



Fourteenth Annual Undergraduate Research Conference Abstracts

2007

2001 Truman State University Undergraduate Research Conference

Truman State University has a well-deserved reputation for excellence in undergraduate scholarship. The Undergraduate Research Symposium is a university-wide, interdisciplinary event that showcases scientific research, literary review, artistic performance, and other forms of undergraduate scholarship from a wide variety of academic programs.

Special thanks to the University Publications and Printing Services, the staff of the Student Union, the Instructional Technology Center, Sodexo, and the Vice-President for Academic Affairs' office.

2001 Recipients of the Distinguished Research Service Award

Dr. Patricia S. Burton, Associate Professor of Philosophy

Dr. David Lesczynski, Professor of Agriculture

Dr. Jerry Mayhew, Professor of Health and Exercise Science

Dr. Sara E. Orel, Associate Professor of Art

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Business & Accountancy

The Affects of Computer Monitoring on Prospective Employees

Krista Bradford

Dr. Michael Blum and Dr. Adrien Presley,
Faculty Mentors

Computer monitoring and the loss of privacy that goes along with it have been cited as one of the greatest concerns for Americans in the 21st century. With nearly 75% of companies in the United States involved in some aspect of monitoring, the issue is of great importance to those who will soon be joining or already are in the workforce. Approximately one hundred and fifty college-age students across majors and demographics will be surveyed to find out their extent of computer knowledge, attitudes towards computer monitoring, and how these affect behavior towards joining and staying with an organization that engages in such monitoring. Statistical analysis will be conducted to determine if relationships exist among demographic characteristics, computer knowledge, attitudes toward monitoring, and organizations that utilize computer monitoring.

An Initial Study of CPA's Reactions to the AICPA's Vision Project

Aaron Cooper
Dr. Keith Harrison, *Faculty Mentor*

The American Institute of Certified Public Accountant's (AICPA's) Vision Project is an effort to determine where the Certified Public Accountant profession will be in the year 2011. The AICPA gathered information about the values, services and competencies of certified public accountants. The top five values, top five services and top five competencies were based on the number of responses including these items. The "Top Fives" give CPAs guidelines making the profession as a whole reach its potential. Our study looks at the effectiveness of the Vision Project and the impact that it is currently having on accountants. Our data were obtained by surveying 1,000 members of the AICPA. The survey hopes to determine whether CPAs agree or disagree with the general thrust of the Vision Project and identify ways that CPAs are implementing the vision in practice.

Tax Consequences for Foreign Businesses in India

Turan Hirji
Steve Klein, *Faculty Mentor*

Because of the increasing liberalization of the Indian economy, India has started to attract a substantial amount of interest from foreign businesses. Corporations interested in India as a potential investment opportunity should be aware of some tax issues related to doing business in India. Data was collected from various Indian newspapers, websites, reference books obtained via inter library loans, and other electronic library resources. There are several existing tax incentives to doing business in India, some of which exist only if the foreign corporation takes the right steps. However, some negative tax consequences are present and foreign corporations should be aware of them before doing business in India. Despite the negatives, India is a viable opportunity because of its huge domestic market, and the tax and investment incentives the Indian government offers.

A Comparative Study of Different Valuation Models

Eric Stockland
Dr. Jason Lin, *Faculty Mentor*

The purpose of this project is to see if traditional valuation models can still accurately predict high growth technology stock prices. Recent years have seen a rapid increase in the volatility of technology related stocks that has raised questions regarding their appropriate valuation. This project examines traditional valuation models and their stock price prediction capabilities. The models used include; the capitalization of earnings approach, the discounted future cash flows method, various valuation multiples, the discounted earnings method, and Benjamin Graham's classic valuation formula. The valuation models were tested on five industries and five companies within each industry. The results were compared across industries and to the individual market values of the securities. The research will attempt to explain what forces cause the market values of common stocks to differ from those suggested by traditional valuation models.

IT Outsourcing: A Competitive Advantage?

Brett Swip
Dr. Jeff Romine, *Faculty Mentor*

Outsourcing is the strategic use of outside resources to perform activities traditionally handled by an organization's internal staff. As the business world becomes more competitive, organizations are looking for ways to gain an advantage. Traditional measures such as cost cutting, price wars and advertising campaigns are still being used to set organizations apart. But increasingly, outsourcing is also being considered. One type of outsourcing has become more prevalent than others, information technology (IT) outsourcing. IT outsourcing is contracting with an outside source to manage the technology within the organization. IT outsourcing has hit close to home here at Truman with the addition of Collegis. This presentation defines outsourcing and looks into why organizations outsource; in particular, why they look to IT outsourcing to gain a competitive advantage. In addition, this presentation looks at the environment of universities both before and after outsourcing of IT services.

The Security Exchange Commission's Acceptance of International Accounting Standards

Michelle Lesley
Dr. Jeff Romine, *Faculty Mentor*

There is much current debate over whether the Security Exchange Commission (SEC) should allow foreign companies to publicly trade within the United States using International Accounting Standards rather than the United State's Generally Accepted Accounting Principles. This qualitative research project identifies the primary participants and their roles in the debate. The SEC is presently testing the international accounting standards. Although international accounting standards will help harmonize global financial markets, the SEC cannot accept standards of lesser quality without disclosed reconciliation. Before the SEC accepts International accounting standards without reconciliation, the International Accounting Standards Committee must decide if they want their standards to be truly global standards or if their standards will be utilized by more industrialized nations. In conclusion, the SEC should not currently accept International Accounting Standards without reconciliation, and they should wait and play a more conservative role, guiding the formation of international accounting standards.

Automobile Price Differentials in the European Union

Dimitar Stoyanov Tonev
Steve Smith, *Faculty Mentor*

The automobile price differentials in the European Union are an interesting business and economic phenomenon. Incomplete pass through of exchange rates, tax rate fluctuations, restrictions on Japanese imports and the right hand drive surcharge are some of the reasons for the differences in automobile prices. The exclusive and selective dealership system is also a key factor for the explanation of the price differentials. The exclusive dealership system made dealers susceptible to car producers. In result, manufacturers restricted the parallel trade among the member states, and fixed the car prices, by controlling the variable margin from which dealers generate the bulk of their profit.

Microsoft vs. The Department of Justice: What Does It Mean?

Amy Taucher
James Turner, *Faculty Mentor*

For years, Microsoft's name has been in the news concerning its overwhelming success and its antitrust legal battles against the Department of Justice. Despite all of the publicity, there is still a lot of confusion surrounding what is actually happening in the courts. It is beneficial for one to understand the history of antitrust law, the major events of the Microsoft trial, and the alternative remedies considered. The battle between Microsoft and The Department of Justice will affect antitrust law, the path of emerging computer technology, and every consumer that computer technology reaches.

On Developing a Search Engine Efficiency Model and its Application

Donald Wray
Dr. Stephen Allen, *Faculty Mentor*

As the volume of data, sources and resources explode on the Internet, users need to be able to access data in a very timely, orderly and efficient manner while avoiding data overload. Information vendors have begun to help users sift through the multitude of data by offering a variety of methods that are free for public use and intended for less sophisticated users—specifically Internet search engines and directories. Unfortunately, the search methods of the various information vendors lack consistency in their approach. Oftentimes, there is also a clear lack of public accessibility

to the descriptions of methods deployed. To address these oft confusing user issues of search engines and directories, this study attempts to categorize many of the more popular, often-used search engines based on methods and tools. While many search engines provide a likelihood hit ratio or some other index, often these data are unused or of unknown relative strength. To address this issue an efficiency index model is developed to measure search engine efficiency and applied to seven different search engines and directories with specific reference to the area of business finance. The search engines are then ranked based upon how well they retrieve information that would be helpful to a user researching business finance topics. Recommendations will also be provided on construction of a successful search. Additionally, user limitations of Internet search engines will be provided.

Multidisciplinary Practices: the Wave of the Future?

Brett Logan
James Turner, *Faculty Mentor*

Multidisciplinary Practices (MDPs) could very possibly be the wave of the future for both accounting and legal professionals. The combination of legal and accounting services within the same firm has released a tidal wave of commentary on the ethical and practical nature of such services. The American Bar Association has made a stand against this form of practice while the Big Five accounting firms attempt to push it through. The American Bar Association waves the banner of attorney-client privilege, confidentiality, and professional independence. Proponents of the Multidisciplinary Practice speak of "one-stop shopping" and providing services best fitting for the consumer. Some changes will need to be made if this will ever become an entirely accepted practice. Although it is already occurring, an integration of work practices and ethical codes in both accounting and legal professions will be necessary to ensure a future for the Multidisciplinary Practice.

Fine Art

Women in Theatre

Karyn Drown
Dr. Becky Becker, *Faculty Mentor*

The world of theatre is often viewed as being very liberal. From the themes presented to the diversity of the people involved, theatre has been very accepting. Surprisingly, though, women have not achieved the same presence in production positions as women have in other fields. This study compares the numbers of men and women in various production and design jobs, including directing, choreographing, designing set, sound, costumes, and lights, stage managing, and producing, on Broadway from 1950 until today. The numbers of women in these jobs are surprisingly low. Truman State University's statistics are much higher, especially in recent years.

Gothic Revival Architecture in the Churches and Cathedrals of St. Louis

Kimberly Kern
Dr. Julia DeLancey, *Faculty Mentor*

This study examines the Gothic Revival architecture of nine churches and cathedrals in St. Louis. Evaluation of the different types of Gothic Revival architecture present in the churches was accomplished by studying the histories of the individual churches and their intended congregations, as well as the history of the city itself. This study gives a broad overview of nine churches and their architecture, later focusing on three individual churches built for immigrant populations.

Fresco in Kirksville

Phil Schiff
Dr. Julia DeLancey, and Jim Jereb,
Faculty Mentors

Fresco is a technique for creating durable wall paintings that traces its roots back 3,000 years, to ancient Greece. This medium was widely used by painters in Renaissance Italy; the ceiling of the Sistine Chapel, painted by Michelangelo Buonarroti, is an example of a fresco. Frescoes often reflected scientific advances in the Renaissance, as well as carrying important art historical implications. This project involved the planning and execution of a fresco at a local restaurant, the Wooden Nickel. Research on fresco technique and history were undertaken, as well as experimentation with the technique. The project was concluded with a full-scale fresco being executed at the Wooden Nickel. This lecture will discuss some of the history and signif-

icance of fresco, as well as some of the technical aspects of its construction.

“Specials” and Photographers during the Civil War

Jennifer Ludwig
Dr. Julia DeLancey, Dr. Sara Orel, and
Dr. Heather Pulliam, *Faculty Mentors*

This paper will address the role censorship and field conditions had on Civil War photography and art. Draftsmen or “Specials” focused on camp and battle scenes while photographers specialized in portraits and still scenes. One of the many reasons for this is that both had to contend with field conditions and censorship but in different ways. Specials, draftsmen and journalists, were employed by the various periodicals, such as Harper’s Weekly and the New York Tribune, to cover the war. The Specials traveled with the armies and risked their lives with the soldiers, recording events of interest. Photographers did not work for the periodicals but did sell them the use of their pictures. Photographers had to make images that would interest newspaper editors and the customers that came to their galleries. The climate of wartime America imposed special conditions in the field and at home for the artists to cope with.

Klimt’s Representations of Women

Marjorie Best
Dr. Julia DeLancey, Dr. Sara Orel, and
Dr. Heather Pulliam, *Faculty Mentors*

Gustav Klimt was an artist who worked during the turn of the century. He created a vast and diverse body of work, but he is most widely known for his portrayals of women. This paper examines the reasons why Klimt portrayed women in the manner that he did. More specifically, it discusses his personal relationships with women and how they influenced his work. He had love affairs with some of his female models and stages of these affairs can be seen in his paintings. In the beginning of the affair, he often portrayed them in a flattering way, and he showed his admiration of them by placing small personal touches in the paintings. However, Klimt was notorious for becoming bored with his affairs, and after time, he represented his models in a less favoring light, often times stressing their flaws and imperfections. He represents his feelings of the women by using both imagery and symbolism.

The Meanings Behind the Portraits of Renaissance Patron Isabella d’Este

Alison Robins
Dr. Julia DeLancey, Dr. Sara Orel, and
Dr. Heather Pulliam: *Faculty Mentors*

Renaissance portraiture is an extremely significant genre because it is the only means of visual documentation the modern viewer has regarding the sitter. Thus, it is important to know how the portrait came to completion, whether it is an accurate depiction of the sitter, who commissioned it and why, and what role the artist played in its execution. Isabella d’Este, marchesa of Mantua, was a prominent Italian Renaissance woman and an avid patron of the arts during the fifteenth and sixteenth centuries. Throughout her lifetime she commissioned portraits of herself, which she used to control and idealize her image to the public, display her fashionable costume, and emphasize her prestige. This presentation will focus on one such portrait of Isabella d’Este by Titian, executed in 1536 when Isabella was sixty-two years old. Through both specific guidelines provided by Isabella d’Este as well as his own artistic style, Titian portrays the marchesa as a dignified young woman in her mid-twenties clothed in luxurious costume. The portrait was commissioned by Isabella d’Este to be placed in her home for her friends and family to admire d’Este’s prestigious and idealized image.

Homoerotic Images in the Work of Michelangelo

Erika Starr
Dr. Julia DeLancey, Dr. Sara Orel, Dr.
Heather Pulliam, and Dr. Doug
Steward, *Faculty Mentors*

During the Italian Renaissance homoerotic themes visible in the work of Florentine artist Michelangelo indicate an attempt on the part of the artist to express his homosexual interests. Michelangelo was involved romantically with a Roman nobleman Tommaso de’Cavalieri. The extent of their relationship was recorded in the letters and drawings sent between the two. Michelangelo had sent Cavalieri many drawings, three of them being Rape of Ganymede (1532-1533), Bacchanal of Children (1530-1535), and Fall of Phaethon (1530-1535). The homoerotic subject matter of these drawings should be read to show both the sexual desire he held for Cavalieri as well as the spiritual struggles he had as a result of his desire, which was a sin, according to the church and Florentine society. This can be seen through the homoerotic themes represented in each drawing. In his later years, at the same time he was involved

with Cavalieri, Michelangelo became consumed by this struggle, often turning to spiritual advisors such as his close female friend Vittoria Colonna.

Hamlin: An Exercise in Writing for Musical Theatre

Joseph Fear and Doug Reside
Dr. Warren Gooch, *Faculty Mentor*

It is a common misconception that, as a genre, musical theatre does not have the artistic merit of either “regular” drama or of opera. This project represents an attempt to address that misconception. Two English majors, one with a theatrical background, the other with a musical background, have come together to prepare an “artistic” musical theatre piece, based on the legend of the Pied Piper of Hamlin. This presentation will focus on salient aspects of this collaboration, and will explore some of the implications for musical style reflected in the dramatic elements and cultural aspects of the Piper legend, as interpreted by the student dramatist. The music reflects a strong Celtic influence, and exhibits a sense of structural unity through the use of cyclical themes and motives. Recorded examples of music and a scene from the project will be employed in conjunction with the presentation.

The Structural Interaction of Whole Tone Hexachords, Modes, and Symmetrical Scales in a Composition For Four Flutes

Joshua Luetkemeyer
Dr. Warren Gooch, *Faculty Mentor*
Katy Anselmo, Kate Christman,
Jessica Inch, and Kerrith Quigley,
Musicians
Dr. Julianna Moore, *Faculty Mentor*

Since the passing of the musical “Common Practice Period”, composers have sought means for self-expression that depart from traditional tonality. These include the use of symmetrical scales, such as octatonic and whole tone scales, harmonies based on intervals other than the third, such as quartal chords, and the use of Greek modes. The original composition “Nervous Breakdown” for flute quartet by Joshua Luetkemeyer uses these elements to help create moods and emotions that address the work’s title. By combining half-step-related whole tone hexachords, mixing hexachordal pitches with those of a Lydian scale, and controlling pitch density in these combinations, the music is made to range in emotional quality from whimsical through rabid insanity! Indeed, the

piece ends with a “musical scream”. The presentation will consist of a lecture-demonstration covering compositional aspects of the piece, concluding with a performance of the work by the Truman Flute Quartet.

Courbet, Manet, and the Parisian Salon

Daniel Coate
Dr. Patrick Lecaque, *Faculty Mentor*

For almost 150 years the Exhibition of the Works of Living Artists, commonly referred to as the Salon, dominated the French art scene, dictating what art styles and subjects were acceptable. Display at the Salon was necessary for artists seeking to gain popularity and patrons. In the 19th century Gustave Courbet and Edouard Manet challenged the official artistic style and subject matter of the Salon, paving the way for the rise of artistic movements such as Impressionism. The research paper explores the works of the above-mentioned artists, why they were accepted or rejected from the Salon, and the effect the Salon had on their careers.

Saint-Saens Concerto No. 3 in B minor, Opus 61

Carrie Jones
Dr. Sam McClure, *Faculty Mentor*

Camille Saint-Saens was said to have favored the musical form of a concerto. A concerto is generally a 3-4 movement piece with the most important or prominent part assigned to the solo instrument. His third concerto for violin and orchestra, Op. 61 in B minor, was written in 1880 for his good friend Pablo de Sarasate. Twenty years earlier, Sarasate had premiered Saint-Saens's first violin concerto. However, it is his third concerto that is most recognized today. This concerto seeks to display the virtuosity of the solo violinist. The first movement is labeled as ‘allegro non troppo.’ The soloist begins boldly and assertively. This is later contrasted by a lyrical and tranquil passage. The movement ends again, though, with the same brilliance with which it began, thus bringing it to a conclusion.

Samuel Barber's Violin Concerto, Op. 14, First Movement

Elizabeth Boehme
Dr. Sam McClure, *Faculty Mentor*
Janet Coggins, *Accompanist*

Samuel Barber received a commission to compose a violin concerto specifically for a young prodigy, and began the composition in Europe. However, Barber finished the work in the United States, as the stirrings of World War II created an unsafe living environment in Europe. According to the young prodigy, the first two movements were too easy, so he wrote an extremely difficult final movement, which proved impossible for the young violinist to play. In fact, it was first premiered by Albert Spradling in 1941. The first movement reveals Barber's romanticism and contains a beautiful opening melody, which begins in the violin solo and moves throughout the accompaniment. This concerto is often seen as a transitional work for Barber, as he broke many traditional restraints in the last movement.

Legacy of the Dead: Mummies and the Social Structure of the Chinchorro

Cynthia Bormann
Dr. Sara Orel, *Faculty Mentor*

The Chinchorro culture of the ancient Chilean coast created the oldest artificial mummies that have been discovered. These mummies fall into three groups – black mummies, red mummies, and simple mud-covered mummies – according to the period in which they were created and the methods used in their construction. Analysis of the mummies reveals that their diet was based on marine life and that earlier periods in the Chinchorro culture were more egalitarian than the later periods, pointing to a tribal system of organization.

Thomas Cole and The Course of Empire: An Allegory

Kristen Erekson
Dr. Sara Orel, *Faculty Mentor*

Thomas Cole, an American landscape artist, produced a series of paintings called “The Course of Empire.” These paintings track the course of a civilization, from its formative years to its ultimate destruction. Cole consciously integrated European and classical history, symbols, and artistic styles into these paintings. This allegorical series was intended to portray a message about the fate of the American “empire.” Through European and classical traditions, Cole's series “The Course of Empire” reflects his prognosis of American

society. Cole intended these paintings as a sequential series, with each scene contributing to the entire message. Each painting can be scrutinized in the context of the whole series, in terms of the European icons and influences as well as the presentation of Cole's broad American message.

Sexual Symbolism in the Portrait of Arnolfini and His Wife By Jan van Eyck

Sarah Swain
Dr. Julia DeLancey and Dr. Sara Orel, *Faculty Mentors*

Northern European Renaissance art is full of symbolism and representation. Artists such as Jan van Eyck strategically placed objects in their work to convey messages to their audience. As we study Jan van Eyck today we often see these objects and place our own value judgments on them. The question we should ask is not “what does this symbol mean to me?” but instead, “what did this symbol mean to van Eyck's audience?” By looking at several symbols in van Eyck's Portrait of Arnolfini and His Wife comparisons can be drawn between modern interpretations of piety, fidelity and loyalty, and the sexual connotations that van Eyck attempted to illustrate.

Paul Desmond and Sonny Rollins: How Historical and Sociological Factors Affected Their Musical Styles

Paul Downing
Dr. Marc Rice, *Faculty Mentor*

A historical, sociological, and musical analysis of the lives and works of Paul Desmond and Theodore “Sonny” Rollins was executed in order to discover how these factors affected their musical styles. In the historical analysis, biographical information, interviews, commentaries, and critiques that focused on the musicians were utilized as principle sources. The sociological analysis utilized jazz history sources addressing both historical and key sociological factors that influenced history. Finally, the musical analysis section focused on several musical works from each musician. Portions of each work were transcribed and examined. The musical elements considered were rhythm, melody, chord changes, motives, tone, and technical facility on the instrument. The aforementioned aspects of the musical analysis serve as a basic definition of musical style. After considering these factors, correlations between them and how they affected the musical styles of Desmond and Rollins were considered.

Concerto for Alto Saxophone and String Orchestra, Op. 109 by Alexander Glazunov

Carlos Di Stefano
Dr. Randy Smith and Dr. Juanita
Becker, *Faculty Mentors*

Generally considered to be a minor master, especially of the symphony, Alexander Konstantinovich Glazunov (1865-1936) was the last of the eminent Russian romantic composers. At a time when most composers such as Stravinsky were turning to new means of expression, Glazunov chose to carry on the tradition begun by Glinka and continued throughout the nineteenth century by Balakirev, Tchaikovsky, and others. Because by 1900 this romantic style was becoming obsolete, as a composer he is largely obscure, remembered instead for being a fine teacher and orchestrator. He directed the Moscow Conservatory for many years and collaborated with Rimsky-Korsakov, for example, on the completion of Borodin's opera Prince Igor. The 1934 *Concerto for Alto Saxophone and String Orchestra* is typical of Glazunov's work. Though it has been criticized for being old-fashioned and conservative, no music professional questions his mastery of romantic composition.

