiscal burdens to an employer. Health care systems are especially feeling the encumbrance of increasing costs. Healthier hospital staffs have less absenteeism, are more productive,
make fewer mistakes and report greater overall satisfaction. The health of nurses affects the overall effectiveness of health systems. The goal of the research was to ascertain the most efficient interventions in which employers could institute to motivate nurses to increase their physical health. The study methodology incorporated a mixed design. Subjects were given a theoretical case study involving Nurse X, who desired to improve her/his health status. The participants were asked to transpose themselves as Nurse X and rate (on a Likert Scale) which of the given scenarios would best motivate and gain their commitment to increase their health status. Results indicated that over half (51.9%) of the 139 subjects were either overweight or obese. Triangulation was used to bridge the qualitative and quantitative data. From this, six themes emerged which related to barriers nurses face to optimal health: lack of time, difficulty with twelve hour shifts, physical demands of nursing, lack of a supportive work environment, nurse’s belief that employers only care about the bottom line, personal accountability and obese nurses believing that their excess weight was a benefit for their careers. Furthermore, employers should emphasize interventions on the overweight group. The obese group was the least motivated and least committed towards improving their health.

Carlando Pierini

The effects of vegetation on the distribution of the Rocky Mountain wood tick, *Dermacentor andersoni*

Faculty sponsor: Grant Hokit

Presentation

The Rocky Mountain wood tick, *Dermacentor andersoni*, is common throughout the Rocky Mountain States and Southwest Canada and is the most important North American tick in regards to disease transmission. It is the principle vector of Rocky Mountain Spotted Fever, Colorado Tick Fever, Tularemia, and Tick Paralysis. The life cycle and host-seeking behavior of *D. andersoni* suggest that
locations suitable for encountering a tick in the human-biting adult stage must provide favorable overwintering conditions and proper vegetation to carry out host-seeking. I hypothesized that if overwintering is a crucial factor in tick persistence, and increasing densities of the ground, shrub, and canopy layers create more favorable overwintering conditions, then tick encounter should be positively associated with increasing vegetation densities. Secondly, I further hypothesize that if a crucial factor in tick presence is climate then there should be an association with floral species, because vegetation is also dictated by climate. There were no statistically significant results detected in this study, but that does not definitively indicate that the factors assessed do not play roles in tick presence. With the multiple interactions being analyzed, the limited sample size of this study is a concern. More data must be gathered to even out misrepresentations by increasing sampling range and sample size. Aspect will be accounted for in future analyses. Future studies will include GIS data for soil types which may be another factor impacting overwintering conditions.

Rachel Rivers

Richard III: Maligned Murderer or Kind King?

Faculty sponsor: Jeanette Fregulia  Presentation

August 22, 1485. Richard III is defeated at the Battle of Bosworth by the Lancastrian heir Henry Tudor, a formerly “obscure and penniless exile in Brittany.” This young man who had become Lord Protector on the death of his elder brother Edward IV, had taken the crown for himself in a rapid coup d’état. His overwhelming purge of those deemed his enemies left England’s traditional aristocracy decimated. The death of Richard marked the end of one of England’s most turbulent periods, but ushered in centuries of conflict regarding his legacy, including accusations of murder. Did he kill an anointed king? Did he savagely cut down a Prince of Wales? Did he
order the deaths of innocent children? This paper seeks to address the deaths of Henry VI, Edward of Lancaster, and the Princes in the Tower, and Richard’s involvement in them. This paper will show that the Richard of legend has been exaggerated, partly by dramatists such as William Shakespeare and partly by Tudor propagandists who sought to reaffirm their dynasty’s succession.

Caitlin Rock

Unsung Heroes: An Expansion upon the Cold War Scholarship

Faculty sponsor: Jeanette Fregulia

Historians and political scientists like Michael Beschloss and Strobe Talbott have posited a variety of reasons for the end of the Cold war. Among the top reasons are the Soviet Union’s failure to keep up with the United States technology, the role of the administrations of both Ronald Reagan and Mikhail Gorbachev. Their arguments, however, omit the role played by civilian pressure. While the items mentioned above are important, this paper argues that civilian pressure played an equally important role in ending Cold War, particularly through American and British music. One of the most significant ways that citizens of the Soviet Union gradually realized their lack of rights compared to countries on the other side of the iron curtain was through music. The music from the 1950s thru the 1990s inspired the spirits of the citizens of the Soviet Union for peace and an end to their government-control lives, as reflected in the perestroika and glasnost reforms proposed by Gorbachev. My paper expands upon the Cold War scholarship with the inclusion of American and British music’s influence as an important contributing factor to the end of the Cold War.
Robert Scanlon

Fetal Stem Cells: Scientific Progress and Its Ethical Implications

Faculty sponsor: Grant Hokit

Presentation

It is maintained by many scientists that stem cell research is an important resource for new discoveries and understanding, especially in the newly developing field of regenerative medicine. However, research involving embryonic and fetal stem cells remains a highly controversial undertaking in today’s world, due to both ethical concerns and skepticism regarding the effectiveness of the treatments obtained through this research. In this thesis, I examine the differing arguments for the continuation of stem cell research, as well as their counter arguments, in an effort to find a compromise between the two positions. I utilize work done by Dr. Irving Weissman, among many others, in understanding arguments for the continuation of research. In understanding arguments against this research, I utilize, in addition to other sources based in bioethics, the philosophies of the Congregation for the Doctrine of the Faith, as found in “Instruction Dignitas Personae on Certain Bioethical Questions.” Additionally, I examine alternatives to the use of fetal and embryonic tissues in stem cell research and the role American politics plays in the continuation of this research. This investigation further establishes that a compromise between these two stances would be hard to find. However, it is my opinion that alternative sources of stem cells, whether from adults or otherwise, would be a more sustainable substitute to embryonic and fetal stem cells in research efforts. This is due to current political constrains and moral concerns against embryonic and fetal stem cells, in addition to new found efficiency in the methods for obtaining such alternatives.
Katherine Schmoke