Concerto Form, Mozart and his Clarinet Concerto

Erin Russom
Dr. Richard Weerts, *Faculty Mentor*

Originating in Italy in the late 16th century, concerto form progressed from a group of soloists to a showcase for solo players. In the Classical Period (1750-1820), Wolfgang Amadeus Mozart (1756-1791) mastered the form of solo concerto, writing for piano, strings and winds. In the last year of his life Mozart wrote the concerto for clarinet. Due to his prowess in this genre, this concerto is considered the model concerto for the instrument. In the first movement, Mozart utilized sonata-allegro form and a double-exposition while providing the clarinet with ample lyrical and technical challenges, creating a well-balanced piece and a prime example of a solo concerto.

Architectural Influences Upon the Iowa State Capitol

Stuart Henn
Dr. Cole Woodcox, *Faculty Mentor*

Architecture is viewed by many as an artistic statement, but it can also be considered as a social and historical statement. The history of Iowa has been shaped by the development of the land and the settlers that inhabited the area. The agricultural base and abundant natural resources of the state played an important role in the settlement of Iowa. Other factors include the political structure, economic structure, and social structure of Iowa, all of which influenced the capitol architecture and the location of the site. Architecture serves as more than shelter and an artistic structure, as Karsten Harris says in *The Ethical Function of Architecture* (1997) "The ethical function of architecture is inevitable also a public function" (p. 287).

Human Potential & Performance

Stretching Duration and Frequency Impact on Hamstring Flexibility in Dancers

Nicole Flickinger, Kim Cain, Emily McCluhan, and Natalie Zivnuska
Dr. Michael Bird, *Faculty Mentor*

The purpose of this study was to compare the effectiveness of a stretching routine on hamstring flexibility between dancers and a generally active group. The dancers (n=38) practiced about three days per week, and the active group (n=43) exercised about five days per week. A standard sit-and-reach pre-test was administered in order to assess hamstring flexibility. Subjects then performed twelve static stretches emphasizing hamstring flexibility four days a week for four weeks. After the four-week period, a sit-and-reach post-test was administered. The dancers were significantly ($p < .05$) more flexible in the pre-test than the non-dancers. The dancers and non-dancers were not significantly different in the post-test, but there was a significant ($p < .05$) interaction between group and test. The dancers seemed to experience a ceiling effect, which limited improvements in hamstring flexibility. For dancers and others with high levels of flexibility, to improve, a more vigorous stretching regimen is suggested.

Digital Microscope Applications in Language Therapy

Kelly Beck, Heidi Beville, Karree Cooper, Heather Craig, Regan Fuemmeler, Jenny Garvin, Jennifer Main, and Carla Youngdahl
Dr. Paula Cochran, *Faculty Mentor*

Inexpensive and user friendly digital microscopes are now readily available to general consumers. This means that schools and clinics can make this technology available as a learning tool for children with and without special needs. Microscopes appeal to people's natural curiosity about their surrounding environment. When objects under the microscope are displayed on a large computer monitor, what once was an individual activity becomes a shared learning experience. Teachers and clinicians can use

these shared experiences to facilitate language development in children. Products such as close-up photos taken by the microscope and printed out can be used to stimulate conversation away from the computer with people of any age. An Intel Play QX3 Computer Microscope (KayBee Toys, \$99) was used to develop language therapy activities and materials which are displayed and demonstrated in this presentation.

Nutritional Habits of Health 194 Students with Respect to Age, Grade, Gender, and Residential Status

Amanda Jones and Kristi Morton
Mary Lou Cole and Dr. Jerry Mayhew,
Faculty Mentors

At the college level, nutrition education is relevant as a result of common weight gain among first year students. The Health 194 class, Lifetime Health and Wellness, educates students on the importance of good nutritional habits. One hundred, sixty-seven students enrolled in Health 194 completed a diet analysis using a computer software program. Eating habits for three days were analyzed by the computer program. This data analysis was compiled in SPSS to determine the nutritional habits with respect to age, grade, gender, and residential status. Significant differences were found between year and the interaction of year and residence for the percent of recommended calories for breakfast. For dinner, there was a significant difference in residence, gender and year interaction, and residence and year interaction. No significant differences were found in the percent recommended calories for lunch or snacks. No significant differences were found in percent total fat, carbohydrate, and protein intake.

Scope of Health Promotion Programs for Physician Assistant Students

Amanda Jones
Dr. Carol Cox, *Faculty Mentor*

The purpose of this study is to describe the number, scope, and characteristics of health promotion programs for students enrolled in physician assistant (PA) programs. A trained interviewer conducted a structured telephone interview with a representative from each of the 110 accredited PA programs in the United States. A modified version of a survey instrument used in medical schools was employed. Only 10 (9.1%) of the accredited programs reported offering a health promotion program for students. The vast majority of PA programs not offering a health promotion

program did not plan to do so in the future. Neither process nor outcome evaluation was conducted in most existing programs. None of the health promotion activities were presented at the two highest levels of intervention. It is recommended that all professional schools, including PA programs, allocate resources to develop, maintain, and strengthen programs designed to enhance the health and well-being of their students including incorporating principles and health promotion and disease prevention throughout the curriculum.

American Red Cross Preventing Disease Transmission Education Project

Casie Curfman and Amanda Jones
Dr. Carol Cox, *Faculty Mentor*

Two hundred seventeen million cases of occupational disease occur each year. Therefore, reducing the number of work-related injuries and frequency of hepatitis B infections are two objectives listed in Healthy People 2000's Occupational Safety and Health Resource List. The American Red Cross Preventing Disease Module provides participants with the necessary information and skills to protect themselves from potentially infectious materials at the worksite. Members of the Gamma Rho Chapter of Eta Sigma Gamma currently volunteer in hospital and clinic settings and will soon enter careers and internships in which they will be at risk for contracting diseases such as hepatitis, meningitis, herpes, tuberculosis, and HIV infections. Gammans participated in the Module and were trained by the Red Cross instructor in: disease recognition, infection transmission, incident reporting, and procedures for incident follow-up. The precautionary methods and skills learned will greatly reduce risk of infection in high-risk settings of the health education field.

TATU - Teens against tobacco use: An anti-tobacco youth education program

Casie Curfman, Amanda Jones, and
Dixie Wheeler
Dr. Carol Cox, *Faculty Mentor*

Truman's Gamma Rho Chapter of Eta Sigma Gamma addressed the community problem of tobacco use among teenagers as they participated in the American Lung Association, American Cancer Society, and American Heart Association's Teen Against Tobacco use (TATU) Program. The program consisted of four phases: (a) planning the Facilitator Training of 14 Gamma Rho Service Committee members, (b) TATU Facilitator Training, (c) planning the area-wide Teen TATU Training, and (d)

conducting the area-wide Teen TATU Training consisting of 36 youth from 4 area schools. Once certified as TATU facilitators, Gammans conducted the Teen Training workshop. They taught teens about tobacco dangers and demonstrated teaching methods to use as they present an anti-tobacco program to elementary classrooms in their school districts. The Teen Training yielded positive evaluations of the Gamman Facilitators, and the teens made presentations to over 120 elementary students. The 14 Gamman TATU Facilitators will continue to conduct Teen Trainings well into the future.

Membership Demographics and Diversity of AWHP Central Region Professionals: A Pilot Study

Maria Godefroid and Kristi Goldsmith
Dr. Carol Cox, *Faculty Mentor*

The purpose of this pilot study was to provide an overview of membership demographics including the current status of culturally diverse ethnic group representation in Association for Worksite Health Promotion (AWHP) Professional Members in the Central Region of the United States. Surveys were faxed to a stratified random sample of 190 AWHP professional members in Regions IV and VIII. The instrument consisted of a series of multiple-choice questions to describe respondents' worksite and personal demographics. The majority of respondents were female, and most possessed at least a Master's degree. As the predominant ethnicity of the respondents was overwhelmingly White, results also provided some evidence of the under-representation of diverse ethnic groups among this region's AWHP membership. The information gathered could be used to improve the region's recruitment and retention of professionals, specifically culturally diverse professionals, into the worksite health promotion field as well as the professional association.

Facilitating Basic Concept Development in Preschool Age Children Through the Use of American Sign Language

Lisa Berna, Jill Hatridge, and Brandi Patterson
Dr. Janet Gooch, *Faculty Mentor*

This study examined the effect of using American Sign Language to teach basic concepts to 25 preschool children. Approximately half of the subjects received signed instruction (Sign Group) while the other half were taught concepts using conventional teaching methods (Non-sign Group). Six training sessions were conducted over a three-week period. Statistical analyses were completed to evaluate the effect of signed versus non-signed instruction. No statistical difference was found between the mean number of concepts learned between the two groups ($p=0.01$). A difference was noted between groups of children based on their level of pre-test knowledge of basic concepts (low, medium, high).

Factors Influencing Health Promotion Behaviors for Diabetes Among Minority Populations: Secondary Analysis of NHANES III

April Howard
Dr. Gretchen Cornell and Stephen Hadwiger, *Faculty Mentors*

Diabetes is currently reaching epidemic proportions among minority populations throughout the United States. Health care providers are increasingly concerned about the severity of this disorder and the contributing factors that play a significant role in the development of new cases nationwide. This study will explore factors influencing self-monitoring behaviors based on Pender's Model of Health Promotion. Respondents ($n=1572$) were chosen from the NHANES III national survey published by the CDC (Centers for Disease Control) on the basis of race-ethnicity and positive diabetes diagnosis. Non-Hispanic Whites, Non-Hispanic Blacks, and Mexican-Americans were surveyed from 81 U.S. counties from 1988 to 1994. Information gathered in NHANES III was used to describe the health status of selected population groups of the U.S. Secondary statistical analysis was performed in order to determine differences among ethnic groups in relation to glucose monitoring.

Relationship of Grip Strength and Exercise History to Bone Mineral Density in Adult Females

Emily Fridlington and Julie Fridlington
Liz Hopkins-Jorn, Craig Utterback (Kirksville College of Osteopathic Medicine), and Dr. Jerry Mayhew, *Faculty Mentors*

The purpose of this study was to evaluate the relationships of bone mineral content (BMC) to age, body dimensions, grip strength, and exercise history. Seventy-eight female university staff members were evaluated for calcaneal BMC by single photon absorptiometry. BMC was moderately but significantly correlated with age ($r = -0.43$), height ($r = 0.27$), BMI ($r = 0.28$), total grip strength ($r = 0.46$), and activity index ($r = 0.36$). Holding age constant by partial correlation did not significantly alter the relationships of key variables with BMC. A multiple regression equation indicated that strength (32%) and activity index (30%) made slightly greater contribution to the explained variance ($R^2 = 0.42$) in BMC than did age (20%) and BMI (18%). Individuals with low BMC (<1 SD, $n = 13$) did not differ significantly in weight, BMI, and strength from those with high BMC (>1 SD, $n = 13$) when age was held constant by ANCOVA, but low BMC individuals did have significantly lower activity index. These results would suggest that bone health in women may be altered by higher activity and strength levels, independent of the decline noted with age.

Effect of Carbohydrate Ingestion on Volume Load Lifted During Acute Resistance Exercise

Sarah Grogan
Dr. Alex Koch, *Faculty Mentor*

The effect of carbohydrate supplementation (CHO) on volume load lifted during acute resistance exercise was examined. Ten resistance-trained male subjects completed a randomized double-blind protocol with sessions separated by 14 days. The exercise session consisted of a high intensity, short rest interval squat workout and was intended to elicit volitional fatigue. Subjects consumed 1.0 g/kg body mass-1 CHO or an equal volume of placebo (PLC) 10 minutes prior to exercise. Volume load was calculated as the product of total weight lifted (kg) times the total repetitions. A dependent t-test indicated no significant difference between volume load lifted with CHO ($9,986.0 \pm 1,229.0$ kg) and volume load lifted with PLC ($9,740.0 \pm 1,331.1$ kg). These data do not support an

ergogenic effect of carbohydrate supplementation on resistance exercise performance.

Relationship Among Perceived Body Image, Social Physique Anxiety, Body Satisfaction, and Activity Level in College Females

Emily Fridlington, Julie Fridlington, and Amanda Wherry
Dr. Chris Lantz, *Faculty Mentor*

Studies have shown conflicting results on the influence of exercise on body image, including its effects on psychological well being, self esteem, and body awareness. The purpose of this study was to assess these variables in terms of actual, ideal, and perceived body weight and fat in three populations of college females: sedentary ($n=22$), active ($n=23$), and varsity athlete ($n=12$). All participants completed the Social Physique Anxiety Scale (SPA), the Body Cathexis Scale (BCS), and estimates of perceived and ideal body fat and weight. Actual body fat was assessed using a Tanita Body Fat Monitor Scale. Repeated measures ANOVA yielded significant differences between ideal, estimated, and actual percent fat with ideal being significantly less ($p<0.0001$) than both estimated and actual. A significant difference was also found between ideal and actual weight with ideal being significantly less than actual ($p<0.0001$). One-way ANOVA on the BCS and SPA scores indicated the athletic population to be significantly lower than both the active and sedentary populations.

Differences in Perception of Ideal Female Body Type Between Women in Social Sororities and Women Not In Social Sororities

Melissa McIntyre*, Tracy Knopp, and Leanna Heritage
Dr. Chris Lantz, *Faculty Mentor*

This study examined the differences in female body perceptions between college women in social sororities (SS) and independents (IND). SS members ($n= 73$) and IND ($n= 69$) attending a small Midwestern university completed an anonymous questionnaire concerning their current body image, ideal female body image and what they believed men find attractive using a body mass index silhouette. In scoring responses, the silhouette was grouped into ectomorphic, mesomorphic, and endomorphic categories. An independent t-test showed significant difference between SS and IND in age [$t = 4.63, p = .001$], current

body image [$t = 1.98, p = .049$], and ideal body image [$t = 2.20, p = .029$]. There was no significant difference in what SS and IND believe men find attractive [$t = 0.65, p = .075$]. These results indicate that SS members perceive themselves as more ectomorphic than IND and SS members have a more ectomorphic perception of ideal female body image than do IND.

Initial Psychometric Properties of the Body Alienation Scale

Jennifer Adams and Tina Anshus
Dr. Chris Lantz, *Faculty Mentor*

This study investigated the psychometric properties of the Body Alienation Scale (BAS); One hundred fifty-two student-athletes at a medium-sized university completed the BAS. Athletes were identified as participating in one of three sport types: collision, contact, and noncontact. Factor analysis revealed a three-factor model accounting for 56.7% of the total variance. The three factors were labeled as: body as a weapon, injury, and training. A MANOVA indicated that collision sport athletes demonstrated a greater likelihood to use their body as a weapon [$F(2, 152) = 27.27, p = .001$] and to train through injuries [$F(2, 152) = 8.77, p = .001$]. Training was not significantly different for the three groups ($p = .058$). These results indicate that body alienation may be characterized by viewing the body as a weapon, training through an injury, and issues associated with training. Further, results indicated collision sport athletes are more likely to manifest characteristics of body alienation than are other types of athletes.

Relationship of Athletic Status and Gender to Social Physique Anxiety, Self Esteem, Eating Attitudes, and Percent Fat in High School Students

Tina Anshus and Emily Hankins
Dr. Chris Lantz and Dr. Jerry Mayhew,
Faculty Mentors

Previous research in college students has concluded that social physique anxiety, gender and %fat can predict eating behaviors. However, little research has been conducted on adolescents. One hundred twenty eight high school students (male = 75, female = 53) provided demographic information and completed the Eating Attitudes Test (EAT), the Social Physique Anxiety Scale (SPAS), and the Self Esteem scale (SE) during regular physical education class. Students were categorized into athletes ($n = 52$) or non-athletes ($n = 76$). In addition, percent body fat was calculated through gender-specific, three site skinfold

equations. A MANOVA indicated significant main effects between gender and athletic status for SE, SPAS, and %fat, but not for EAT. There were no significant interactions. Separate gender correlation analysis revealed significant relationships between EAT and SE ($r = -0.30$), SPAS ($r = 0.44$), but not %fat ($r = 0.13$) in females. In males none of the relationships with EAT were significant ($r < 0.21$). Among non-athletes, EAT was significantly related to SE ($r = -0.36$) and SPAS ($r = 0.37$), but not to %fat ($r = 0.08$). Among athletes none of the relationships were significant ($r < 0.24$). Multiple regression analysis produced no significant variables to predict EAT in males, while SPAS was the only significant variable to estimate EAT in females ($r = 0.44$). This study suggested that SPAS, SE, and %fat were not strong predictors of eating behavior among high school students.

Demographic Study of Birth Variables in Missouri

Larissa Ball
Dr. Thomas Linares, *Faculty Mentor*

Nationally, the birth defect rate is 4 per 1000 live births; in Missouri, the rate approaches 6 per 1000 births. Similarly, infant mortality is slightly higher in Missouri compared to the rest of the country. Much speculation has been presented as to the etiology of the higher Missouri numbers, but definitive causes cannot be isolated. It appears that, depending on the county or region, different factors affect birth patterns. This study investigated 42 variables related to birth demographics for the entire 114 counties, plus St. Louis City. Results revealed that high-risk births were related to young women, typically unwed, giving birth to low-weight infants, receiving little pre-natal care, on state assistance, living in the southeast part of the state. Other findings will also be presented.

The Effect of Music on the Efficiency of a Ten-Minute Treadmill Run in College Students

Tara Thomure and Tina Thomure
Dr. Jerry Mayhew, *Faculty Mentor*

The purpose of this study was to determine the effect of fast, slow and no music on the efficiency of a 10-minute submaximal treadmill run. Fourteen college students (males=5, females=9) volunteered to be tested. Each subject ran for 10 minutes on a motorized treadmill at a one-degree grade, wearing an open circuit spirometry mouthpiece connected to a metabolic cart. Subject test order was randomized with a rest of one week between test sessions. The mechanical efficiency was

calculated using work output divided by energy expenditure. A repeated measures ANOVA found no significant difference ($F = .87$) across trials. There was also no significant difference within subjects' ventilation ($F = .17$) and VO_2/Kg ($F = .44$). A significant difference ($F = 3.91$) was found in the respiratory rate of subjects between the music and no music conditions, with no significant difference between the music conditions. While music tempo had no effect on the efficiency of an aerobic treadmill run, the respiratory rate was higher with music than without.

Analysis of Upper Body Strength by Allometric Scaling

David Mayhew
Dr. Jerry Mayhew, *Faculty Mentor*

This study sought to evaluate the efficacy of allometric scaling for comparing differences in upper body strength between college men and women. One-repetition maximum (1-RM) bench press (BP) was measured in untrained college-aged men ($n = 602$) and women ($n = 620$). The commonality of slope of the relationship between body mass (BM) and BP for men and women was evaluated using a multiple, log-linear regression model. The nonsignificant interaction term ($p = 0.06$) for gender x $\ln BM$ confirmed a similarity of slope and revealed the exponent for BM to be 0.59. Computing separate allometric equations for men ($BP = 5.81 BM^{0.59}$) and women ($BP = 2.98 BM^{0.59}$) indicated that men were approximately 1.95 times stronger in the upper body than women after controlling for the influence of BM. The correlation between the scaled variable ($BP/BM^{0.59}$) and BM was nonsignificant in both men ($r = 0.04, p = 0.29$) and women ($r = -0.07, p = 0.10$) indicating that the ratio is free of any confounding influence of body size. The allometric scaling approach may be more valid for comparing individuals of different size than is the widely used ratio standard (i.e., BP/BM).

The Influence of a Mental Imagery and Relaxation Protocol on Golf Chipping Accuracy

Rebecca Dunlap and Sara Mitchell
Dr. Jerry Mayhew and Dr. Chris Lantz,
Faculty Mentors

This study investigated, using an A-B design, the effects of mental imagery and relaxation techniques on golf chipping performance. Eight NCAA Division II female golfers were required to chip a regulation golf ball to a bulls-eye shaped target at a distance of 15' three times a week. Zero to four points could be earned for each attempt with zero being

assigned to attempts missing the target and up to 4 points for attempts landing in the bulls-eye. Baseline was defined as three consecutive sessions with no more than a five-point difference. The intervention consisted of subjects listening to a relaxation and mental imagery tape and then performing the same chipping task. After four weeks, seven subjects had reached baseline conditions and all seven had participated in the intervention phase for at least one week (3 sessions). Preliminary results of subjects' accuracy in the intervention phase indicated a slight increase over baseline with fewer "no point" strokes.

Variability of Body Fat Measurement of Female Athletes Using Four Techniques

Cindi Lanners

Dr. Jerry Mayhew, Liz Hopkins-Jorn, and Robin Schook, *Faculty Mentors*

The purpose of this study was to determine the degree of variability using different body composition techniques. Seventy-two college female athletes from basketball, softball, track, cross-country and tennis were measured using six skinfolds, two forms of bioelectrical impedance (BIA), and near-infrared reactance (NIR) method. The skinfold measurements allowed prediction of %fat using a generalized equation and two athletic-specific equations. A 5 x 6 two-way ANOVA with repeated measure over the second factor revealed that (1) the Tanita BIA produced significantly higher estimates of %fat than all other methods, (2) the BodyLogic BIA was significantly lower than the Tanita but significantly higher than the other methods, and (3) none of the other methods differed significantly. In conclusion, considerable variations in % fat measurements may be noted when using different techniques. Therefore, caution should be exercised when establishing optimal competition weights for female athletes using different %fat estimates.

Effect of Cold Water Exposure Upon Divergent and Analytical Thinking

Erin Lesczynski

Dr. James Padfield, *Faculty Mentor*

There is widespread anecdotal evidence that cold exposure decreases thinking ability, but little scientific research is available to document this observation. Many individuals are required to perform complex mental tasks under cold environmental conditions, such as military personnel, search and rescue teams, and those pursuing outdoor recreational activities. Combining an independent variable from environmental physiology with dependent variables from educational psychology, we studied the effects of cold-water exposure on mental processing. After validation of the test protocol in an independent control group, subjects were tested for divergent (creative) and analytical (logical) thinking while experiencing brief exposure to cold-water immersion (ten minutes at between 40 and 50 degrees Celsius) using a randomized, crossover study design. The results indicated that both divergent ($p < 0.001$) and analytical ($p < 0.05$) thinking were significantly and negatively affected by cold-water exposure.

Effect of Clothing Upon Rate of Dehydration in Runners

Kristi Willenberg

Dr. James Padfield, *Faculty Mentor*

While it is generally assumed that excess clothing decreases heat tolerance and limits athletic performance, there has been little formal scientific study to validate this assumption. Eight runners (male = 2, female = 6) ran at 90% of their individualized 8-kilometer race pace at 1% grade on an indoor treadmill, with nude weight measured before and after the run. Time to exhaustion was measured for two randomized trials: one wearing shorts, t-shirt, sweat pants, sweat shirt, and hat; another wearing shorts only (males) or shorts and a sport top (females). The difference in weight loss (a measure of dehydration) between the two runs was not significant, but the difference in time to exhaustion for the light clothing trial was significantly ($p < 0.01$) longer.

Physiologic Performance Profile of Elite Female Adolescent Cheerleaders

Sara Fincham

Dr. James Padfield, *Faculty Mentor*

Organized cheerleading is struggling to gain acceptance as an athletic activity – a sporting event as opposed to a social phenomenon. To investigate the physical demands of high school cheerleading, we performed a physiologic performance profile on members of a female cheerleading squad ($n = 17$) that has been nationally recognized for elite ability. Measurements were taken of body composition, aerobic capacity, anaerobic power, explosive power, flexibility, and motor skill. While aerobic capacity (average of 51 ml/kg/min) and percent fat (average of 20%) were not comparable to elite adolescent female endurance athletes, these values are far above age group norms. In a similar manner, while measures of anaerobic and explosive power were not comparable to elite adolescent female power athletes, the cheerleaders' values are above age group norms. In addition, most of the cheerleaders demonstrated extreme hamstring and low-back flexibility. These data indicate that the physical fitness levels of elite cheerleaders are consistent with those of well-trained female high school athletes.

College Students' Evaluation of HIV Prevention Counseling & Testing

Brie Cantrell

Dr. Stephanie Powelson, *Faculty Mentor*

College students, as young adults, are at risk of HIV transmission, especially through unprotected sex. For several years, a rural midwestern college has offered biannual HIV counseling and testing outreach with certified peer educators. Previous outreach efforts were increasingly successful, but lacked a client evaluation component. In November 2000, college-age clients were surveyed concerning their satisfaction with the counseling and testing efforts on campus. Of the 147 students tested, 106 completed an evaluation survey (72% response rate). The information obtained from these surveys was used to enhance counselor effectiveness. Using a Likert scale, clients rated the characteristics listening, respect, and clear explanations most highly. Services deserving further client/counselor discussion included increased information about HIV transmission and the client's methods of risk reduction. By continuing to use an evaluation process in future outreach events, counselors may be more effectively trained to have an impact on clients' risky behaviors.

A Comparison of the Ability of African-American and Caucasian College Students to Discriminate Standard English Phonemes

Carla Ezell
Dr. Janet Gooch, *Faculty Mentor*

The purpose of this study was to investigate different aspects of two dialects, African-American Vernacular English and Standard English, in order to determine the abilities of African-American and Caucasian college students in discriminating Standard English phonemes, or sounds. Forty subjects, 20 African-American and 20 Caucasian college students, each filled out a short demographic survey and was given a blank answer sheet consisting of thirty numbered lines. Each subject listened to the tape which contained instructions, three practice examples, and thirty words, 15 AAVE and 15 Standard American English. By having each subject write the words presented to them, this showed whether or not the subject heard the phonemes which were said. The collected data were then analyzed using SPSS Version 10, a statistics package. For all 40 subjects the average number of items correct was 35, with a standard deviation of 2.8537. An independent t-test showed a t-value of .325 which was not significant at p is less than or equal to .05. In other words, there was no significant difference in the performance of the African-American and Caucasian subjects.

Comparative Analysis of Implementation of Standardized Nursing Languages at Truman State University

Kristen Leiby
Dr. Stephanie Powelson, *Faculty Mentor*

Standardized nursing languages have been useful in planning patient care for over 25 years, but have become especially necessary for computerized patient records. These languages, nursing diagnosis, nursing interventions, and nursing outcomes, were introduced to the Truman Nursing Program in Fall 1998. Since implementation, faculty and students have evaluated use of the languages annually. This poster presentation will compare the respondents' evaluations (juniors, seniors, and faculty) over three years. Using a Likert-type scale (1=low to 5=high), most respondents rated the languages as follows: helpful as a resource (mean >4.0), pertinent to the course (mean >3.8), and pertinent to

clinical (mean >4.0). Over time, faculty have increased their ratings, while students' ratings have slightly decreased. Comments revealed the need for additional orientation and more in-depth discussion about relating nursing languages to individualized patient care.

Influence of Intercollegiate Athletic Involvement on the Academic, Athletic, and Social Experiences of American and British Students

Emily Hankins
Pete Schroeder, *Faculty Mentor*

A majority of the research on intercollegiate athletic experiences has been done in the United States. However, the role of athletics at foreign universities is less clear. Eight basketball players from a university in London were interviewed about their athletic, academic, and social experiences. Data from observations and interviews were compiled and analyzed using a grounded theory approach. The results revealed that basketball participation played a minor role in the academic and social aspects of the men's lives. Unlike many intercollegiate athletes in the United States, the Europeans indicated that they did not receive any external rewards or incentives, and did not foresee basketball influencing their lives in the future. However, each player reported a high level of personal fulfillment due to his intercollegiate athletic participation.

Language & Literature

Crossing Frontiers in Search of Freedom: An Analysis of The God of Small Things and The Shadow Lines

Andrew Blandford
Dr. Hena Ahmad, *Faculty Mentor*

Two recent Indian novels, *The God of Small Things*, by Arundhati Roy, and *The Shadow Lines*, by Amitav Ghosh, depict characters that decide to cross both tangible and intangible frontiers in their quest for freedom, inevitably leading to violence and sacrifice. Hope remains, however, as new generations learn valuable lessons from their predecessors. In *The God of Small Things*, a social border is crossed when a mother breaks the rules of the Hindu caste system by sleeping with the untouchable Velutha, in an attempt to transcend the restraints put on females in Indian culture that results in the death of her lover. A similar martyr can be found in *The Shadow Lines*, when Tridib sacrifices himself for the sins of his nation by resisting rioters in East Pakistan. Velutha and Tridib both achieve a transcendent unification of imagination and reality, but must die in a "final redemptive mystery," leaving behind only the example that they set for the younger observers, from whom their story is told.

Hard Lessons: The Impact of Colonial Education on Women as Seen in Mariama Ba's So Long a Letter and Anita Desai's Clear Light of Day

Sadie Carter
Dr. Hena Ahmad, *Faculty Mentor*

Colonial education had a dual impact on women: it gave them new opportunities for work and education, but also deconstructed many traditional beliefs upon which the structures of their societies were based, leading to feelings of cultural alienation and a paradoxical social role that meant practicing both traditional and western values. Two works that illustrate this paradox as well as the creativity and patience required to live within it are Anita Desai's work *Clear Light of Day* and Mariama Ba's *So Long a Letter*. Through their introspection and social inquisitiveness, the protagonists Bim and Ramatoulaye pinpoint the need for their nations, India and Senegal, to restructure to support a new, more liberated way of life for women in society, protected from injustice.

The Hindu Opiate: A Marxist View of Religion in “Breast-Giver” and “The Road to Salvation”

Ty Fagan
Dr. Hena Ahmad, *Faculty Mentor*

In the Communist *Manifesto*, Karl Marx calls religion a tool of the oppressing class, “behind which lurk ... many bourgeois interests,” namely, the pacification of the lower classes. I will examine the ways in which two Indian short stories reflect the religion’s exploitative and oppressive. “The Road to Salvation,” by Premchand, a noted 20th-century social critic and advocate of social change, describes the mutual ruination of two peasants, Buddha and Jhingur. Religious rhetoric divides, not unites, the two men. The Hindu religion is manipulated by the upper class Brahmin priests throughout the story. In Mahasweta Devi’s “Breast-Giver,” religion serves as a true opiate, a welcome escape from the realities of class oppression, particularly for the characters of Jashoda and Nabin. These representations of religion affirm Marx’s characterization of religion as the “opiate of the masses,” a means of keeping the lower classes under the thumb of the upper class.

The Alarm Clocks of the World

Trish Svendsen
Dr. Monica Barron, *Faculty Mentor*

Utilizing both surrealism and realism, Henry Miller in his first novel, *Tropic of Cancer*, and Rene Magritte, through three of his major paintings, *The Treachery of Words*, *The Great War*, and *The Rape*, both commented on the bourgeois lifestyle. Seeking to improve the human condition by creating art that opened eyes and minds to the reality of the human consciousness, Miller and Magritte introduced people to new ways of thinking in an attempt to stir them into action. Magritte, in urging his audience to feel and live their lives beyond the superfluous images they hide behind, fulfills one of Miller’s main points in *Tropic Of Cancer*. For Miller, the artist is the alarm clock of the world and, as a result, it is the purpose of the artist to shake people into realization. For both artists the goal was to remind people of their own humanity, and that to truly live and know reality one must dare to go beyond the status quo.

A Case Study: The Implementation of Communicative Language Teaching

Erin Markley
Dr. Cheryl Engber, *Faculty Mentor*

In foreign language teaching, the choice of methodology and the manner of its implementation are crucial elements in designing a program. This paper reports on a case study in which the researcher attempted to implement Communicative Language Teaching in tutoring sessions in a community language program setting. The researcher, who was also the tutor, recorded all sessions, collected written work from the subject, and kept a journal reflecting on each session. These were analyzed to determine the extent to which implementing CLT as the sole methodology was successful. The results of the analysis suggest multiple factors contributed to the difficulty of implementing CLT in this study. Among them were the difficulty in characterizing the methodology, the lack of experience of the researcher (tutor) with the method, the setting, and the prior educational experience of the student coming into conflict with the procedures of the methodology.

Detours Magazine: “Catch the Fever”

David Grone
David Fortney and Dr. Gary Jones,
Faculty Mentors

It is becoming increasingly difficult for the average fan to attend a professional sporting event with the seemingly exponential rise in ticket and concession costs. However, the purpose of the article entitled, “Catch the Fever” is to show that there are alternatives to Major League Baseball in Missouri – in the form of the River City Rascals in O’Fallon, Missouri. This article, written and researched for the Fall 2000 edition of *Detours* magazine, outlines the experience from a fan’s perspective while at the same time providing the reader with some background information on various players. “Catch the Fever” required on-site research, telephone interviews, and background numerical research that is so commonplace for today’s journalists. While the St. Louis Cardinals may be “Baseball From Another Era,” as their advertising campaign suggests, a night at T.R. Hughes Stadium in O’Fallon, Missouri to see the hometown Rascals of the independent Frontier League proves to be just as exciting.

The Tom Green Cancer Special and its Effects as a Public Health Care Campaign

Heather Carmack
Dr. Todd Holm, *Faculty Mentor*

Health campaigns dealing with the illnesses that afflict men are rare in mainstream advertising. Testicular cancer, to this point, has been the least publicized disease and, because of this, the topic has become taboo. Comedian Tom Green created a one hour special, “The Tom Green Cancer Special,” documenting his ordeal with testicular cancer. An application of Erica Weintraub Austin’s effective health care campaign model to the Tom Green Cancer Special shows how the cancer special can be considered a public health campaign for testicular cancer designed to target a younger audience demographic.

Terror, Comfort, Absurdity: Identification in John Berryman’s The Dream Songs and Albert Camus’ The Myth of Sisyphus

Theodore Frushour
Dr. Royce Kallerud, *Faculty Mentor*

John Berryman’s long poem *The Dream Songs* is the story of Henry, “a white American in early middle age, sometimes in blackface, who has suffered an irreversible loss.” Albert Camus’ classic existential essay *The Myth of Sisyphus* is an attempt to understand humankind’s place in an absurd world. Both texts deal extensively with the theme of identification, the act seeing oneself as another, or part of a greater whole. Berryman sees identification with others as a form of “autotherapy,” a way to come to terms with loss.

Camus looks at man’s inability to identify with any part of the outside world, and later presents “the actor” as an archetype of his absurd hero, a person who makes a living through identification on the stage. Reading each text in the light of the other, we can come to a greater understanding of the process of identification and self-understanding.

Was Euripides a Slanderer of Women? An Examination of Euripides' Manipulation of the Helen and Iphigenia Myths

Jennifer Ice

Dr. Clifton Kreps, *Faculty Mentor*

Not only in his *Lysistrata*, but in other comedies as well, Aristophanes included among his characters his literary contemporary Euripides, almost always presenting him as a chauvinistic slanderer of women. There can be little doubt as to why Aristophanes would present Euripides in such a manner and why some scholars have dubbed Euripides a misogynist; the plays of Euripides are full of slanderous remarks regarding women and their purpose in Greek society. Euripides alone provides the reader with justification to condemn him as a hateful slanderer of women. Euripides, however, does not provide the reader with a consistent portrayal of women or any one woman; rather, he provides the reader with devilish and murderous women like Medea, but he also provides heroic, brave, and sympathetically portrayed women including Iphigenia and Helen. Euripides' Helen and Iphigenia are two of the most heroic characters of ancient literature, surpassing even the noted heroism of Achilles and Menelaus; the presence of such heroism and a positive portrayal of women are obstacles in convicting Euripides of Aristophanes' charge of misogyny.

Reading As A Process Without Bound, Accessibility, or Goal

Benjamin Braun

Dr. Dennis Leavens, *Faculty Mentor*

"Poetry is no less mysterious than the other elements of the orb. A lucky line here and there should not make us think any higher of ourselves, for such lines are the gift of Chance or the Spirit; only the errors are our own." – J.L. Borges

While reading Borges' "A Biography Of Tadeo Isidoro Cruz (1829-1874)" and Joyce's *Finnegans Wake*, we are pressed to ask how to deal with words as objects which transcend our own experience, defying capture or explanation, and ultimately dominating us; to do this, we view reading as a process without bound or limit, accessibility, or goal. Through a look at these works and literary criticism regarding Borges by Bell-Villada, we explore these ideas as well as the inherent intertextuality of our words.

Positing a Stance on the Relative Value of a Fictive Reality

Shawn Gilmore

Dr. Dennis Leavens, *Faculty Mentor*

In Jorge Borges' short story "The Aleph," *Uqbar, Orbis Tertius*, a carefully constructed reality is presented, first as fiction, then as a force that overwhelms the narrator's reality. This paper looks at the Schopenhauerian influence on Borges, the nature of encyclopedias and mirrors (two of Borges' favorite objects), and the power of memory towards an illumination of the subjective and collective nature of reality.

The Semiotic Structure of Joycean Intertexts

Sarah Dennis

Dr. Dennis Leavens, *Faculty Mentor*

Ulysses provides its reader with the extraordinary opportunity to glance simultaneously backward and forward on the breadth of the English language. By fusing copious instances of allusion, parody, and mythology within a structure radically departed from its forerunners, the text compiles a unique canon while predicating much of twentieth century literature through a nascent Joycean language. This paper focuses on the intertextual structure of *Ulysses* through an exploration of its relation to semiotics, primarily through the scholarship of Thomas Aquinas, Charles Sanders Peirce and Umberto Eco. This approach offers an understanding of Joyce's form as historical, contextual, and even ahistorical, differentiating through its readers, yet ultimately understood in terms of a communal consciousness.

Interspecies Communication

Jenny Fields* and Megan Taylor

Nancy Majewski, *Faculty Mentor*

Interspecies communication is an emerging field of study. There have been many recent publications exploring communication with animals. Thirty pet owners (25% response rate) were surveyed to gain their opinions on pet communication. The responses included testimony to instances of interspecies communication. Three pets were observed in their natural habitat to gain a greater understanding of specific communication events that may be typical of most domesticated animals. Research proved that a majority of pet owners feel that they communicate with their animals and vice versa. This, added with scholarly research, shows that interspecies communication is possible and common.

"Sex has Consequences:" A Rhetorical Analysis

Robert Layne II

Dr. Kevin Minch, *Faculty Mentor*

Teen pregnancy rates in the United States are the highest when compared to industrialized nations. More than a million teen pregnancies occur in the United States each year. To combat this problem, the National Campaign to Prevent Teen Pregnancy has created a new campaign effort to help prevent these pregnancies. The presenter analyzes the rhetoric of the National Campaign to Prevent Teen Pregnancy's new public service announcements. By applying Erica Austin's "General Principles for Targeting Children and Adolescents" to the artifact, the speaker will take a critical look at the implications drawn from this analysis and the campaign's rhetoric.

"Actions That a Man Might Play:" Hamlet and Revenge Drama

David Yost

Dr. Arnold Preussner, *Faculty Mentor*

Throughout *Hamlet*, we see a man obsessed with revenge drama: a prince who counts a troupe of actors among his best friends, who can quote the tragedies of his day by heart, and whose every word is an unconscious mimicking of these tragedies. This obsession leads Hamlet to shape a revenge drama of his own, with the predictably tragic results. In my presentation, I plan to demonstrate the depth of Hamlet's attraction to revenge drama, outlining the genre's critical features along the way. I will particularly focus on the nature of Hamlet's relationship with the players, which must be carefully reconstructed from the few hints Shakespeare gives us. To conclude, I will summarize the impact of Hamlet's interest on his "real-life" behavior in the world of the play.

Maghrebins Residing in Paris: A Portrait of Social Turmoil

Rachel Beckett

Dr. Gregg Siewert, *Faculty Mentor*

While living in France last spring, I witnessed a great deal of social unrest stemming from the large Maghreb population (immigrants from the former French territories in North Africa) that crowds into the ghettos of French cities. This population was not automatically integrated into the French social structure upon arrival in the country, and although many Maghrebins have lived in France for several generations, to a great extent they are still not integrated. Social turbulence abounds, particularly in France's capital. Paris has many quali-

ties, but it is not necessarily tolerant or accommodating, as seen in this portrait of a Parisian sub-culture. I will explore this issue first with a historical perspective, then look at some of the religious and cultural reasons for the dislike of these peoples by the French, and finally I will suggest some possibilities for future improvement in the social situation in France.

Right of Privacy v. Right of Newsgathering

Kim Tempel
Dr. Karon Speckman, *Faculty Mentor*

The line between the First Amendment freedom of speech and the Fourth Amendment right of people to be secure in their home has become blurred. By examining the cases of *Dietemann v. Time, Inc.*, *Baugh v. CBS, Inc.*, *Shulman v. Group W Productions*, *Wilson v. Layne*, and *Wolfson v. Lewis*, the researcher concluded privacy rights are indeed more integral to a free society than rights of the public to know. With the rapid expansion of technological newsgathering tools, the public's hunger for reality television, and the advancement of broadcast technology, people have become dissatisfied with the protection of their privacy rights, especially in cases of intrusion. Privacy rights in intrusion cases need to be more defined, and the researcher suggests a model such as the California anti-paparazzi law.

Freedom of Speech In Protests Against Abortion Clinics

Jeffrey Mersman
Dr. Karon Speckman, *Faculty Mentor*

Abortion has become a hotly debated issue in the 21st Century. As people fight to protect either the right to have an abortion or the right to protect the unborn child, the difference between what is verbal expression versus verbal assault becomes blurry. This study examines how U.S. courts are protecting freedom of expression while ensuring the safety of people choosing to have an abortion. Protests of an emotional nature can become violent and threatening. With this in mind, U.S. courts tend to favor the safety of those who wish to have an abortion over the rights of abortion protestors to express their viewpoint. Therefore, U.S. justices have decided that the Constitution favors physical protection over protection of speech and expression in this circumstance.

First Amendment Restrictions on the Arts

Rebecca Jaycox
Dr. Karon Speckman, *Faculty Mentor*

Art portrays not only beauty but also ugly reality in the form of political speech. The arts have recently come under attack with the "decency and respect" clause that the National Endowment for the Arts is advised to consider when giving grants to artists. This study examines how the "decency and respect" clause threatens the diversity of the arts and produces a chilling effect on the arts and the marketplace of ideas. This clause violates the artist's First Amendment rights, and the government is not keeping the criteria content neutral.

Communication Through the Blues: A Facet of African-American Literary Theory

Benjamin Ryan
Al Weitz, *Faculty Mentor*

For hundreds of years, African-Americans have been oppressed and downtrodden. Unfortunately, they have had to overcome restraints that society has put on them. The brutal and inhumane conditions of slavery may have seemed to make it unlikely that any form of artistic expression could develop. However, slavery and oppression have fostered a way of communication known as the blues, which are a musical expression of a person's inner desires and feelings.

Gendered Writing Expectations

Emily Fiftal
Mary Lou Woehlk, *Faculty Mentor*

Gendered writing is the widespread belief that men and women write about different subjects, take different slants on writing topics, and write using different styles. Students may be treated differently based on such expectations; in academia, women writers are often thought to be more competent, and writing that exhibits "feminine style" is often preferred by academic readers. Feminine writing is thought to be more emotional, personal, subtle, detailed, and polished than the work of males. Writing samples by former Writing Consultants from Truman's Writing Center were analyzed to determine what gender differences exist in students' own works. Writing Consultants were surveyed about their own opinions concerning gendered writing, and they were asked to evaluate "typical" pieces of male and female writing. The concept of gendered writing was supported by the analyses of writing samples, and those surveyed indeed held predictable stereotypes regarding writing differences between men and women.

Math & Computer Science

Tornado Codes as an Efficient Erasure Code

Eric Norige
Dr. Michael Adams, *Faculty Mentor*

Tornado codes are examples of a new class of erasure codes that have applications in transmitting data over the Internet. Information is sent over the Internet in packets, small chunks of data, some of which get lost in transit. Tornado codes protect against this by generating a small number of specially constructed blocks, combining information from several packets. The inventors of tornado codes describe a general erasure code structure and then demonstrate a construction that is good for recovering messages. We implemented the general structure of this class of codes and used several constructions, including that of the inventors. We will compare the several constructions, and give graph theoretic and linear algebraic interpretations of how the system works.