**General Electric: Power, Greed, Deception and Our Environment**

*Faculty sponsor: Jamie Dolan*  
*Presentation*

General Electric is a United States multi-national corporate conglomerate. General Electric, or GE, is one of the largest, most profitable corporations in America. Yet, despite the corporation’s immense success in business and otherwise, large-scale environmental effects have been noted from General Electric’s past and present business activities, advertising techniques, and lobbying methods. The following research identifies two main areas of devastation along the Hudson River in New York and the Housatonic River in Massachusetts. Along with an examination of environmental damage, this research implements a post-Marxist deconstruction of power. The following research also examines the media, corporate welfare, corrupt activities, and existing policy in order to achieve a better understanding of General Electric’s vast wealth and success.

Hillary Stayner

**Music: Helpful or Hindering?**

*Faculty sponsor: Kelly Cline*  
*Presentation*

As a future educator, I want to give my students the best experience possible the classroom. In contemporary society, students are bombarded with media in the form of television, music, and advertisements. In the classroom, many teachers play music while students do seat work. We decided to conduct this study to determine if playing music while doing schoolwork is distracting or helps students perform better. We randomly assigned 183 students into groups and timed how long it took each group to take a quiz. Each group listened to a different type of music while working. We then statistically analyzed the data to determine if listening to music while studying is helpful or hindering.
James Thomas

**Economic Importance of the Early Western United States**

*Faculty sponsor: Jeanette Fregulia  Presentation*

This paper introduces the idea that without the resources found in the western territory, the United States would not have been able to become the world power that it is today. The expansion into the west was a crucial step for the American government to ensure the survival of its country. This assertion goes beyond the idea of ‘Manifest Destiny’ which proposes that it was inevitable for America to settle the west. It is overwhelming to consider the worldwide repercussions possible had America not explored and settled the west. The resources that were discovered and used pushed the U.S. into the industrial revolution and the modern era. Without them what would the nation have become? This is a question that cannot be overlooked by historians.

Kiersten Utsey

**Development of Software for Generating Synthetic Fetal Electrocardiograms**

*Faculty sponsor: Eric Sullivan  Presentation*

Some of the most common and fatal birth defects are those related to the heart. In adults, possible heart conditions are often identified through the use of an electrocardiogram (ECG). However, due to the presence of other signals and noise in the recording, fetal electrocardiography (fECG) has not yet proven effective in diagnosing these defects. We develop a mathematical model of three-dimensional heart vector trajectories, which we use to generate synthetic maternal and fetal ECG signals. This dipole vector model simulates the electrical activity of the heart as a single time-varying vector originating at the center of the body. We use a system of ordinary
differential equations whose numerical solution approximates the cardiac dipole vector. This system of equations is modified to account for noise, heart rate variability, and other physical and physiological considerations. Using this model, we have built a database of realistic, synthetic fECG signals using different parameter values and noise levels. Currently, algorithms to extract the fetal signal from the fECG are tested on databases of clinical recordings. Our synthetic database can be used in further algorithm effectiveness testing on a broader set of data. We have also built a publicly accessible, interactive user interface for our model.

Paige Williams

**Kidney Stones in Fruit Flies and the Zip10 Transporter**

*Faculty sponsor: Brandon Sheafor  Presentation*

Kidney stones are a common health ailment, yet the mechanism and initiation of stone formation remains incompletely explained. Calcium oxalate (CaOx) stones are known to initially form on sites called Randall Plaques that are high in zinc content. A suggested correlation between stone disease and the Zip10 transporter in a genome-wide association study on Miniature Schnauzers allowed me to investigate the role of zinc and Zip10 on CaOx stone formation. My results from radioactive Zn-63 uptakes in frog oocytes indicate that both hZip and dZip10 transport zinc. Both clones had highest function at a pH of 7.5. The effects of zinc and Zip10 on CaOx stone formation in a fruit fly (*Drosophila*) model are also presented in this paper. *Drosophila* Zip10 knockdown (KD) flies were created and compared to wild type (WT) flies in tubule experiments. Tubules taken from WT and KD flies and immersed in sodium oxalate (NaOx) solutions develop CaOx stones within 45 minutes. When zinc was added to immersion solutions, stone volume in both WT and KD flies increased. The addition of cadmium to immersion solutions also increased stone volume. KD flies formed larger stones than WT flies among all
solutions in tubule immersion experiments. WT flies formed more stones than KD flies among all solutions besides the cadmium + zinc + oxalate solution during tubule immersion experiments. In feeding experiments KD flies formed smaller stones with zinc present than without zinc. The difference in results between feeding and tubule immersion experiments is likely attributed to gut absorption of solutes. Our results indicate that WT flies formed larger stones when zinc was present in an oxalate rich diet, and KD flies formed larger stones when an oxalate rich diet lacked zinc. Both a knockdown of Zip10 and the addition of zinc to immersion solutions and diet altered stone formation. The present study suggests that Zip10 and zinc play a role in CaOx stone formation. Our results support previous studies on the correlation between kidney stones and zinc intake. Further studies should determine the exact mechanism of zinc transport by Zip10, as well as the relationship between zinc and its transporter with CaOx stones.