Neural Networks: A New Approach to AI

Sarah Martin
Dr. Ruthie Dare-Halma, *Faculty Mentor*

The field of artificial intelligence has experienced renewed interest during the past two decades as a research area. Neural networks take a different approach to achieving artificial intelligence from traditional approaches. While neural networks have existed since the middle of the century, they have recently experienced an explosion of further research into their capabilities. This study investigates how neural networks are made and function, as well as their applicable uses today. A significant portion of the research involved creating a neural network simulator as a means of further investigating how neural network simulators function. A commercially available software simulator, Predict, was utilized to construct and investigate the computational power of neural networks using real life data sets. Using Predict, the neural networks achieved a 96-98% accuracy in predicting outcomes using the provided data sets. The Predict simulator results will be discussed.

Change of Variable Formulas for Multiple Integrals

Greg Knese
Dr. Eric Howard, *Faculty Mentor*

Most students in Calculus I and II would recognize the simplest change of variable formula as the "u-substitution" formula for integration. As students in Calculus III would know, the idea of the "u-substitution" can be extended to two and even three dimensions with the use of Jacobian functions, line integrals, and surface integrals. However, undergraduate students do not traditionally learn the general change of variable formula for multiple integrals of any dimension. This talk will present the general change of variable formula for multiple integrals at a level accessible to students who have had Calculus III and Linear Algebra. In addition, this talk will also present an interesting generalization of the Pythagorean Theorem related to the general change of variable formula.

The Slice and Anti-slice Groups of Rubik's Cube

Sandra Tenbrink
Dr. Tony Vazzana, *Faculty Mentor*

A permutation is a rearrangement of any set of elements. The different conditions of a scrambled Rubik's Cube can be considered permutations of the smaller cubes. A collection of such permutations forms the structure of a group. It is then possible to study the mathematics of the groups that are generated by the possible moves on Rubik's Cube. The Slice and Anti-slice groups are those generated by certain types of moves on the cube. By investigating the mathematical structure of these two groups, a solution can be reached by simply identifying the permutation of the smaller cubes and applying the appropriate moves to correct it.

Science

Functionalization of Porphyrins

Brad Comstock
Dr. Dawood Afazal, *Faculty Mentor*

Porphyrins are a naturally occurring molecule found in cytochrome P450 and Hemoglobin. Other functions include uses in Photo Dynamic Therapy in cancer patients, catalysis (especially with Magnesium, Iron, and Palladium), biomimetic models of several enzymes, and model systems for the photochemical reaction. We are exploring the chemistry of several metalloporphyrin molecules such as Copper and Zinc. We are also functionalizing the metalloporphyrins in the Beta-Position with nitro and chlorine groups using a modified literature method. These compounds are characterized by ^1H -NMR and UV-VIS spectroscopy.

Equine Education Web Site

Jennifer Crow
Dr. Charlie Apter, *Faculty Mentor*

The Agriculture Discipline has, for several years, been developing extensive online resources, which include photos, syllabi, faculty information, and agriculture resources (<http://www2.truman.edu/agriculture>). One set of pages that is not developed fully is the Equine Education Page (<http://www2.truman.edu/educate>), which will include photos, links, lecture notes, and other information which may help attract equine enthusiasts to Truman and to help provide course resources for students who are already a part of the program. Web design and use is an integral part of our education and our future.

Expression, Purification, and Crystallization of a Single-Stranded DNA Binding Antibody Fragment

Season Prewitt*, Jonathan Schuermann, and Susan Deutscher
Dr. John Tanner (University of Missouri-Columbia) and Dr. Russell Baughman, *Faculty Mentors*

DNA recognition and binding of antibodies to DNA proceeds via a mechanism about which relatively little is known. Gaining an understanding of anti-DNA antibodies is an important topic of study because these types of interactions have been implicated in autoimmune disease and serve as a model for protein-DNA recognition. Since the summer of 1999, the mass production of an *E. coli* strain that contains an antigen-binding fragment

(Fab) known as DNA-1 has been optimized as well as the purification of this Fab engineered with a histidine tag. Over the past year, the crystal structure of DNA-1 complexed with dT5 has been determined to a resolution of 2.1Å. To better understand the binding mechanism and interaction of the Fab with DNA, crystallization experiments using oligothymidine of different lengths and other short chain oligonucleotides have been performed. This presentation provides the protein expression, purification, and crystallization results for the Fab complexed with oligothymidine.

The Sequencing of a Portion of the $\gamma 1$ Gene in Sorghum and Comparison to Maize

Kim Cressman, Elizabeth Hahn, Katie Krueger, and Stacey Leonatti
Dr. Brent Buckner, *Faculty Mentor*

The $\gamma 1$ gene encodes phytoene synthase, an enzyme essential for the synthesis of carotenoids such as beta-carotene. We have cloned and sequenced a portion of the $\gamma 1$ gene of sorghum, a close relative of maize, and compared the sequences. The gene of interest was amplified using the polymerase chain reaction and cloned into a plasmid. This recombinant DNA was isolated and sequenced. Our studies reveal that the exons of the sorghum gene were nearly identical to the corresponding maize exons, while the introns showed a higher degree of variability. Previous studies have demonstrated that at the level of gene organization the agriculturally important grass genomes are highly conserved. Our study contributes to the ongoing effort to compare selected portions of these genomes at the gene sequence level. This research was conducted by students in Dr. Brent Buckner's Spring 2000 Genetics Class.

Sequence Analysis of the $\gamma 1$ Gene Promoter from Maize and Teosinte

Joanne Grayson and Angela Ingraham
Dr. Brent Buckner, *Faculty Mentor*

The $\gamma 1$ gene of maize codes for phytoene synthase, an enzyme involved in carotenoid biosynthesis. There are two standard $\gamma 1$ alleles. Our laboratory previously demonstrated that the promoter of the dominant allele contains two transposable elements, *INS2* and *Stowaway*, and a retrotransposon, Tekay, while the recessive allele possesses only *Stowaway*. We hypothesized that the recessive allele is the progenitor allele and that the transposable elements disrupted the original $\gamma 1$ promoter,

modifying its expression without disrupting the protein's normal function. Thus, teosinte, the ancestor of maize, would be expected to contain the progenitor allele of *y1*. We performed PCR to amplify the *y1* promoter region of teosinte. Sequencing revealed that *Stowaway* was present in two different accessions of teosinte and *INS2* was absent in all teosinte analyzed. Thus, these findings are consistent with our hypothesis that the dominant *y1* allele arose from the recessive allele.

Prevalence of Insertions and Deletions in the Genes of Maize

Laura Mayberry and Caroline Murphy
Dr. Brent Buckner, *Faculty Mentor*

Small allele-specific DNA insertions and deletions (Indels) are thought to be common in maize. A type of allele-specific DNA marker, known as an Indel marker, can be designed for genes of maize by selecting Polymerase Chain Reaction (PCR) primers in which one primer of the pair hybridizes to an allele-specific insertion. To develop Indel markers in a high-throughput manner, it would be useful to know in which gene region (5' UTR, exon, intron, or 3' UTR) indels are most frequently found. Using PCR and sequence analyses, we compared variation in the presence of indels between different gene regions for alleles of several genes within the inbred lines B73 and MO17. Our data suggest that indels are not as prevalent between these two lines of maize as was previously assumed.

The Influence of Light Cycling on the Spatial Expression Pattern of the *Camouflage 1* Gene of Maize.

Kerry Massman
Dr. Brent Buckner, *Faculty Mentor*

Mutants of the *camouflage 1* locus of maize exhibit a zebra banding pattern of yellow-green and necrotic tissue on the leaf. When *cf1* mutant plants are grown in continuous light they do not exhibit the *cf1* phenotype. When these plants are returned to light/dark cycling the zebra banding phenotype develops on leaf tissue that was grown in continuous light. Thus, the light/dark cycling does not appear to establish the spatial expression pattern of this gene. We hypothesized that if the *cf1* gene expression is regulated by a circadian rhythm we should be able to reset this rhythm by growing plants in a 2 hour light/dark cycle. The 2 hour light/dark cycle did result in a more frequent banding pattern. However, when these plants were placed in

continuous light and then given one dark cycle, they exhibited the standard *cf1* banding phenotype. Thus, we did not see any evidence of resetting a circadian rhythm.

A Comparison of Fly Visitation Among *Epichloe* Fungi and Consequences For Fungal Reproduction

Thomas Peck
Dr. Thomas Bultman, *Faculty Mentor*

Botanophila flies are "pollinating-parasites" of *Epichloe* fungi; adult flies fertilize the fungus through the transfer of fungal spores while fly larvae feed on products of fungal fertilization. This interaction is unusual in that insects act as "pollinators" of a fungus. *Epichloe* fungi infect several species of grasses. To further our understanding of this unusual interaction the number of fly eggs and reproductive output of five *Epichloe* species infecting six host species in a common garden setting in Zurich, Switzerland, were assessed. *Epichloe typhina* infecting *Dactylis* attracted the most fly eggs ($F_{5,159}=16.2$; $p<0.001$). Across all *Epichloe* species larger stromata attracted more eggs ($R^2=0.35$; $p<0.001$) and *E. typhina* on *Dactylis* produced the largest fruiting bodies. *E. typhina* infecting *Dactylis* also had the highest reproductive output, while *Epichloe bromicola* was intermediate and the remaining 5 *Epichloe* species had lower reproductive output ($F_{5,165}=26.5$; $p<0.001$). The results suggest that reproductive fitness differs among *Epichloe* species in a common garden setting.

Effect of Fungal Endophyte Infection on Resistance and Tolerance to Herbivory of Tall Fescue

Wendy Martin
Dr. Tom Bultman, *Faculty Mentor*

Tall fescue grass infected with its endophytic fungus (*Neotyphodium coenophialum*) produces loline alkaloids. I tested if the fungus mediates wound-induced resistance to insects in their host species by applying aphids (*Rhopalosiphum padi*) to previously damaged (by clipping) and undamaged plants of both infected and uninfected tall fescue. Aphids had higher reproduction on uninfected compared to infected tall fescue (mean aphids \pm SE=21.8 \pm 4.3; 0.5 \pm 0.2, respectively; $F_{1,60}=53.4$, $p<0.001$). I also found the treatments of infection status and damage interacted ($F_{1,60}=4.8$, $p<0.05$) such that aphid reproduction was enhanced by damage on uninfected plants, but reduced by damage on infected plants. Damaged plants that were

allowed to re-grow over a two-week period showed faster growth rates among uninfected compared to infected plants ($T=-4.18$, $df=34$, $p<0.001$). This provides evidence of a tradeoff between resistance and tolerance that is modulated by endophytes.

Current Holdings of the Truman State Mammal Collection: Where Do We Go From Here?

Nathan Harman
Dr. Scott Burt, *Faculty Mentor*

A major factor in determining man's affect on nature is understanding what impacts we have on biodiversity. Through the establishment of museum collections greater insight into the diversity of animal life has been achieved. By creating a database established from the museum collection at Truman State, my goal was to assess the extent that the Truman collection represents the mammal fauna in Missouri. Another goal is pinpointing areas in Missouri that are under represented in the collection. I will report on the holdings of the collection, including a summary of representative orders, families, genera, and species. My future goals include obtaining mammal collection data from other institutions gathered in Missouri. Such data will indicate what areas need more extensive study. This preliminary investigation will guide future collection activities, with the ultimate goal of creating a collection that accurately represents Missouri mammals and is readily available to the academic community.

Development of a Core Subset of Chilean Maize (*Zea mays L.*) Populations by Near Infrared Transmittance Spectroscopy

Jessica Talbert and Tyler Stevens
Dr. Mark Campbell, *Faculty Mentor*

Plant-genetic resources, currently maintained by the U.S. National Plant Germplasm System, are an important source of genes for improving yield, pest resistance and grain quality. Since collections are often large, core subsets are used when screening for traits in order to minimize redundancy. Core subsets have previously been developed by multivariate analysis using morphological data. Our objective has been to develop a core subset of maize (*Zea mays L.*) germplasm based on near infrared spectra of grain so that the subset will display a maximum amount of diversity with regard to grain composition. Using near-infrared spectra of 309 Chilean maize accessions, we have attempted to identify several distinct groupings. These

groupings were compared to racial classifications, region and grain texture category. A procedure for developing a core subset using this data will be discussed.

Evaluation of Experimental Corn Lines Possessing Exotic Germplasm for Starch Amylose

Heather Yaeger
Dr. Mark Campbell, *Faculty Mentor*

The objective of our corn breeding work was to examine exotic germplasm together with the recessive amylose-extender (ae) allele in order to identify high starch amylose levels (>65%). The materials included GEM (Germplasm Enhancement of Maize project) crosses, LAMP (Latin American Maize Project) populations and various plant introductions. Seed resulting from crosses with OH43ae x H99ae was planted to produce F1 ears segregating mutant ae kernels. Mutant kernels were advanced to produce F2 ears homozygous for ae and 50% exotic. For GEM crosses, F4 plants obtained in 2000 from the pedigrees GUAT209:S13 x (Oh43ae x H99ae) and CUBA110:N1711 x (Oh43ae x H99ae) had many ears exceeding 70% amylose. In addition, plant introductions including Zia Pueblo NRC 5357 and Cochiti Pueblo NRC 5298 had ear samples above 70%. At least two sources from LAMP appeared to show promising amylose levels (65-68%) including CHZM 04 11 x (Oh43ae x H99ae) and CHZM 05 001 x (Oh43ae x H99ae).

Pollination and Seed Dispersal in Bird's-Foot Violet

Sarah Morehouse
Dr. Steve Carroll, *Faculty Mentor*

Viola pedata is a spring wildflower common along forest edges. Populations include two flower-color types. In one, all five petals are lavender, while in the other, two petals are lavender and three petals are dark violet. Individual butterflies, which are the primary pollinators of this violet, were followed to determine if time spent on flowers was affected by the color of the previously-visited flower. In addition, seeds produced by each flower-color type were placed in pairs on the ground to determine if seeds of one flower-color type were collected by ants more quickly than the other type, since this has implications for seed dispersal and seedling establishment. Time spent on flowers was not significantly affected by the color of the previously-visited flower. Ants favored seeds from lavender flowers over those from bicolored flowers ($p < 0.01$). This preference may help explain the maintenance of lavender-flowered plants in populations.

The Effect of Male Flower Age on Seed Fitness and Number in *Silene latifolia*

Kristen Riebeling and Angela Walker
Dr. Steven Carroll, *Faculty Mentor*

How long individual flowers last should be determined, in part, by the number and reproductive success of offspring produced by flowers of different ages. We analyzed male reproductive success by comparing number, mass, and germination of seeds sired by one- and two-day-old male flowers of *Silene latifolia*, a widespread weed. Male flower age had a significant effect on seed mass ($P=0.012$), resulting in heavier seeds from two-day-old flowers. Male flower age did not have a significant effect on time to germination ($P=0.33$), percent germination ($P=0.88$), or seed number ($P=0.20$). If larger seeds produce more fit seedlings, then all other things being equal, natural selection should be expected to favor two-day-old male flowers.

Tracking an Ephemeral Population of *Viola pedata*

Jasen Matyas
Dr. Steve Carroll, *Faculty Mentor*

Viola pedata (bird's-foot violet) is a spring wildflower found in prairie edges and open woodlands throughout the eastern U.S. Populations generally include two flower-color varieties, one in which all five petals are lavender in color and one in which the upper two petals are dark violet and the lower three petals are lavender. An ephemeral population of *V. pedata* located in a forest canopy gap in Big Creek Conservation Area was censused from 1994 to 2000. The adult population declined 61% during this time. Of the original 286 plants present in 1994, only 67 (26%) remained in 2000. This suggests that the population is likely to disappear in the near future.

The Quantitative Separation of Benzodiazepines by Capillary Electrophoresis

Deanna Jackson
Dr. Dana Delaware, *Faculty Mentor*

Benzodiazepines are a class of drugs that are being seen more frequently in crime labs because of their cause of traffic accidents and their use by perpetrators to incapacitate their victims. Capillary Electrophoresis is a fast, economical, and a high-resolution technique for the separation of water-soluble compounds from small amounts of solvent. This instrument can differentiate between very similar components with greater separation

efficiencies than HPLC. A 5-15 % methanol phosphate- borate buffer of pH 8.5 was used with instrument conditions of 25°C and 200nm wavelength. The elution time of two drugs, nitrazepam and alprazolam, is determined and a calibration curve developed. A blind mixture of the two drugs is analyzed and the concentration of each determined from the calibration curve. Results will be discussed.

Development of a Biochemistry Experiment Procedure for Vitamin Detection and Separation Through Capillary Electrophoresis

Christine Gould
Dr. Dana Delaware, *Faculty Mentor*

Capillary electrophoresis has become popular as a separations technique that is centered upon the principle that analyte ions will migrate at different rates under the influence of an electric field. Capillary electrophoresis has the advantages of high-speed, high-resolution separations using very small volumes (typically in the nL range). The goal of this project is to develop an experimental procedure that can be implemented in the biochemistry course. Five vitamins were analyzed: thiamine, nicotinamide, pantothenic acid, pyridoxine, and ascorbic acid. These vitamins were separated in a mixture. To identify peaks, standard amounts of the individual vitamin were added. A calibration curve is being developed for the mixture. Using these techniques, samples from food sources will be analyzed in order to detect and quantify the specific vitamins.

Active Water Uptake in the Cat Flea, *Ctenocephalides felis* (*Siphonaptera*)

Tara Thiemann
Dr. Laura Fielden, *Faculty Mentor*

Various groups of arthropods have developed mechanisms for active uptake of water vapor from unsaturated air in order to counteract water loss due to excretion and cuticular transpiration. In fleas, active uptake has been demonstrated in the larval, prepupal, and pupal stages of rat fleas (genus *Xenopsylla*) and hen fleas (*Ceratophyllus*). In this study, active uptake is demonstrated in these stages of the cat flea, *Ctenocephalides felis*, for the first time. To determine critical equilibrium humidity (CEH), the lowest relative humidity where water uptake can occur, pre-desiccated fleas were weighed and placed in a series of humidity regimes ranging from 47% to 93% RH. The lowest relative humidity where no

mass change occurred indicated that water loss was equal to water gain. This humidity was designated as the CEH. Results show that active uptake can occur in larval stages at relative humidities above 59%.

The Use of Computational Chemistry to Model ABA-Binding Requirements

Kendra Morris
Dr. Ken Fountain and Dr. Dan Hite,
Faculty Mentors

The plant hormone abscisic acid (ABA) mediates stress-induced responses when water availability is limited (e.g. drought, temperature extremes, and salinity stress). Abscisic acid mediates rapid stomatal closure, which limits further water loss. Over a longer period, ABA causes changes in gene expression that enhance water-stress tolerance. These different responses may be mediated through different ABA receptor proteins. Generally, hormones transmit signals by binding to receptors. Because normal biochemical procedures have not been successful in identifying ABA receptors, ABA analogs have been employed to determine receptor-binding requirements. Using *HyperChem*, a computational chemistry program, twenty-two analogs of known biological activity were modeled, both in gas phase and in water cages, and their lowest energy configurations were determined. Structural comparisons were made between ABA and ABA analogs in an attempt to identify structural trends that correlate with differences in biological activity. Structure/function comparisons between ABA and ABA analogs will be discussed.

Ionic Liquids Made From Mixtures of FeCl₂ or FeCl₃ and BMIC

Melissa Sitze
Dr. Griff Freeman and Dr. Eric Patterson,
Faculty Mentors

Ionic liquids were made from mixtures of iron(II) chloride and 1-butyl-3-methylimidazolium chloride (BMIC), or iron(III) chloride and BMIC. Mixtures of FeCl₂ and BMIC were found to make stable liquids at room temperature in a range of 1FeCl₂: 3BMIC to 1FeCl₂: 1BMIC. At an excess of FeCl₂, the major iron species is FeCl₄²⁻. Mixtures of FeCl₃ and BMIC were found to make stable liquids at room temperature in a range of 1FeCl₃: 1.9BMIC to 1.7FeCl₃: 1BMIC. At an excess of FeCl₃, the major iron species is Fe₂Cl₇⁻, and the ionic liquid has Lewis acidic character. At an excess of BMIC, the major

iron species is FeCl₄⁻, and the ionic liquid has Lewis basic character. The ionic liquids were characterized by Raman scattering. Secondary studies were done on mixtures of FeCl₂, FeCl₃, and BMIC.

Synthesis of Octadecanethiol Coated Silver Nanoparticles By a Two Phase Method

Jennifer Nieweg
Dr. Griff Freeman, *Faculty Mentor*

The goal of this synthesis was to obtain octadecanethiol coated Ag nanoparticles of a uniform diameter surpassing 20nm. The ultimate goal after synthesis is to characterize the particles using Surface Enhanced Raman Scattering. A two-phase synthesis scheme, based on experiments previously carried out with Au nanoparticles, was utilized. AgNO₃ provided the silver source, tetraoctylammonium bromide (TOAB) the transfer reagent, and NaBH₄ the reducing agent. For each synthesis trial, the amounts of AgNO₃, TOAB, thiol, and NaBH₄ used were varied so as to find the combination that produced nanoparticles with the largest diameter, and in the highest yield. The organic layer, potentially containing the octadecanethiol coated Ag nanoparticles, was reduced in volume by rotavaporation and then cooled in a dry ice-acetone bath. Characterization proceeded after sufficient cooling, rinsing, and filtering. Analysis of ¹H and ¹³C NMR spectra, which exhibited characteristics that differed from free thiol, verified that the nanoparticles were indeed synthesized.

Laser Cooling and Trapping of Rubidium

Adam Bauer, Danielle Camarota,
Lucas Ward, Nicole Jones, and Todd Lansford
Dr. Michael Goggin, *Faculty Mentor*

Laser cooling and trapping consists of Doppler cooling and magneto-optical trapping. Cooling exploits the Doppler Effect by making atomic absorption of photons velocity dependent. The recoil when momentum is transferred to the atoms from the photon produces a damping effect. Utilizing the magnetic properties of the atoms and the polarization of the laser beams, the atoms are spatially confined to the trapping region by an inhomogeneous magnetic field. Currently we are establishing the correct magnetic field gradient, constructing the laser system, and aligning the optics to center six laser beams on one point inside the trap. Ultimately we plan on trapping rubidium atoms in the magneto-optical trap.

Sleeping Patterns and Sleep-Site Fidelity of *Anolis gingivinus* on Anguilla

Justin Shew
Dr. Peter Goldman, *Faculty Mentor*

Sleeping behavior and sleep-site fidelity of an anoline lizard (*Anolis gingivinus*) were studied in three ecologically distinct habitats on the north coast of Anguilla. Sleep-site has been proposed to be the safest area of an animal's home-range. Perch height, distance from perch center, perch diameter, and body orientation were recorded for all sightings. We captured and marked first sighted anoles for later recognition. Qualitative observations reveal anoles demonstrate sleep-site fidelity; we found one male sleeping in the same bush for at least six consecutive nights. Significant differences in sleep-site characteristics were found between sites. These differences are attributed to the structurally distinct vegetation that dominated each site. A comparison between male and female sleeping characteristics produced no significant differences, suggesting sex and sleep site preferences were unrelated. We also saw a positive correlation between perch sleep height and snout-vent-length.

Effects on Viability and Germinability of *Sporobolus cryptandrus*

Sarah Hayes
Dr. Jose Herrera, *Faculty Mentor*

Seeds of the grass, *Sporobolus cryptandrus*, may be moved among den chambers of differing depths and relative humidities by the kangaroo rat *Dipodomys spectabilis* to decrease the seeds' viability and germinability. Capsules of seeds were placed on the soil or at 0.25m or 0.75m within the den. Viability was tested using a tetrazolium chloride assay after 10 and 56 days. Seeds stored within den chambers for 10 and 56 days were significantly less viable than those stored above the soil surface, and this inviability was correlated to water potential. We suspect that *D. spectabilis* competes with *S. cryptandrus* for the energy stored in the endosperm and so may benefit by killing the seeds' embryo. Our study demonstrates that this benefit is achieved by varying storage depth and relative humidity, possibly to cultivate fungal pathogens that infect and kill seeds at high relative humidities.

Effects of Fire on Culturable Bacterial Populations on the Phyllosphere and Sub-Surface Soil of *Andropogon Gerardii*

Tina Bishop and Caren DeGiacinto
Dr. Jose Herrera, *Faculty Mentor*

We evaluate the effects of fire on numbers of culturable bacteria existing on and near the prairie grass, *Andropogon gerardii*. We expected a significant difference between numbers of bacterial cells in leaf and soil samples taken from burned and unburned transects of *A. gerardii*. Samples were diluted and plated on tryptic-soy, cornmeal, nutrient, and potato dextrose agar. Colony forming units (CFU's) in leaf and soil samples were compared using a Mann-Whitney U test and a Wilcoxon test, respectively. Our data suggest leaves in burned areas have consistently fewer CFU's than those in unburned areas. Conversely, data from soil samples suggest that burned areas contain more bacteria than unburned areas. However, because the numbers of bacteria in our samples exhibit a large amount of variance, our study does not yield consistent significant differences. Our study suggests that fire affects the number of microbes and their community structure, particularly on those populations existing on and near *A. gerardii*.

Determination of Physiological Adaptation Against the Mycotoxins Sterigmatocystin and Aflatoxin B1 in Three Rodent Species

Walter Coats
Dr. Jose Herrera, *Faculty Mentor*

Desert rodents physiologically metabolize mycotoxins produced by fungi that infect their food stores. We used the Ames mutagenicity assay to determine how effectively different rodents metabolize two fungal toxins (sterigmatocystin and aflatoxin B1). We used liver homogenate obtained from three rodent species (*Dipodomys spectabilis*, *Neotoma albigula* and *Rattus norvegicus*), to ask whether, and to what extent, these rodents possess a generalized physiological mechanism to circumvent the mutagenic effects of sterigmatocystin and aflatoxin B1. Presently, our results indicate that *Dipodomys spectabilis* (banner-tailed kangaroo rats) are especially effective at physiologically circumventing the mutagenic effects of both aflatoxin B1 and sterigmatocystin. These findings suggest that banner-tailed kangaroo rats have adapted a generalized physiological mechanism against a broad range of fungal toxin.

Effect of Protein Concentration on Ames Test Mutation Rates

Sofia E. Taboada
Dr. Jose Herrera, *Faculty Mentor*

Aflatoxin B1 is a mutagenic mycotoxin known to contaminate animal and human food stores. Some food storing rodents that consume fungally-infected food and are exposed to aflatoxin B1 appear to have a physiological defense to the mutagenic and cytotoxic effects of aflatoxin. Protein concentration is known to affect the number of mutagenic metabolites produced by aflatoxin. We measured liver protein concentrations using a modified Bradford Protein Assay (Bio-Rad Laboratories) in three rodent species (white laboratory rats, *Rattus norvegicus*; banner-tailed kangaroo rats, *Dipodomys spectabilis*; and white-throated woodrats, *Neotoma albigula*) and compared those concentrations to each rodent's ability to convert aflatoxin B1 to its corresponding toxic metabolites. When compared to white laboratory rats, the same amount of protein in banner-tailed kangaroo rats and woodrats had a lower ability to convert aflatoxin B1 to its corresponding toxic metabolites. Thus indicating an adaptation in kangaroo rat and woodrat metabolism of aflatoxin B1.

Guard-Cell and Superoxide Dismutase Activities Demonstrate a Low Level of Photosynthetic Oxidative Stress in *Vicia faba L.*

Jill Franklin*, Merina Foster and Katie Nielsen
Dr. Daniel Hite, *Faculty Mentor*

Catalase and superoxide dismutase are two antioxidant enzymes common to aerobic organisms. Oxidative stress results from normal aerobic metabolism. In plants, catalase, which is predominantly found in peroxisomes, plays an important role in the photorespiratory cycle, which is active in photosynthetic organs and cell types. Leaf and mesophyll catalase activities were high. Guard-cell catalase activities were approximately ten-fold lower, similar to those of root and stem. Superoxide dismutase is an important antioxidant enzyme found in the cytosol, chloroplasts, and mitochondria. Superoxide dismutase activities and isozyme patterns of guard cells demonstrate that cytosolic superoxide dismutase activities are high, while chloroplastic superoxide dismutase activities are low. Unlike leaf and mesophyll, chloroplastic superoxide dismutase activities of guard cells are only a minor contributor to total superoxide dismutase activity.

Comparison of Guard-Cell Glutathione Reductase and Ascorbate Peroxidase Activities and Isozyme Patterns in the cytosol of *Vicia faba L.*

Merina Foster*, Jill Franklin, and Katie Nielsen
Dr. Daniel Hite, *Faculty Mentor*

Total activities and isozyme patterns of the major antioxidant enzymes ascorbate peroxidase and glutathione reductase were determined in select organs and cell types in *Vicia faba L.* Isozymes of these enzymes are chloroplastic and cytosolic. Reactive oxygen intermediates are byproducts of aerobic metabolism, produced chiefly in chloroplasts, mitochondria and peroxisomes. Antioxidant enzyme activities and isozyme patterns can offer insight regarding activity of different cellular compartments. Photosynthetic mesophyll and leaf showed the highest chloroplastic isozyme activities for glutathione reductase. In contrast, guard-cell glutathione reductase isozyme patterns did not show chloroplastic activities and was most similar to that of roots. The major ascorbate peroxidase isozyme activity for all organs and cell types examined was cytosolic. Total activities of both enzymes were found to be highest in guard cells. Together these findings indicate a high potential for oxidative stress in guard cells that is controlled primarily through cytosolic isozyme activities.

Listening to Love to Determine Environmental Health: Anuran Call Survey at Prince William Forest Park, Virginia

Sara Schoomaker, Carol Pollio, and Jennifer Lee
Dr. Daniel Hite, *Faculty Mentor*

Amphibians have been called "the canary in the coal mine", indicating when environmental damage is occurring. They are believed to be more sensitive to environmental factors than other organisms during their aquatic and terrestrial life cycle and because of their permeable skin. There have been declines in amphibian populations not only in areas heavily populated by humans, but also untouched areas. Understanding these declines is important for the health of all species. Utilizing amphibians as an indicator species can be done only when there is a good understanding of the baseline populations. With the support of the National Park Service and the Student Conservation Association, I was able to help contribute to an anuran call survey this past summer to

establish base-line data on anuran populations at Prince William Forest Park. The research has helped to establish which species are currently breeding in the park and the time and locations of breeding activity.

Salicylic-Acid Signaling in Black Mexican Sweet Maize Cell Culture

Sarah Davenport
Dr. Daniel Hite, *Faculty Mentor*

Chemical recognition of pathogens by plants results in elevated levels of salicylic acid (SA), a plant hormone that signals cells to initiate diverse responses leading to general immunity. The signaling events of this response are currently being elucidated. We investigated cellular signaling events following the initial perception of SA in a monocot system, Black Mexican Sweet maize cell culture. SA induces a transient increase in hydrogen peroxide level, which was determined by assaying the hydrogen-peroxide dependent chemiluminescence of luminol. Calcium chelators, such as EGTA, deplete calcium from cells, and protein-kinase inhibitors, such as staurosporine and K-252a, prevent protein kinases from functioning. EGTA, staurosporine, and K-252a block the SA-induced increase of hydrogen peroxide. The observed hydrogen-peroxide transient increase seems to require calcium. Inhibition by staurosporine, an inhibitor of calcium-dependent protein kinases, indicates that calcium may be required to stimulate protein-kinase-dependent phosphorylation that is required for elevated hydrogen-peroxide production.

Evaluating Genetic Variation in the Locally Rare *Plantago cordata* (Heart-Leaved Plantain) Using a New PCR-Based Technique Called ISSR.

Luke Meyer* and Anne Wood
Dr. Elisabeth Hooper, *Faculty Mentor*

Plantago cordata is a relatively rare plant in Missouri. It is generally confined to southeastern Missouri, but there are disjunct localities in Adair County. It is of concern to conservation biologists because of declining abundance across its range. Our research focused on developing a new (to our lab) PCR-based technique (ISSR) for analyzing genetic variation in plant populations, using *P. cordata* as a test case. This technique aims to find genetic markers in hypervariable regions of the genome. It has been used mainly to identify plant cultivars, but lately it has been applied to studies in population genetics and systematics. We applied ISSR to detect

genetic variation within a local population of *P. cordata* to see if it could detect differences that previous studies could not. Preliminary data indicate there is no genetic variation within the population surveyed.

Assessment of Rubisco Degradation in Response to Wound-Induced Programmed Cell Death in Plants

Danielle Slater and Kim Cressman
Dr. Diane Janick-Buckner, *Faculty Mentor*

The recessive orthologous *lethal leafspot 1* and *dropdead 1* mutants of maize and sorghum, respectively, are unable to suppress programmed cell death (PCD) in response to injury. We took advantage of this characteristic to examine aspects of PCD induced in leaf tissue by either abrasive or puncture wounding. Fragmentation of DNA, a characteristic of PCD, was examined 2 and 20 hours following wounding. DNA fragmentation in wild-type (WT) and mutant plants was evident at 2 hours, however, only mutant plants displayed DNA fragmentation at 20 hours. Previous studies indicate that ribulose biphosphate carboxylase (Rubisco) is degraded during pathogen-induced PCD. We hypothesized that Rubisco may also be degraded during wound-induced PCD and therefore may be used as a marker of PCD in plants. Puncture wounding did not induce Rubisco degradation, whereas abrasive wounding caused Rubisco degradation in both WT and mutant plants. These results indicate that Rubisco is not uniformly degraded during PCD.

Use of Calcium Fluorimetry for Studying Steady-State Calcium Levels in Dystrophic and Nondystrophic Skeletal Muscle

Anton Gueorguiev
Dr. C.G. Carlson (KCOM) and Dr. Diane Janick-Buckner, *Faculty Mentors*

It has been previously reported that dystrophic muscles have elevated steady-state calcium levels. In order to test this, a fluorescent calcium indicator FURA-PE3 was used to measure fluorescence intensity of calcium-FURA complex at excitation wavelengths of 340nm and 380nm. Since FURA's excitation spectrum changes in a predictable way in physiological solutions of different calcium concentrations, steady-state calcium levels may be deduced from the F_{340}/F_{380} ratios. To determine the effect of resting calcium, influx on steady-state calcium levels influx was abolished by addition of EGTA, a calcium

chelator. In most experiments, EGTA reduced the ratio. Replacement of extracellular calcium, after blockade of the SR Ca^{2+} ATP-ase (CPA, 100mM), reversed the effect of EGTA on the ratio. Experiments to determine R_{min} and R_{max} parameters, which will allow us to calculate resting calcium concentrations, are currently underway.

Cultural Evolution In Yellow Warblers

Julie Thien
Dr. Nedra Klein, *Faculty Mentor*

Population changes in bird songs are considered a form of cultural evolution, in which cultural traits being passed down are influenced by processes similar to biological evolution. Memes are units of cultural transmission, and thus the functional equivalent of a gene. The song meme, a syllable, phrase or whole song, can be a useful tool for determining diversity and transmission of learned traits among populations. This memetic approach was used to study different populations of Yellow Warblers from the West Indies and Costa Rica, analyzing sonograms to determine the meme of the populations. All one-, two-, and three-syllable memes were identified in each population. Memetic diversity and meme sharing within and among populations was calculated using similarity indices. Results suggest that the meme being passed from one generation to the next is the individual syllable, with decreased meme sharing as meme length increases.

The Synthesis and Application of Organosulfur Compounds in the Characterization of Polyfunctional Electrode Surfaces

Jennifer Hargrave*, Kristen VonGruben, and Ben Slentz
Dr. Brian Lamp, *Faculty Mentor*

A recent trend in analytical chemistry has been the development of techniques for sensor miniaturization, providing increased flexibility along with portable, rugged instrumentation. Our interest has been focused on polyfunctional electrode surfaces because of their capacity to perform chemistry and detect activity on a single surface. One mechanism we have explored to create polyfunctional surfaces consists of the deposition of gold islands onto glassy carbon. In this work, we synthesized several organic model compounds that will be used to characterize these surfaces. The organic molecules contain an electrochemically active portion, useful for

monitoring reactivity, and sulfur moiety, serving as a tether. The strong interaction between gold and sulfur enabled organosulfur compounds to preferentially bind to the gold islands allowing characterization of the structure and reactivity of the islands using scanning electrochemical microscopy and other surface characterization techniques.

Investigation of the Application of Hydrolyzable Monolayer Films in Surface Design

John Brockman and Karen Stranghoener
Dr. Brian Lamp, *Faculty Mentor*

The ability to modify the reactivity of a surface in localized regions is an important aspect in the design of new sensor systems. In this poster, we describe a method to modify an electrode surface by using the microelectrode tip of the scanning electrochemical microscope (SECM) to produce reagents necessary to drive simple organic reactions for species bound to the electrode. The initial stages of this process involved the synthesis of a long chain alkyl succinimide as a possible precursor compound for this modification. Immobilization of the precursor onto a gold electrode provided a suitable anchor for compounds containing amine functional groups, such as dopamine, that were used to alter the electrochemical properties of the surface. Electrochemically inactive sites were created using a microelectrode to deliver hydroxide to cleave the amide bond and remove electrochemically active functional groups. SECM imaging was then used to characterize the resulting surface.

Antibody Responses in Mice Immunized with Thermally Treated SIV VLPs

Kenneth Martin*
Dr. Michael Lockhart, Dr. Cathy Yao,
and Dr. Richard Compans, *Faculty Mentors*

It is thought that hidden cryptic epitopes in HIV Envelope proteins (Env) will only be exposed during the gp-120-CD4-CCR5 or CXCR4 fusion complex formation and the exposure of these epitopes could lead to production of higher and broader neutralizing antibodies against primary isolates of HIV. We have shown in this study that a simple thermal treatment of SIV virus-like particles (VLPs) was able to induce conformational changes in the Env, potentially exposing critical epitopes. We found that by heating SIV VLPs at 65°C for 5 minutes, it was sufficient to induce a change

in the susceptibility to proteinase K treatment as compared with other lower or higher temperature treatment. When these thermal treated, conformationally changed, and chemically fixed Env VLPs were used in an immunization study in mice, we found that serum antibody responses to SIV Env was similar to the untreated SIV VLP immunization. In all immunization groups, intraperitoneal (ip) immunization induced an Ig response. These results indicate that SIV VLPs are potentially important in SIV/HIV vaccine studies.

Determination of Proline and Hydroxyproline in Blood Serum and Urine Samples Using Laser-Induced Fluorescence High Performance Capillary Electrophoresis

Kristen Mertens
Dr. Yinfa Ma, *Faculty Mentor*

A capillary electrophoresis technique has been developed to analyze the hydroxyproline (HYP) and proline (PRO) levels in human serum and urine for diagnosis of bone disease, chronic uremia and severe kidney disease. Elevated levels of urinary and serum HYP and PRO are known to be indicative of metastatic bone diseases, chronic uremia and severe kidney disease. A commercial capillary electrophoresis instrument with a laser-induced fluorescence (LIF) detector is used to separate and detect HYP and PRO in human serum and urine samples. The samples are labeled with fluorescein-5-isothiocyanate (FITC). This molecule labels the sample amino acids with fluorescence, enabling detection. Molecule fluorescence is linearly proportional to concentration, making it possible to quantitatively determine concentration of HYP and PRO in a given solution.

The Effects of Genetically Modified Corn on Lamb Growth and Diet Palatability

Floyd Simpson
Dr. Tom Marshall, *Faculty Mentor*

A 93-day feeding study evaluated whether lamb diets prepared with genetically modified (Bt) corn influenced the growth of lambs as compared to diets prepared with nongenetically modified (control) corn grain. Forty-two lambs were assigned by weight and sex to one of the two diets. Lambs gained 47.6 and 50.8 lb. on the Bt and control diets respectively. No statistically significant differences ($p=0.69$) in gain over the 93-day feeding period were observed between lambs fed diets containing genetically modified corn and

similar diets containing control corn. After the 93-day feeding study, lambs were fasted for 24-hours and then placed in an enclosure containing equal amounts of Bt and control corn. Seventeen lambs chose the Bt corn, 21 lambs chose the control corn and 4 lambs failed to choose. There were no statistically significant ($p=0.47$) differences in preference between Bt and control corn.

Coordination Chemistry of p-Block Metals

Catherine Schmidt
Dr. James McCormick, *Faculty Mentor*

Human activity has increased the amount of lead, bismuth, thallium and other toxic heavy p-block metal ions in the environment. The toxicity of these metals may be due in part to their electronic structures, but the exact mechanism remains unknown. A unique feature of these metal ions is the presence of a lone pair of electrons that is capable of occupying a coordination position and causing the complex to be stereochemically active. These metals often exhibit distorted molecular geometries, making the location of the lone pair electrons difficult to determine. In order to develop a systematic means of locating the lone pair electrons in heavy p-block metals, several complexes of lead and bismuth have been synthesized and characterized by infrared spectroscopy, NMR spectroscopy, and x-ray crystallography. The structures of the different complexes will be presented and discussed, as will a novel compound.

Trace Level Determination of Chromium (VI) Ion in Solution Using Colorimetry in a Sol-Gel Matrix

Heather Frericks
Dr. David McCurdy, *Faculty Mentor*

Chromium, a trace metal contaminant found in water, is routinely measured in drinking water. Though EPA-approved methods of analysis require the determination of total chromium, it would be beneficial to distinguish the concentration of chromium (III), a trace level nutrient, and chromium (VI) which is carcinogenic. Current methods of chromium determination are often sensitive enough to accurately determine total chromium at the ppb level, but cannot distinguish between the two oxidation states. Methods that can distinguish between the forms of chromium are not sensitive enough for environmental measurements. The work presented in this talk will describe our efforts to devise a method for the determination of chromium (VI) that is selective and sufficiently sensitive enough for environ-

mentally important concentrations. In this work, we are attempting to develop a simple colorimetric analysis scheme that "locks" a preconcentration step into a sol-gel matrix, followed by a colorimetric determination for chromium (VI) directly in the sol-gel matrix.

Atomic Spectroscopy with a Digital Micromirror Array Echelle Spectrometer

Joel Miller*, John Hagen*, and Sam Valenti
Dr. David L. McCurdy, *Faculty Mentor*

The SVGA digital micromirror array (DMA) consists of an 800 x 600 array of 16 μ -square micro-mirrors capable of rotating to reflect light either +10° or -10° from the normal to the DMA. These mirrors can be used to reflect light through a desired optical path or away from it. In this presentation the DMA was placed at the focal plane of an Echelle spectrometer and was used to select atomic spectral images and focus them to a single detector. Scans of these images demonstrated flexible and precise selection of atomic emission features from these sources. This presentation will describe the construction, programming, and characterization of the DMA-Echelle spectrometer, including some preliminary data on the analytical performance. Though there are some obstacles in making the DMA a universal tool for atomic emission spectrometry, it may prove to be a low cost alternative to the modern CCD and CID array plasma spectrometers.

Deletion Mapping of a Suppressor Mutation of Segregation Distorter in *Drosophila melanogaster*

Colleen McDaniel *, Rebecca Blue *, Cynthia Khan *, and Susan Kartiko
Dr. Janna McLean, *Faculty Mentor*

Segregation Distorter is a collection of genes that cause unequal transmission of homologous chromosomes. If distortion is complete, only one homologous chromosome is passed to the progeny; if there is no distortion, each chromosome is transmitted equally. A suppressor of distortion has been identified, and deletion mapping has been initiated to isolate the suppressor mutation. This procedure involves crossing flies carrying the suppressor to flies carrying a known deletion of the second chromosome. If the deletion is located in the same area of the chromosome as the suppressor, the lack of a functional gene at that position will result in lethality. If the deletion does not correspond with the position of the suppressor, the chromosomes

will complement each other and viable offspring will be produced. By comparing the location of the deletion and the presence or absence of progeny, we can locate the general position of the suppressor mutation.

Synthesis and Complexation of Two New Turn Molecules to be Utilized in the Synthesis of a Doubly Wound [2]-Catenane

Kevin McWilliams
Dr. John O'Brien, *Faculty Mentor*

With the intention of synthesizing a new doubly wound [2]-catenane, two new turn molecules have been synthesized that are based on 2,2'-bipyridil. The topologies presented by these molecules are subtly different from one another, but crucial for the success of the overall project. One of the turns, when coordinated to a tetrahedral metal center, orients secondary functional groups in the same direction as the ligating atoms. The other turn, when coordinated to a metal center, orients its secondary functional groups in the opposite direction of the ligating atoms. The ligands are characterized via melting point, ¹H and ¹³C NMR spectroscopy, and single crystal X-ray crystallography.

Pollen Development in the Water Lily *Cabomba caroliniana*

Natalie Melrose* and Angela Ingraham
Dr. Jeffrey Osborn, *Faculty Mentor*

The water lily *Cabomba caroliniana* Gray is commonly known as fanwort and occurs throughout North and South America in subtropical to temperate environments. While fanwort enjoys popularity as an aquarium plant, it is also a nuisance, often clogging recreational waterways. Evolutionarily, water lilies are widely regarded to be among the most primitive flowering plants. Although studies of pollen morphology and development provide important data for determining evolutionary relationships, little is known about these reproductive traits in *Cabomba*. The objective of this study was to use electron microscopy to examine pollen development within *Cabomba caroliniana*, focusing specifically on the formation of pollen wall layers. The major developmental stages have been identified, including microspore mother cells, tetrads, free microspores, and mature pollen grains. Pollen at each stage was compared with regard to a number of key characters such as size, surface sculpture, aperture structure, wall ultrastructure, and presence of wall microchannels.

Analysis of Grant Funding of the National Science Foundation's Research in Undergraduate Institutions Program within the Biological Sciences

Rebecca Bohning
Dr. Jeffrey Osborn, *Faculty Mentor*

The National Science Foundation (NSF) is one of the primary federal agencies that provide funding for basic scientific research. To support research in the predominantly undergraduate environment, the NSF funds faculty grants through their *Research in Undergraduate Institutions* (RUI) program. Each fiscal year, the NSF disciplinary directorates publish comprehensive lists of awards, which, however, do not separately categorize RUI grants. The objective of this project was to ascertain the level of RUI funding within the three principal Divisions of the Biological Sciences Directorate (Integrative Biology and Neuroscience, Environmental Biology, and Molecular and Cellular Biosciences). By accessing the NSF's website, divisional awards lists for the three most recently available fiscal years (1997-1999) were obtained for analysis. The RUI parameters evaluated for each division and their disciplinary programs included the total number of grants, number of zero-month supplements, total amount of funding, average grant amount, average grant duration, and the funding range.

An Investigation of the Localization of Presenilin-1, an Alzheimer's Disease Related Protein, at Post Synaptic Densities

Angela Ingraham
Dr. Shula Sarnar, Dr. Spiros Efthimiopoulos, Dr. Nikolaos Robakis (Mount Sinai School of Medicine) and Dr. Jeffrey Osborn (Truman State University), *Faculty Mentors*

Alzheimer's Disease is the most common age-related neurodegenerative disorder. Familial Alzheimer's Disease is primarily caused by Presenilin 1 (PS1) gene mutations. PS1 localizes at epithelial and synaptic cell-cell adhesion sites. Specifically, PS1 binds to E-cadherin in epithelial cell-cell adhesion sites and may bind to N-cadherin in the synapse. Electron microscopical staining indicates that PS1 is concentrated in neuronal post-synaptic densities (PSDs). Our objective was to biochemically establish whether PS1 is located within PSDs. Synaptosomes as well as PSDs

from mouse brain were isolated and analyzed. Our data indicated that the methods for preparing the synaptosomes and PSDs were effective. However, Western Blotting revealed that PS1 was not enriched in the PSDs. PSDs prepared from depolarized synaptosomes also showed de-enrichment of PS1. Therefore, further research is needed to examine the discrepancy between the microscopical and biochemical data to determine the exact location of PS1 at the synapse.

Using Computational Chemistry to Explore the Mechanisms for the Addition of OH and OOH Anions to VX

Ryan Emmett
Dr. Eric Patterson, *Faculty Mentor*

VX is arguably the most deadly of all the nerve toxins known. In bulk, the best method for neutralization of this toxin is incineration. It has also been found that OH⁻ and OOH⁻ anions can be used to neutralize small quantities of VX. When OH⁻ is added, only an 85% yield of the neutralized product is produced, while a 15% yield of another nerve toxin is produced. Yet, when OOH⁻ anion is used as the nucleophile, complete neutralization occurs. Using theoretical chemistry, we have explored the mechanism for these neutralization processes. Quantum chemical calculations have been carried out to explore these mechanisms. It has been found that the toxic product is not formed with the OOH⁻ anion due to thermodynamic considerations though the complete mechanisms remain undiscovered. In addition, we are computationally examining the utility of a copper (II) catalyst, which may efficiently neutralize VX.

A Computational look at the Reductive Dechlorination of Carbon Tetrachloride and Perchloroethene

Doug Knigge
Dr. Eric Patterson, *Faculty Mentor*

Small, polychlorinated organic compounds such as carbon tetrachloride (CT) and perchloroethene (PCE) are widespread trace-level contaminants in drinking water supplies. These compounds possess characteristics of known carcinogenic compounds. We have utilized density functional theory to compute the structures and energies of these contaminants and their possible intermediates, allowing the analysis of methods for removing these compounds from the drinking water supply. The effects of aqueous solvation have been considered. Two possible reaction pathways for the reduction have been studied.

One pathway examines the addition of an electron to the initial species, followed with the stepwise addition of an electron to each of the intermediate products. The second pathway examines the possibility of producing a carbene as an intermediate.

Design and Implementation of an Action Minimizer

Bill Newton
Dr. Peter Rolnick, *Faculty Mentor*

While Classical physics presents many methods to solve a problem, a one approach may be more suitable than others. One method is that of the principle of least action. Originally conceived by Maupertuis and refined by Lagrange, This principle states that the path taken by a particle is the one in which the difference between the kinetic and potential energies integrated over time is a minimum. We created a computer program incorporating this principle. The program is novel in that it directly minimizes the action rather than the more typical process of converting the problem into a differential equation. The program can be applied to a countless number of problems in physics, some of which will be demonstrated. The program will be made available in source code form as well as a windows executable on the Internet.

Fuel Cells—A Possible Savior For Mother Earth

William Romine
Dr. Peter Rolnick, *Faculty Mentor*

Since the Industrial Revolution, burning of wood and fossil fuels has been society's primary method of energy production. Unfortunately, though easy and cost-efficient, this practice bears some serious environmental consequences, the most prevalent being the continuous release of greenhouse gases into our atmosphere. Though somewhat elusive right now, there is a pollutant free, efficient energy source lurking in the future – the fuel cell. This study focuses on why we need fuel cells, the basic electrochemical principles behind their operation, the different types of fuel cells, and how these different types can replace the burning of fossil fuels for energy production. A major setback in the progress of fuel cells is the tendency of our cheapest, most efficient fuel cells to be poisoned from impure hydrogen and oxygen. Challenges in devising a method of cleanly storing and reacting hydrogen and oxygen in a fuel cell system will be discussed.

Measuring Pedagogical Effectiveness by Comparing Professor Intentions with Student Experiences

Kevin Haworth
Dr. Peter Rolnick, *Faculty Advisor*

Over the past two decades, physics pedagogical methods have been under intense scrutiny. The majority of it is concerned with whether traditional lecture methods or interactive engagement methods are more effective. One hundred and fifty students and eight professors were surveyed regarding how they use lectures. The questionnaire also included questions concerning demographics, academic progress, and classes taken in physics. Students consistently responded that they did not use lecture in the way professors intended. However, the differences were within the standard deviations. This implies that while students do not use lecture exactly as it is intended to be used, the majority of students do use it in a similar way as intended.

Measurement of Calcium Influx in Dystrophic (MDX) and Non-Dystrophic Mice By Using Manganese Quench Assay

Rebecca Ashmore
Dr. George Carlson (KCOM) and Dr. John Rutter, *Faculty Mentors*

Duchenne muscular dystrophy is due to the loss of cytoskeletal protein dystrophin and may be associated with elevated steady-state calcium levels and resting calcium influx. Triangularis Sterni (TS) muscles of dystrophic (MDX) and non-dystrophic mice were loaded with Fura PE3, a fluorescent indicator of the free Ca²⁺ concentration. To measure Ca²⁺ influx, Mn²⁺ was added to the solution to quench the fluorescent signal. A linear decline of the signal was observed at an excitation wavelength of 360 nm. Since Mn²⁺ enters the cell through calcium channels, this is a measure of calcium influx. To test whether the quenching was intracellular or extracellular, DTPA, which chelates Mn²⁺, was added to the solution. DTPA did not reverse the quenching, thus indicating that Mn²⁺ must have entered the cell. Experiments are underway to compare Mn²⁺ quench rates between dystrophic and non-dystrophic TS muscles to determine if calcium influx is elevated in dystrophic skeletal muscle.

An HPLC-EC Method for the Separation and Detection of Three Neurotransmitters

Andy Miller
Dr. John Rutter, *Faculty Mentor*

Brain tissue samples from rats that had received repeated injections of methamphetamine (twice daily for four days at 10mg/kg i.p.) were harvested on day seven post-injection to analyze the effect of the treatment on neurotransmitter levels. In order to get a good separation of the monoamine neurotransmitters (NT), norepinephrine (NE), dopamine (DA), and serotonin (5-HT), and their respective metabolites many steps had to be taken prior to analysis of the tissue samples. Alterations of the mobile phase, particularly the concentration of the organic solvent and soap used, allowed effective separation of the NT's and metabolites. Peak oxidation occurred at approximately 5.5 minutes for NE, 9 minutes for DA, and 15.5 minutes for 5-HT. Detection was enhanced by constructing a current vs. voltage curve and determining the electrode setting that gave the most favorable signal to noise ratio. Following this determination, homogenized tissue samples were injected and the analytes quantified. Preliminary data indicate that the high level, repeated METH dosing resulted in the depletion of all three NT's, with the most significant decreases observed in the 5-HT pool in the cortex, and NE pool in the caudate.

Direct Marketing and Sustainability: A Trend in Agriculture

Katie Dallam
Dr. Michael Seipel, *Faculty Mentor*

After several years of low commodity prices, good yields and reduced export markets, America's farmers are looking for new ways to harness a larger share of the food dollar. Some are attempting to do this by eliminating the middleman and taking products directly to the consumer. This project explores the experiences of five Missouri Katahdin lamb producers and of the marketer hired to coordinate their direct marketing activities. The group is creating a marketing brochure about their product, organizing various events (cooking demonstrations and product tastings), and evaluating different marketing techniques. This presentation reports on this ongoing marketing effort and uses the group's experience to highlight the challenges, advantages and rewards of direct marketing.

Marketing Truman Popcorn

Katie Dallam, Laci Cook, Jenny Howk, Matt Jones, and Krista Hediger
Dr. Michael Seipel, *Faculty Mentor*

Researchers at Truman State University have identified the correct combination of dominant alleles that will produce popcorn with a blend of purple and white kernels on each ear. Further research was needed to determine whether a market existed for this popcorn on campus and among Truman students, parents, faculty, staff and alumni. The Food and Agricultural Marketing class performed secondary research to determine the pricing and packaging of conventional popcorn and decorative Indian corn. Then, class members conducted two focus groups with students, faculty and staff to develop product, place, price and promotional strategies. Based on the focus group findings, the class developed a marketing plan for student groups to use to sell "Truman" popcorn.

Energy Utilized by Rotational vs. Continuous Grazing Systems Of Dairy Replacement Heifers

David Trott
Dr. Michael Seipel and Dr. Thomas Marshall, *Faculty Mentors*

Livestock farmers are experimenting with rotational grazing systems as an alternative to conventional grazing systems. This research project attempts to answer the question: Is rotational grazing able to provide a healthier, more cost-effective means of raising replacement dairy heifers than continuous grazing? A 24-acre field was divided into 2 continuously grazed pastures and 2 rotationally grazed pastures and were stocked with one-year-old replacement dairy heifers. The weight gain was measured monthly, and the forage production was measured weekly. The average gain over the entire period was 176.49 lb. per heifer for the continuous system and 157.23 lb. per heifer for the rotational system ($p < 0.02$). However, the total forage yield estimate for the rotational system was 60,582 pounds of forage versus 42,445 pounds of forage for the continuous system. The rotational system utilized more total energy due to the management of the pasture.

Social Stratification and the Role of Leaders in Ghanaian Agriculture.

Doe Adovor
Dr. Micheal Seipel, *Faculty Mentor*

Agriculture in most of West Africa is subsistent and heavily influenced by the cultures in which it is practiced. This project is a case study examining the socio-cultural and socio-economic make up of Siko, a rural community in the Volta region of Ghana, West Africa. In this community, power rests in the hands of the Queen mother, the Chief, and the community's spiritual leaders. These leaders designate some days as working days and others as forbidden, thereby controlling agriculture and other economic activities. Siko has very little stratification in terms of economic, occupation, and social classes. The most common economic activities in Siko are fishing and farming, which are performed on a small, labor-intensive scale. Major crops are cassava, sweet potatoes, maize, and cocoyam. Small-scale, free-range livestock and poultry industries are also practiced. This presentation will examine the role of social stratification and leadership in the agricultural development of rural Ghana using Siko as a typical example.

Escargot On The Run: Crayfish Predation On Freshwater Snails.

Sarah Lovern, Katie Spears, and Ashley Smith
Dr. George Shinn, *Faculty mentor*

The crayfish *Orconectes virilis* populates lakes, ponds, and streams in northeastern Missouri. This crayfish is omnivorous and feeds readily on freshwater snails. Crayfish collected from Hazel Creek Reservoir were kept in aquaria and videotaped while feeding upon the snail *Physodon halei* from Patryla Park Pond. This species of snail has an unusually large shell opening. Our goal was to evaluate the relationship between snail shell form and feeding behavior of crayfish. Feeding behaviors were analyzed and compiled into an ethogram that documents the techniques used. The most effective method involved using small pincer appendages (2nd periopods) located behind the claws (chelipeds) to extract tissues through the shell opening. This is a novel feeding behavior not reported in the literature. More typically, crayfish chip or crush snail shells using their jaws (mandibles).

Freshwater Snails of Adair County, Missouri.

Stephanie Toole, Robin Perrtree, Ashley Smith, Sarah Lovern, and Katie Spears

Dr. George Shinn, *Faculty Mentor*

According to a recent treatise on the snails of Missouri, Adair County contains only three species: a large ram's-horn (*Heliosoma trivolvis*), a left handed, high-spined snail (*Physa anatina*), and a tiny, gilled snail (*Pomatiopsis lapidaria*). Our collections from local streams and ponds has turned up seven additional species of pulmonate ("air-breathing") snails. All of them live close to the surface, near the water's edge. We have identified five species with some certainty, including a tiny "ram's-horn" snail (*Gyraulus deflectus*); two right handed, high-spined snails (*Pseudosuccinea columella*, *Fossaria humilis*), and two species of left handed, high-spined snails (*Physodon halei*, *Physella gyrina*). Identifications of the other two (*Physodon pomilia*, *Ferrissia rivularis*) are tentative. Knowing the names of local species enables us to explore the scientific literature for information about their biology. Our study demonstrates that the aquatic invertebrate fauna of northeastern Missouri remains poorly studied.

The Effects of Irgarol 1051 on Coral Photosynthesis

Christina Kachulis

Dr. George Shinn, *Faculty Mentor*

The herbicide, Irgarol 1051, is used in antifouling paint for boats. The chemical constituents of antifouling paints leach out of the paint matrix and form a boundary between the boat and water. Irgarol has been found to contaminate marine water samples at concentrations up to 1693ng L⁻¹. Recently Irgarol was shown to be toxic to phytoplankton and other algae. This study was concerned with the potential effects of Irgarol on the photosynthesis of the symbiotic algae in the coral, *Madracis sp.* It was conducted at the Bermuda Biological Station for Research in collaboration with Richard Owen. At concentrations of 500ng L⁻¹ no inhibition of photosynthesis was detected. However at 2000ng L⁻¹, photosynthesis was greatly reduced with no net photosynthesis (respiration equaled photosynthesis). Because coral growth depends on excess photosynthesis by algal symbionts, widespread use of Irgarol could have negative impacts on the coral reefs.

Growth Performance and Economic Comparisons of Two Starter Rations by Weaned Beef Calves

Justin Kelly, Beth Leubbering and Shannon Klepper

Dr. Glenn R. Wehner, *Faculty Mentor*

Weight gain of newly weaned beef calves can have long term effects on total performance through harvest age. Faster gaining calves tend to maintain their edge until processing but the cost of this early gain is influenced by feed costs and efficiencies. Twenty newly weaned Gelbvieh calves were randomly assigned by sex and weight to one of two commercial rations. Weights were obtained biweekly for a 28 day trial. Total pen feed consumption was measured weekly and combined for the trial. Rations were proprietary and varied slightly in energy and protein content. Performance was similar for heifers (P>0.25) but differed for steers (P<0.05). Feed efficiency was similar (P>0.27) but cost of gain revealed a two-fold differential (P<0.05) between the two rations. It would appear that the rate of gain, although significantly different for steers, was not great enough overall to offset a two times higher cost of that gain.

Social Science

An Analysis of the Relationships Between Self-Esteem and Body Image Among American and International College Students

Theresa Conley and Amy Atkins

Dr. Raymond Barrow, *Faculty Mentor*

High or low levels of self-esteem have often been connected to perceived body image within different sexes, races, nationalities and age groups. Similar studies have connected levels of media exposure to self-esteem and body image. For this study, fifty-nine college-age men and women were surveyed to seek relationships between nationality, media exposure, self-esteem and body image. The instruments included Nugent and Thomas' Self-Esteem Rating Scale, Secord and Jourard's Body Cathexis Scale and a short questionnaire concerning demographic information and media exposure. The results to the survey included a positive correlation between self-esteem and body image, especially among females, overall lower scores for both self-esteem and body image for females and American students, stronger correlations between self-esteem and body image for those international students who have spent more time in the United States, and lower self-esteem and body image corresponding to increased media exposure.

The Effect of Experimenter Gender on Male Dating Preferences

Kristin Curtis and Matthew Fink

Dr. Michele Breault, *Faculty Mentor*

When males ask females for dates do they choose a possible date based on physical attractiveness, intelligence or personality characteristics? Do men change the characteristics that they report depending on whether they are questioned by another male or by a female? Other studies have shown that men place a heightened importance on the physical characteristics of females compared to non-physical characteristics. Additionally, previous studies have shown that the gender of an experimenter affects how subjects answer questions. Forty-one college-aged males were surveyed on their dating preferences. A female experimenter surveyed twenty, and a male experimenter surveyed twenty-one. When surveyed by the female experimenter, males

were not as likely to cite physical characteristics as being important when selecting a possible date as when they were questioned by the male experimenter.

Effects of Dyadic Sexual Orientation, Audience Characteristics, and Level of Intimacy on the Perception of Public Displays of Affection

Melissa Brittain
Dr. Michele Breault, *Faculty Mentor*

To examine the effects of dyadic composition and type of public display of affection on an observer, a mixed factorial design was used. Thirty-four participants were exposed to photographs of a heterosexual, a lesbian, and a gay couple holding hands or kissing. Results indicated that public displays of affection were thought to be more appropriate and resulted in lower levels of audience discomfort when the dyad was heterosexual and the contact was low in intimacy. Heterosexual dyads overall received higher ratings, with regard to public appropriateness and comfort level and suitability, than either homosexual dyad. A contact and gender interaction also indicated that women distinguish between levels of contact to a greater degree than males.

Effects of Type of Disorder and Labeling on Perceptions of Children

Nathan Thwing, Stephanie Steinman, and Nicole Lekich
Dr. Michele Y. Breault, *Faculty Mentor*

This study examined the effects of the presence of a diagnostic label and the nature of the label on perceptions of children with disorders. Fifty-four participants read six vignettes of children diagnosed with dyslexia, developmental disabilities, depression, obsessive-compulsive disorder, attention deficit hyperactivity disorder, or oppositional defiant disorder. For half of the participants the children were labeled with the diagnoses; for the other half there were no labels. As hypothesized, type of disorder had a strong effect on perceptions of responsibility, control, and seriousness. Children with oppositional behavior were evaluated more negatively. In addition, participants were least comfortable with oppositional children. A main effect of label indicated that parents and children were held less responsible when the child had a diagnostic label.

Foreign Aid: Fatigue or Redirection?

Elizabeth McCracken
Dr. Marijke Breuning, *Faculty Mentor*

"Aid fatigue" has been provided as an explanation for the decline in Official Development Assistance (ODA). This suggests that donor countries have tired of giving aid, especially since such aid has often failed to contribute to economic development. In addition, Cold War motivations for supporting governments in developing countries have been replaced by concern with economic growth in post-communist societies. This paper suggests an alternative hypothesis: rather than aid fatigue, there may be a redirection of aid. The literature has suggested a shift towards more grassroots oriented development strategies, as well as increasing use of nongovernmental organizations (NGO) and private investment, but not linked this changed focus with a lessening on government ODA. Our findings suggest partial support for the redirection thesis. The discussion suggests that these findings are partially explained by the manner in which the Organization for Economic Cooperation and Development (OECD) reports the data.

Sensational Press in the Leo Frank Case, 1913-1915

Erin McFarland
Dr. Robert Cummings, *Faculty Mentor*

Perhaps one of the most famous court cases in American history, the trial and lynching of Leo Frank was less about Frank's innocence or guilt, and more about the relationship between Jews and Gentiles, newspapers and their public, and an individual state's relationship with the rest of the country. Leo Frank, a Jewish factory manager in Atlanta, was convicted of murdering Mary Phagan, a young Gentile employee. After the governor of Georgia commuted his death sentence to life in prison, Frank was lynched by a mob of Southern men who claimed that their actions were no more than what "the dirty Jew" deserved. Had it not been for the sensational press the case received, from newspapers within Atlanta and across the nation, as well as from Tom Watson's popular magazines, Southern opinion against Frank as "the Jew" would not have reached such great heights.

Heaven's CyberGate: The Heaven's Gate Cult and its Connection to the Internet

Nicholas Kindred
Dr. Dereck Daschke, *Faculty Mentor*

When the Heaven's Gate cult committed suicide in March 1997, the Internet made a wider amount of material on the group available to the public. Before their deaths, the Internet served as a source of income, a place to inform others about their group, and a means to recruit new members. After their deaths the public could receive on their web site first-hand information on the group and the reasons they took their lives. The Internet also served as a place for many to discuss this event and to release emotions with anonymity. This project explores the many aspects of the Heaven's Gate cult relating to the Internet including news articles, newsgroup postings, chat room transcripts and web sites.

Major General John Schofield and the Middle Tennessee Campaign of 1864

Zach Lechner
Dr. Mark Hanley, *Faculty Mentor*

A fair share of scholarship has been done on assessing John M. Schofield's role as commander of Union forces during the Confederate invasion of Tennessee in November 1864, but not in a manner that analyzes each of Schofield's key decisions during the campaign. This project takes a more holistic approach and demonstrates that Schofield's generalship during the campaign was mediocre overall. Prior to and during the Battle of Spring Hill, his slowness in retreating despite knowledge of enemy advances placed his command in danger. At the Battle of Franklin, Schofield cannot be held accountable for a subordinate's decision that endangered the Union army, but the Federal commander lacked knowledge of the fullness of his force's victory that would have made his decision to retreat rapidly to Nashville unnecessary.

Relations Between Public and Private Education and College Experiences

Sara Walkenbach* and Grant Farmer
Dr. Teresa Heckert, *Faculty Mentor*

This study assessed the relation of public or private education to students' college experiences. A total of 62 college students from a medium-sized, Midwestern public university were asked to fill out a questionnaire assessing high school and

college grade point average, organizational involvement, and leadership positions within these organizations. No significant differences were found between students receiving a public versus private education. Further analysis revealed no significant differences between elementary and secondary education pertaining to college education.

The Impact of Being “Out”: Self-Disclosure of Sexual Orientation and Its Relation to Self-Esteem, Sexual Anxiety, and Religiosity Among Lesbians and Gay Males

Grant Farmer
Dr. Teresa Heckert, *Faculty Mentor*

The purpose of this study was to examine the relationship between self-disclosure, self-esteem, sexual anxiety and religiosity among lesbians and gay males and to determine how these relationships are affected by age and gender. Eighty homosexuals, 37 male and 43 female, completed a survey packet. Results suggest that increased self-disclosure is linked to greater self-esteem and lower religiosity levels, and that sexual anxiety may decrease with age.

Job Satisfaction of Truman State University Faculty Members

Grant Farmer, Bridget Goodwin, and Margaret Wiechert
Dr. Teresa Heckert, *Faculty Mentor*

This study measured job satisfaction, organizational commitment, and turnover intent of Truman State University faculty. A six-item scale was used to measure job satisfaction, a 15-item scale measured organizational commitment and a single-item measured turnover intent. Faculty members were also asked to rate their satisfaction, on a seven point scale, with 22 job aspects including income, resources, expectations of faculty (such as teaching and service loads), curriculum and policies. The survey had a 41% response rate. It was found that job satisfaction was related to organizational commitment and to turnover intent. Also, faculty members were least satisfied with summer salary, medical benefits for dependents, LSP curriculum, and base salary. Open-ended questions were included to determine top likes and dislikes of Truman and what changes they would like to see. Faculty members most commonly mentioned the people at Truman, either students or colleagues, as likes and location, adminis-

tration/leadership, salary and facilities as dislikes. The three most frequently mentioned recommended changes were an increase in pay, improved technology and improved leadership from administrators.

The Historical Rise and fall of the St. Louis Area Underworld

Walter Fontane
Dr. Jerrold Hirsch, *Faculty Mentor*

Organized crime has become a highly publicized phenomenon in popular film and literature. The secrets, the operations, and the grizzly murders fascinate the American public. By the end of Prohibition in 1933, Italian gangs had emerged as the dominant underworld power in most cities. This was not the case in St. Louis, Missouri. During the heyday of organized crime in America (ca. 1933-1980) the St. Louis underworld was predominantly non-Italian. Research reveals that the St. Louis-area underworld emerged from the rural mining communities of the Southern Illinois and centered itself in the industrial city of East St. Louis, Illinois. Economics, and not law-enforcement, displaced the strongest organized crime group, the Wortman Gang, and ushered in the era of drug gangs in the 1970s. The Italians of St. Louis County had a brief Renaissance (1969-1980) but they too succumbed to economic pressures.

Mixed Electoral Rules and their Implications for Party Nomination Strategies: The Case of the Ukraine

Ryan Kennedy
Dr. John Ishiyama, *Faculty Mentor*

The effects of electoral rules, the method by which seats in the legislature are divided based on the results of an election, on political party development is one of the most exciting fields for researchers in comparative politics. While these laws are rarely encoded in the constitution of the state and are easily changed, they have sweeping implications for party development. However, mixed electoral systems, those that combine proportional representation and single-member district characteristics, have largely been neglected. Even though these systems are the most common in the world today, the tendency of political scientists is to assume that they act simply as a mixture of the incentives, rather than as a system with unique incentives of its own. This paper tests these assumptions in the case of the 1998 Ukrainian elections and finds that they lead to incorrect conclusions about the development of the Ukrainian party system.

Political Parties and the Nationalization of the Electorate: The Case of Post- Reunification Germany

Matt Franker
Dr. John Ishiyama, *Faculty Mentor*

The reunification of Germany in 1990 has given scholars the opportunity to analyze what occurs when two areas with similar histories and cultures, but vastly different political systems are incorporated into a common nation-state. The concept of nationalization, the similarity of voting patterns across an entire country, was identified by Jackman (1972) as the crucial factor in determining if national integration had occurred. This study applies Jackman's method to reunified Germany. Voting preferences for the five largest parties are analyzed across all 328 districts in order to determine the degree of nationalization in the German electorate. Dummy variables are also included to test the integration of the former East and West Germanys, as well as to determine if there is an overriding regional factor. The study concludes that voting patterns in the former East are beginning to approximate those in the former West. Although the study could benefit from another election cycle, this presents a hopeful scenario for integration between the East and West.

Women Voting in the Russian Parliament: Applying Gender Models to the Russian Duma

Holley Hansen
Dr. John Ishiyama, *Faculty Mentor*

Since the end of the Soviet Union, the politics within the former communist countries have presented a new challenge to researchers. Fast-changing at times, these states represent a totally new, fascinating field to study. Though research has been done that has analyzed different aspects of these new states, relatively little has been done examining the role of women in these new states, specifically, the choices women make as they interact and vote in the post communist legislatures. This study will compare voting behavior of male and female representatives gathered from written recordings of voting during roll call votes for substantive issues in the Russian State Duma from 1993-1996. Western models on gender voting behavior will be tested to ascertain whether the legislative voting behavior of women within in the Duma corresponds to the behaviors predicted by these models.

Kincaid v. Gibson: Preservation of the College Free Press

Amy Sanders
Martin Jayne, *Faculty Mentor*

In January, the Sixth Circuit Court of Appeals overturned an earlier ruling that had stifling effects on freedom of speech and freedom of the press on college campuses. Prior to the Court's ruling, college journalists around the country were being pressured by administrators for publishing news that was unfavorable to the university. While doing so, university officials often pointed to the U.S. Supreme Court's 1988 ruling in *Hazelwood v. Kuhlmeier*, which upheld prior review of high school publications. In its landmark *Kincaid* decision, the Sixth Circuit rejected the use of the *Hazelwood* standard, used to determine when a high school publication can be censored. This research project examines the history of *Kincaid* and its implications on college press freedom and presents a chronology of recent college press censorship in light of lower court ruling regarding *Kincaid*.

Interpersonal Dependency and Eating-Disordered Behavior Among Sorority Women

Kimberly Donovan
Dr. Chris Maglio, *Faculty Mentor*

Women in social sororities appear to suffer from eating disorders and eating-disordered behavior more frequently than college women who are not members of a social Greek organization. This study was an effort to increase the body of knowledge in regard to eating disorders among sorority women and the potential role dependency plays in establishing and maintaining eating-disordered behavior. Approximately 300 sorority members from four separate national sororities volunteered to participate in the study. The three subscales of the Interpersonal Dependency Inventory (IDI) and the score on the Emotional Dependence Questionnaire (EDQ) were used to measure dependency. Eating-disordered behavior was measured by the Eating Attitudes Test (EAT). The effect of several demographics, such as academic level, age, years in the sorority, and involvement in a current relationship were also studied.

The Effect of Relationship and Gender on the Self-Evaluation Maintenance Effect

Abby Heckman
Dr. Judi Misale, *Faculty Mentor*

According to the self-evaluation maintenance theory, if someone close to you outperforms you on a task that falls within a shared area of expertise, a negative effect on your self-esteem results. Eighty-three participants (50 female, 33 male) read hypothetical scenarios describing one of three possible self-evaluation maintenance situations. The scenarios asked participants to imagine a fiancée, a close friend, or a stranger outperformed them on a test. Nine-point scales assessed participants' affective and behavioral reactions. The trend suggested by the responses to some, but not all, of the affective and behavioral scales was that men suffered more negative effects after being outperformed than women did, and that participants responded more negatively to being outperformed by a friend than by a fiancée or a stranger.

Students' Perceptions of Racism on Campus

Scott Calhoun, Melissa Reese, Abby Heckman, and Shanelle Letcher
Dr. Judi Misale, *Faculty Mentor*

Although the civil rights movement occurred more than 30 years ago, most scholars agree racism remains an active process in America. To assess current perceptions about racism on our campus, forty-eight African American and Caucasian females and males responded to a 15-item survey. Among other things, we asked students if racism existed at Truman and in what form, how serious a problem racism represented at Truman, how they knew about racist incidents, what they thought caused racism, if professors addressed racism in their classes, and whether Truman students in general or they specifically were racists. A large percentage of the students agreed racism persevered at Truman, and across all groups they generally agreed on the causes of racism. They identified several ways in which racism occurs, but very few admitted they held racist feelings. The results also demonstrated interesting differences as a function of race and gender.

Misconceptions and Illusions About Sexual Behaviors and Sexual Risk

Abby Heckman, Shanelle Letcher,
Scott Calhoun, and Melissa Reese
Dr. Judi Misale, *Faculty Mentor*

As psychological events, health judgments remain subject to the same cognitive and motivational biases as other types of judgments. For instance, perceptions of health threat often precipitate denial of danger or inappropriate processing of threat-relevant information, possibly to avoid anxiety or distance oneself from threat. These biases, plus ignorance and a common belief in invulnerability, characterize many college students today. The net result: frequent failure to respond appropriately to health threats. This research demonstrated how students' beliefs and misconceptions about sex and sexual risk can increase health risks. Eighty-nine female and male undergraduates completed a "Health Issues Survey" primarily assessing attitudes and behaviors regarding specific sexually related issues, either from their own perspective or from the perspective of "most people." The results showed students collectively underestimate threats to their health while overestimating their ability to deal with threats.

Taxation Policies in South Asian Countries

Janaka Madawela
Dr. Terry Olsen, *Faculty Mentor*

The scope of this article extends to the five major countries of South Asia: Bangladesh, India, Nepal, Pakistan and Sri Lanka. The tax structure of the above mentioned countries is typical of developing economies, both in terms of level and composition. Not only is it a major source of revenue but the tax system is also used to influence resource allocation, redistributive justice and other socio-economic objectives. This paper analyses the role of tax versus non tax income, direct versus indirect taxes, taxes on income and property, taxes on domestic production and taxes on International trade as pertaining to the South Asian region. The findings support previous scholarly research in suggesting that tax systems in South Asian countries rely heavily on indirect taxes thus causing a unbalanced and relatively unjust tax system. Moreover the findings conclude that the omission of agricultural income from the income tax base deprives governments in this region of a lucrative source of revenue. Therefore an important objective of tax reform in these countries would entail the strengthening of the direct tax system through the pruning of current tax concessions and the curbing of widespread tax evasion.

The Politics of Archaeology: The “Elgin” Marbles

Caroline Ahillen
Dr. Martha Rose and Dr. Steven
Reschly, *Faculty Mentors*

Upon visiting the Parthenon in Athens, one is immediately struck by its beauty and power, but something is missing. In 1801 The British Ambassador to the Ottoman Empire, Lord Elgin, removed much of the best pieces of sculpture from the face of the Parthenon and took them to London where they have become a permanent exhibit at the British Museum. Since their removal a fierce custody battle has been fought over the “Elgin” marbles, and many have called for their return to their rightful home in Athens. However, the British Museum refuses to give them up, claiming that they legally own the treasures. I will summarize the main arguments that British Museum Officials have made to justify their retention of the marbles and provide refutations to each of these arguments.

Olympia, Phidias, and the Temple of Zeus

Jennifer Ludwig
Dr. Martha Rose and Dr. Steven
Reschly, *Faculty Mentors*

Olympia is one of the most important sites from ancient Greece. It was not only the location of the Olympic games, but also the sanctuary of Zeus. In this presentation, I will trace the archaeological context of the statue of Zeus, one of the seven wonders of the ancient world. Olympia was a shrine, not a town. In 456 B.C. the Eleans built a large temple to Zeus. The most well-known work of art in the temple was the cult statue of Zeus by Phidias. When I visited the site in December 2000 I realized fully how large the temple and statue must have been. Made of gold and ivory and taller than a three-story house, Zeus was seated on a throne, holding a smaller statue of the goddess of Victory in his right hand. The statue stayed at Olympia until Theodosius II had it taken to Constantinople and decreed the destruction of all pagan temples. The statue was destroyed by a fire in A.D. 475.

The Real Olympic Games: Athletic Competition During Classical Greece

Timothy O’Neil
Dr. Martha Rose and Dr. Steven
Reschly, *Faculty Mentors*

With the conclusion of the Olympic Games in Sydney, many people were left with the idea that this was an example of how the Olympic Games have always been conducted. In reality, the modern version of the Olympics starkly contrasts with the version the ancient Greeks performed from 776 B.C through the fourth century A.D. If an ancient Greek witnessed our version of the Games, he would be horrified and offended by what he saw, regarding our version of the Olympics to be blasphemy. The ancient Olympic games were part of a religious festival that included devout worship of the god Zeus. Visiting the site of Olympia made it clear that the Greeks regarded athletic competition as spiritual. They believed the closest a mortal could come to divinity was by victory in an Olympic event. The popularity of the festival was tremendous, for the games offered the Greeks a chance to see what they believed to be divine intervention at work.

The Nemean Games

Cassy Felkerson
Dr. Martha Rose and Dr. Steven
Reschly, *Faculty Mentors*

Today, we are familiar with the Olympic Games, but the Olympics were only one of four major games held in Greece. The Nemean Games were another one of the four Panhellenic Games held in ancient Greece and were elevated to this elite status in 573 BC. The games were held every two years at Nemea in honor of the Nemean Zeus. A mixture of four myths serves as the background for the games, in which the victor received a crown of celery. The site at Nemea, which I visited in December 2000, contains a Temple of Zeus, a stadium, a locker room, and a vaulted tunnel. The games lasted for five days with events including foot races, the pentathlon, boxing, wrestling, and the pankration. On June 1, 1996, the games were brought back by The Society for the Revival of the Nemean Games with more than 650 participants from 29 countries, and held as the games would have been in antiquity.

Apollo Worship: His Nature, Deeds, and Delphic Site

Karen Barnard
Dr. Martha Rose and Dr. Steven
Reschly, *Faculty Mentors*

Apollo represents what could be called an ideal Greek god, evidenced by his youth and dual nature. Although he is relatively “young” to the Greek pantheon, his worship became widespread with the help of missionaries and he gained importance by regulating law, punishment, and atonement through his oracles and ministers. I first examine Apollo by exploring his non-Greek origins, then by his mythology, including references to his temple at Delphi and his iconography, seen in the Archaeological Museum of Delphi. Next, I discuss his dual nature, shown by association with the bow and the lyre, also with healing and plague. I address his worship practices, including sacrifice, festivals, and music as well. Apollo reflected many Greek values and created a feeling of affinity in his worshippers, as he, like them, knew both a light and dark side to life.

Interdisciplinary Studies

Empathy and the Unconscious Extraction of Facial Expressions: Implications to Implicit Learning and Visual Attention Guidance

Abby Heckman
Dr. Terry Palmer, *Faculty Mentor*

The present study tests whether the ability to unconsciously perceive facial expressions is related to the perceiver's empathy. One hundred nineteen undergraduates viewed blurred pictures of happy and sad facial expressions. Participants then rated how positive the character in an emotionally ambiguous situation felt. For each of the 53 participants who failed to overtly recognize the faces, the researchers subtracted their rating of the situation following the sad face from their rating following the happy face. The highly empathic participants judged the ambiguous situation preceded by a happy face more positively than the situation preceded by a sad face, $F(1, 11) = 4.00, p = .03$. These results suggest highly empathic individuals implicitly extract emotionally relevant information from faces.

Partners in Crime: Public Opinion, Legislators, and the Death Penalty

Wayne Yocum
Dr. Paul Parker, *Faculty Mentor*

While public opinion research is a highly regarded data gathering tool in social science, there are shortcomings. One is the wording of the questions. There is growing discontent with the ability of standard polling questions to measure public opinion regarding capital punishment. The structure of standard polling questions has led to misperception of the true punishment preferences of the American public by demonstrating overwhelming public support for the death penalty. Newly formed polling questions offering respondents more nuanced punishment alternatives produce a decided drop in death penalty support. This suggests policy makers have relied upon faulty opinion indicators to shape criminal punishment policy. In this study, a recent survey of Missouri State Legislators explores both the existence of this misperception as well as the effect it exerts on the crime punishment policy preferences of State Representatives and State Senators.

Barriers to the Utilization of Counseling Services in a Rural Population

Lisa Smith
Dr. Patrick Peck, *Faculty Advisor*

The underutilization of counseling services has been an ongoing problem in the mental health field. Rural residents are less likely to seek out professional counseling services than are other populations. The current study was an attempt to determine if knowledge of counseling, stigma, attitudes toward seeking psychological help and access barriers effect the utilization of counseling services across age in a rural population. Fifteen hundred participants were randomly selected from an eight county region in a rural area of Missouri. Participants were asked to fill out a demographic data sheet, questions about accessibility of services and knowledge of counseling, and the Attitudes Toward Seeking Professional Psychological Help Scale. Statistical analysis demonstrates that age effects help seeking attitudes, access barriers, stigma, and knowledge of counseling. Further, a significant difference was found between whether or not a person will ever seek out counseling services and their attitude toward seeking psychological help.

The Gender Gap: Voting Behavior and Partisan Self-Identification

Megan Lewis
Dr. John Quinn, *Faculty Mentor*

Recently, the media has emphasized the importance of the gender gap on electoral outcomes. The current political science literature focuses on this gap in voting patterns and partisanship. However, this literature does not control for rival explanations for voting and partisanship, such as income, religion, and race. Using aggregate data from the National Election Survey, this study tests for the gender gap in elections and partisanship, controlling for rival explanations. One of the chief findings in the research indicates that Jews show the highest correlation between gender and partisanship/voting behavior. All of the findings indicate that the gender gap is not a constant phenomena among differing demographic groups, but a phenomena that varies within each demographic group. The specific results of the correlation between respective demographic groups and gender is discussed in-depth in this research project.

Rediscovering The Bible: Translation History of the King James Version

Shabaka Williams
Dr. Martha Rose, *Faculty Mentor*

Many people believe that the Bible is the unadulterated Word of God. Others view the Bible as an ancient piece of world literature. The authenticity of this collection of texts from antiquity is widely debated. Many historians agree that extensive research must be done, ranging from ancient tablets to modern translations, to understand the Bible in its context better (and even then only minimal clarity may be attained). This paper highlights a portion of that range: the King James Version of the Bible. When reviewing the KJV from a historical perspective several factors must be taken into account, such as the time, circumstances, and conditions surrounding its translation. These variables reveal two methods of translation used within the text: formal equivalence (word-for-word) and dynamic equivalence (thought-for-thought). By exploring the style and context of translation, a better understanding of the KJV can be established.

Is Prayer Relaxing?

Elizabeth Malone, Christina Callahan,
and Adam Lipps
Dr. Fred Shaffer, *Faculty Mentor*

The present study compared the effects of two forms of prayer (silent Bible reading and silent self-composed prayer) with their secular counterparts (silent reading of a secular passage and silent review of the subject's day) on musculoskeletal (accessory sEMG) and autonomic (heart rate, skin conductance, and skin temperature) variables. Silently composing a prayer significantly lowered accessory sEMG 31% below baseline values, but did not affect any other physiological measurements. Silently reading a Bible passage did not affect any of the monitored variables. The authors encourage further study of the psychophysiological effects of self-composed prayer.

A Revised Truman Breathing Protocol

Elizabeth Malone, Tina Sippely, and Agnes Jos
Dr. Fred Shaffer, *Faculty Mentor*

This abstract described a revised Truman Breathing Assessment Protocol, which monitors abdominal tension, ETCO₂, SpO₂, respiration rate, inhalation volume, respiratory sinus arrhythmia (RSA), and accessory sEMG. Patients were evaluated during resting baseline, two stressors (serial-7s and visualization), two activities (talking and typing), and an spirometer challenge (patients inhaled increasing volumes to detect excessive accessory muscle use). A male undergraduate breathing profile was presented to illustrate how this procedure may be used to assess patients and personalize diaphragmatic breathing training. The authors encouraged clinicians to develop their own protocols to screen for dysfunctional breathing behaviors and develop measurable training goals.

Relationships Between Implicit Learning and Working Memory

Kim Hass and Sara Walkenbach
Dr. Karen Smith, *Faculty Mentor*

Working memory capacity is related to many other cognitive constructs, including general intelligence, problem-solving, and other explicit learning tasks. Learning that occurs without intention, implicit learning, may not rely as heavily on working memory capacity as other types of learning. To test this hypothesis, forty participants each performed a flanker task to measure their implicit learning and an operation span task to measure working memory. Participants in the flanker task did display implicit learning: they learned relationships among target and nontarget stimuli even when they were specifically told to ignore the nontargets. However, the flanker effect was not reliably related to working memory span score. This supports the hypothesis that implicit learning involves different processes than more explicit types of learning.

When Instructions Don't Help: Implicit Learning of Probabilistic Relationships

Tisha Wiley and Erika VanTuyll
Dr. Karen Smith, *Faculty Mentor*

In implicit learning, humans learn relationships between events, but do not show full conscious awareness of what they have learned. When learning probabilistic relationships, implicit learning is sometimes done so easily that explicitly instructing the person actually causes more errors. To examine this effect, eighty participants completed a computer task. In three explicit conditions, participants were given specific instructions about the underlying probabilistic relationships. Participants in the implicit condition were not instructed to learn the relationships. All participants demonstrated learning the underlying relationship, but instruction did not produce differences in the amount of learning. Of those who were instructed at the beginning, 68% reported they were not trying to use the instructions by the end of the experiment. 48% believed the instructions were inaccurate, even though they were completely accurate.

The Role of Action in Implicit Visual Search

Patrick LaShell
Dr. Karen Smith, *Faculty Mentor*

Previous research has suggested that participants implicitly learn only when they actively participate in the task. It is not clear whether that active participation need be directly related to what is being learned. 40 undergraduates viewed computer displays of letter strings, indicating the presence of specified target letters. Unknown to participants, stimuli were constructed such that certain nontarget letters were likely to appear in groups. In the final trial block, letters which had been nontargets were made targets. Participants responded more slowly to trials with nontargets which had not previously been grouped with the new targets. This indicates that participants were sensitive to the underlying structure, even though that structure had never been directly associated with the required response. In other words, the action in implicit learning need not be directly related to what is being learned.

Influence of Various Factors on Salary in Management Related Occupations

Jason Holland, Shelby Swan, and Jenn Mitchell
Dr. Jane Sung, *Faculty Mentor*

There are many different economic factors that can influence one's salary. Our study was designed to examine the effects of two biological factors in addition to two determinable factors. The biological factors are gender and ethnicity, and the determinable factors are level of education and geographical location. In our study, we set up an econometric model to test whether or not these factors have a significant effect on salary. We did our study on management-related occupations within a specific age range, 45-54, and tested for differences based on education level, geographical location, gender, and ethnicity. Through econometric tests of our model, we found that all the factors were significant to varying degrees.

The Effect of Economic Variables on Real Stock Returns

Sunil Bhawe and Donald Wray
Dr. Jane Sung, *Faculty Mentor*

With recent increases in the amount of volatility in the stock market, many investors are beginning to search for a way to make a prediction about the future movements of stock prices and the market in general. This study was conducted by applying an econometric model to test the effects of real GDP growth, the real interest rate, and the unemployment rate on the growth of real stock returns. The time-series data set consisted of annual measurements from 1961-1997. The correlation between the growth of real GDP and that of real stock return growth was positive, while there was found to be an inverse relationship between each the real interest rate and the unemployment rate on real stock return growth. However, the unemployment variable was found to be insignificant.

Content and Location Memory for Both Plain and Formatted Text

Melissa Reese and Maria Perez
Dr. Robert Tigner, *Faculty Mentor*

Students often report that they can recall the exact location in their notes where a certain piece of information is written, even if the details of the information are forgotten. The present student empirically investigated this ability to recall location information and compared it to memory for content. Forty-seven college students read 7 pages of text that was either formatted like a colorful formatted magazine article or presented in plain, monochromatic, single spacing. Participants were then quizzed on the content and asked to indicate the exact location in the article where various items were written. Confidence was also measured. Results indicate that location memory is quite good, but largely unaffected by the format of the material. Confidence was found to be a very poor indicator of actual performance. The complicated relationship between content memory and location memory will be discussed.

The Effects of Negative Political Advertising

Karen Callanan
Dr. Candy Young, *Faculty Mentor*

The purpose of this research is to design a study to examine the effects of negative political advertising in the way voters vote for candidates. The literature review addresses both negative advertising and the ways to study it. Specifically the virtues and weaknesses of survey research and exit polls are contrasted with those of an experimental design. Following, a research design and methodology are proposed to circumvent the weaknesses of traditional survey and experimental methods. The proposed innovative solution is to study a political campaign in an open seat with two similarly qualified candidates that used dissimilar advertising techniques, and survey voters' responses to those techniques. This paper is a timely discussion given the important political campaigns recently witnessed by all Americans in November 2000. Regional residents witnessed two negative special elections that took place at the end of January. This presentation is especially of interest because political advertising is so prevalent in the United States.

The Politics of the Olympics

Nishant Bhajaria
Dr. Candy Young, *Faculty Mentor*

This research project explores the commercialization of the Olympics by nations throughout the world. Specifically it seeks to answer the question of what are the financial benefits to nations of athletes winning medals and of successfully hosting an Olympic games? Detailed research devoted to the ramifications, positive and negative, is reported along with general conclusions about the changes in national approaches to sports. What used to be a simple outdoor activity cannot function today without national or corporate sponsorship and infrastructure. The methodology used for this research is a cost-benefit analysis along with examination of several nations' experiences. Finally, the implications for future research are discussed.

Stroop Task Poor Predictor of Eating Disorders

Theresa Doll and Jennifer Harris
Dr. Karen Smith, *Faculty Mentor*

This study investigated the possible use of the modified Stroop task as a predictor of eating disorders in adolescent females. Thirty females color-named words related to eating, depression, and control words printed in various colors of ink. Their times were compared to scores on the Eating Disorders Inventory-2. Although there was a mild positive trend, no significant correlations were found between the interference caused by eating-related words. There was a significantly greater interference caused by eating-related words for those who had high scores on the EDI-2. While this study does not support the use of the Stroop task as a predictor of eating disorders, its value as a tool in assessing the severity of symptoms and effectiveness of treatment still remains valid.

Academic Integrity at Truman State University

Matt Bowen, Amy Weinberger, Scott Haarmann, Karl Whiteside, Jim Rocchio, Adam Winfrey, and Stacia Dreyer
Dr. Scott Alberts, *Faculty Mentor*

A lack of academic integrity has been a problem among many students at Truman State University. In past studies at Truman, almost all students have admitted to cheating in one way or another. Also, Truman's current honor code is vague and many students do not even realize that it exists. The purpose of this study is to reduce cheating at Truman and determine if an honor code is applicable. The

instruments used to determine the need for an honor code were a faculty focus group, a faculty survey, and two student surveys. Statistical analysis of the instruments will be presented as will recommendations on policy changes.

Slavery in Democratic Athens

Kristin Curtis
Dr. David Christiansen, *Faculty Mentor*

One of the great paradoxes from history is that the Athenians of ancient Greece, who had a democratic government, owned slaves. Professors of government teach that Athens created the first true democracy. How can that be correct if, at the same time, they owned slaves? The definition of a democracy is that every citizen may participate in government, own property, and enjoy other rights and privileges. The key word of that sentence was citizen. Only certain people could be citizens. What, then, determined if someone was a slave or citizen? Under what conditions were the slaves forced to live and work? How did the Athenians justify owning slaves?

Effects of Post-Hypnotic Suggestion and Hypnotic Imagery on Competitive Anxiety in Collegiate Swimmers

Ryan Crews*, Brad Kinnear*, Lynn Giddings*, Brian Stamm*, Ben Jankowski, and Matt Fink*
Sal Costa, *Faculty Mentor*

This study examined the effect of post-hypnotic suggestions and hypnotic imagery upon competitive anxiety in collegiate swimmers. After completing their first intercollegiate swim meet of the season, volunteers were given Form A of the Sports Competition Anxiety Test and were randomly assigned to either the hypnosis treatment group (N=13) or the control group (N=13). Over the course of five weeks the hypnosis subjects participated in five hypnosis sessions. During the sessions subjects received post-hypnotic suggestions and participated in hypnotic imagery aimed at lowering competitive anxiety. The control group received no treatment in addition to their regular swim practices. After the fifth week all subjects were given the SCAT again, following an intercollegiate swim meet. An independent t-test was used to look at the two groups' changes in pre and post scores. The t-test revealed that the hypnosis group had a significantly (p.01) greater drop in SCAT scores over the course of the study.

Proto-Slavonic Mathematics: The Development of a Quantitative Vocabulary

Ryan Kennedy
Dr. Todd Hammond, *Faculty Mentor*

While there have been several attempts by mathematical historians to trace the pre-historic roots of mathematics, there are some interesting gaps in the literature. In the area of Proto Indo-European mathematics, scholars have tended to look directly at the reconstructed Proto Indo-European roots without evaluating intermediate levels of linguistic development. This paper addresses this gap, with a particular emphasis on the Slavic languages. By tracing the roots of number words in six Slavic languages, this paper finds support for two major hypotheses posited by mathematical historians: that our modern number words evolved from common roots and that they evolved from earlier base-two system and base-four. This study also casts some doubt on the hypothesis that number words were originally conceived as adjectives. Most importantly, however, it begins the exploration of the intermediate levels of linguistic development that need to be more thoroughly explored by mathematical historians in their study of pre-historic mathematics.

Laðamon's *Brut*: An Exploration of Heroic versus Chivalric Perspective in the Making of an English Merlin

Kristin Vinck
Dr. Christine Harker, *Faculty Mentor*

Of all the characters in the *Brut* whom Laðamon has altered, the magician Merlin undergoes one of the most dramatic changes - from a submissive plot device in Wace's *Roman de Brut* to a fierce and independent wizard in Laðamon's *Brut*. Laðamon takes the multiple ethnic identities of Wace's *Roman de Brut*, and creates a binary, "us versus them" mentality. He does not differentiate between Saxon and Welsh - he in fact considers both peoples to be English, by simple virtue of occupation before the Norman Conquest, and creates a duality in his ethnic distinctions, namely English versus Norman. To complement this binary mentality, he then chooses to abandon Wace's chivalric Norman style and instead resurrects a heroic approach to the story, giving it a stronger, English character and a stronger, English Merlin.

Discussion and Decision Making in Self-Directing Musical Groups

Kyle Fieleke
Dr. Thomas Hueber, and Dr. Pyung Han, *Faculty Mentors*

One of the most problematic aspects of self-directing musical groups involves discussion and decision making. Part of the challenge relates to the fact that many rock bands, combos, and small to medium size vocal ensembles don't have a "director", and oftentimes lack hierarchical structure. In addition, the unique problems of group artistic interpretation make decision making in this setting particularly difficult. Each member has his own, often passionately held, view about the group's musical style and other artistic facets of the group. These differences aren't necessarily reconcilable in the same manner as a non-musical group. Through synthesis and analysis of personal experience and original data gathered from questionnaires and interviews with members of local self-directing musical groups, existing methods for group discussion and decision making were applied to the context of a self-directing musical group.

The Courage of One: Leadership Influence of Harriet Tubman in the Underground Railroad

Julie Noelker and Elizabeth Kuehnle
Dr. James Padfield, *Faculty Mentor*

Harriet Tubman escaped from a Maryland plantation under threat of being separated from her family and sold further south. Recalling a white woman's previous offer of help, Tubman fled the plantation and sought refuge with the woman, entering the loosely organized chain of slave sympathizers known as the Underground Railroad. Moving from safe house to safe house, Tubman made her way to the free state of Pennsylvania. Tubman eventually became a "conductor" on the Underground Railroad, first leading members of her family to freedom, then returning again and again to slave states to lead anyone who would come. Under stress- and fear-filled conditions, followers gain strength from the courage of their leaders. Credited with leading over 300 slaves north, Tubman displayed remarkable courage - courage that translated into a high degree of personal leadership power.

Charismatic Shadow: John F. Kennedy and the Failure of the Bay of Pigs Invasion

Blake Schneider and Rachael Clouse
Dr. James Padfield, *Faculty Mentor*

John F. Kennedy is one of the most charismatic leaders in U.S. history. Coming to power in the height of the cold war, he preached incessantly of the evils of communism. But when it became time to take serious action against the spread of communism in the Western Hemisphere he faltered. A charismatic leader sells their followers a vision of the future. Because this vision is usually lofty and involves great risk, the leader must convince the followers he or she has the ability to bring this vision into reality. Ironically, Kennedy failed to appreciate the power and resources of another highly charismatic leader, Fidel Castro, and sent a woefully inadequate and unsupported force of Cuban expatriates into a disastrous amphibious operation at the Bay of Pigs. The failure of this operation seriously undermined the American anti-communist position for several years.

Unanchored Objectives: Inappropriate Goal-Setting Leads to Tragedy on Mount Everest

Gwen Robertson and Kerry Weisz
Dr. James Padfield, *Faculty Mentor*

The commercial expeditions to the summit of Mount Everest in 1996 provide an exemplary illustration of the tragedy that can occur when goals are not properly formed. Had Rob Hall and Scott Fischer developed appropriate goals for their expeditions, they may have prevented the loss of eight lives, including their own. These leaders neglected to analyze their goals to ensure they were unified, time-lined, and realistic. Perhaps the most critical problem arose out of the commercial nature of the expeditions. Although there was a spirit of friendly cooperation on the mountain, Hall and Fischer were business competitors in a business that recruits new clients in proportion to the number of former clients who are able to achieve their goal of standing on the roof of the world. The fee-for-service nature of these trips may have produced greater individuality (lack of a unified goal) among the team members and encouraged the leaders to persist in trying to summit as many clients as possible despite the risks involved.

Captains Disadvantageous: Lack of Heroic Leadership in the Immediate Management of the Exxon Valdez Oil Spill

Melissa Coonfield and Crystal Rowland
Dr. James Padfield, *Faculty Mentor*

The oil tanker Exxon Valdez ran aground shortly after midnight on March 23, 1989, rupturing eight of her eleven tanks and spilling 1,264,155 barrels of crude oil into Prince William Sound. At a time when decisiveness was as precious as the pristine natural environment threatened by the oil spill, state and federal authorities participated in an impotent spectacle of bureaucratic hand-wringing. It was two days until the first real action was taken to deploy oil-containment booms, with waves spreading the oil over an ever-increasing area. In addition, without a clear central vision and established precedent, the enthusiastic clean-up efforts that followed may have, in some cases, done more damage to the environment than the initial oil spill.

Unbridled Optimism: The Donner Party Tragedy as an Illustration of Incompetent Planning

Rebecca Dunlap and Monique Funkenbusch
Dr. James Padfield, *Faculty Mentor*

The scenes of horror and despair that transpired in the snowy Sierra Nevada during the winter of 1846-47 require no exaggeration: The morbid fascination associated with a group of snowbound travelers reduced to cannibalism has elevated the story of the Donner Party to one of the darkest pieces of folklore in American history. Although the winter storms of that year were some of the worst on record, the root of the Donner Party's tribulations lay in the naiveté and optimism that engulfed the leaders of the wagon train. Lansford Hastings was an ambitious man, so lost in dreams of attracting a large number of immigrants to the new land of California that he began to advertise a shortcut long before he or anybody else had actually found it. The leaders of the Donner Party eagerly accepted the promise of "Hastings cutoff" and thereby excluded one of the most important phases of planning - an accurate assessment of the situation.

An Officer and a Gentleman: Leadership of Colonel Robert Shaw in the Formation of Black Army Units During the American Civil War

Miyo Saeki and Paul Zilch
Dr. James Padfield, *Faculty Mentor*

It requires great courage to lead men into battle when there is much more at stake than just a plot of ground. In the case of Robert Gould Shaw and the 54th Massachusetts Infantry, the fate of black men all over the United States was at stake. Although he was a white man, Colonel Shaw led the first unit of black soldiers enlisted in the Union Army during the American Civil War. When the entire nation doubted the integrity and ability of black men to serve as soldiers, Shaw devoted himself to his command and led the 54th Massachusetts as an illustration to the nation that black men could perform well as soldiers and had the same passion for freedom as other men. As a result, the Union Army expanded the enlistment of black troops, many units serving with great distinction.

"What Gender Do You Do?" Gender Construction Among Truman State University Undergraduate Students

Heather Helm
Dr. Linda Seidel, *Faculty Mentor*

When you looked at my name, you attributed a gender to me. I am a "she" a "woman." You have automatically labeled me as a woman and ascribed certain ideas to me as a result of your definition of what a woman is as opposed to a man. Our culture's prescriptive and descriptive binary gender system is questioned and analyzed in this project, which was formulated to investigate how students at Truman State University attribute genders to others. It was also developed to examine the nature of their understanding of gender as a social construct. Through background readings in the fields of feminist criticism, queer theory, communication, and anthropology, as well as survey research, the project became an investigation not only of others, but of my own assumptions about gender and understanding of gender studies.

The Fabulous Fox and The Palatial Powell: Conservation of Social History in St. Louis

Megan Ferrell
Dr. Cole Woodcox, *Faculty Mentor*

During the extravagant decade of the twenties in the United States, the motion picture became a significant entertainment event for a variety of social classes. Movie palaces of the time remain today as a link to this distinct era in the social history of the nation. Two such theaters remain in use in St. Louis: Fox theater and Powell Symphony Hall. While the Fox has been recognized on the National Register of Historic Places, Powell Hall has yet to see such a distinction. Powell has preserved the history and importance of the motion picture during the 1920s through its grandiose architecture and elegant European décor. Historic, aesthetic, and scientific examinations of the building and its preservation reveals that Powell Symphony Hall should be placed on the National Register of Historic Places along with the Fox and other movie palaces of the 1920s.

On the Unity of the Interests of the State and the Interests of the Individual in the Apology and Crito

Kenneth Boyce
Dr. Patricia Burton, *Faculty Mentor*

This paper explores Socrates' views regarding the relationship between self interest and the interests of the state as evidenced from a reading of the early Platonic dialogs – specifically The Apology and Crito. Its thesis is that in Socrates' mind there is complete unity between self-interest and the interests of the state. In order to demonstrate my thesis, I first present a counter-thesis supported with evidence that seems to indicate that Socrates thought of himself as having neglected his own interests for the interests the state. I then move through a series of rebuttals to the counter-thesis which elucidate several examples in support of the thesis. The attempted rebuttals are shown to be inadequate and a final rebuttal is given at the end demonstrating the synthesis between self-interest and the interests of the state in Socrates' mind.

Punishment and Justice Explained by Socrates

Heather Mollé
Dr. Patricia Burton, *Faculty Mentor*

To first time readers of Plato's Apology, Socrates' actions may seem rather strange. He does not use the standard language of the court, he refuses to grovel for forgiveness, and at one point he actually demands that the court put him to death. However, by looking at some of Plato's other early dialogues, Socrates' peculiar actions can be explained. In both the Crito and the Protagoras, he expresses his philosophies on punishment and justice. In light of these views, Socrates' actions in the Apology are only to be expected.

An Interpretation from Protagoras Regarding Political Virtue

Scott Niermann
Dr. Patricia Burton, *Faculty Mentor*

Political virtue, or *arête*, is the sense of wisdom and justice that allows people to live in harmony with one another, devising the arts of both civil government and self-government. In his dialogue Protagoras, Plato taught that political virtue is both teachable knowledge and is also instilled in us naturally. Scholars have argued that Protagoras presented a "fundamental" defense for *nomos* (conventional law) against *physis* (natural law) in the endless "nomos-physis controversy." Socrates challenged this sophistic assertion, primarily regarding the nature of and relationship between *arête*, *aidos* (reverence, shame, humility, conscience) and *dike* (justice, order). As scholars debate over the commonalities and differences between Socrates, Plato and major sophists such as Protagoras, a reconciling position can be found between Protagoras' arguments and the questions of Socrates, thus reflecting a more truthful assessment of Plato's true views.

Chaos in Plato's City of the Soul

Kevin Koch
Dr. Patricia Burton, *Faculty Mentor*

In the Republic, Plato's system of characterizing the soul shows a recursive structure. The soul is modeled by a city, but each city consists of more souls, each of which must be characterized by another city. This self-similar recursive structure is the canonical definition of fractal geometry. Fractal geometry is typically the manifestation of chaos in dissipative systems, yet is not a necessary result of chaos' presence. Nor does fractal geometry prove the existence of chaos in a system. Fractal geometry merely serves as a road sign that chaos could be present. A chaotic system, either quantitative or qualitative, must exhibit four symptomatic behaviors: nonlinearity, sensitivity to initial conditions, a flow through well-defined phase-space, and the presence of attractors in this phase space. This analysis demonstrates Plato's City of the Soul not only defines a fractal geometry, but also exhibits chaotic behavior that can be modeled following the example of the Lorentz Attractor system.

The Suppression of the Soul

Jeremy Gray
Dr. Patricia Burton, *Faculty Mentor*

In The Republic, Plato describes the good man as having reason guide the decisions of the soul. In the oligarchic man, the higher parts of the soul, both reason and spirit, are no longer used for epistemic virtue. Rather, these parts of the soul are subjugated only for the acquisition of that desire. Furthermore, the other desires of the body are forced down by spirit and controlled by reason such that the one desire can flourish. These other desires are never tamed or moderated and cause a great amount of discord in the soul. By permitting this, the oligarchic man harbors an unhealthy soul which leads to a loss of epistemic virtue and knowledge of the good.

The Appearance of Drones in Plato's Republic

Jerry Schirmer
Dr. Patricia Burton, *Faculty Mentor*

Plato's use of drone analogies in Books VIII and IX of the Republic indicate that the individuals described as drones live a life of unproductiveness and dominance by desires within the polis. Such lives eventually lead to the "degradation" of the just city, and explains, to Plato, the primary difference between the just city and the tyrannical city. When this explanation of the drones within the work is understood in the context of the polis being a metaphor for the soul of the individual, this discussion of drones soon becomes a message to the individual demanding proper self-governance.

The Polarity of Desires in Regard to Harmony

Leigh Anne Barnes
Dr. Patricia Burton, *Faculty Mentor*

In the attempt to find (define) the happy (flourishing) individual, one must encounter the existence of desires. The question is not whether one has desires since everyone has appetites, rather, the question lies within how one flourishes despite these desires. The tyrannical man in Book IX of The Republic is an example of an individual who has allowed desire to override resulting in lawlessness. The tyrannical man's lack of moderation leads to his own enslavement, which is further fueled by the polarities/multiplicities within his life. These polarities lie within the realm of *doxa* and lead one to a state of *aporia*. Internal government is essential if one is to rise above the "seeming" (*doxa*) towards the "real" (*episteme*). The multitude of forms within the individual must seek integration by adhering to their own nature (justice).