



**First Annual
Science Undergraduate Research
Symposium**

**Thursday, December 2, 2004
Beaman Student Life Center
Belmont University**

RECEPTION

**Beaman Student Life Center Meeting Room Lobby
3:00 – 3:30 PM**

KEYNOTE ADDRESS

**Beaman Student Life Center Meeting Room A
3:30 – 4:30 PM**

**“Links Between Anger and Pain: The Role of
Endogenous Opioids”**

**Stephen Bruehl, Ph.D.
Assistant Professor of Anesthesiology at Vanderbilt
University School of Medicine**

**Sponsored by the
Belmont University
School of Sciences
Department of Biology
Department of Chemistry & Physics
Department of Mathematics & Computer Science
Department of Psychology**

POSTERS

Beaman Student Life Center Meeting Room Lobby and Atrium
West Lobby
4:30-5:00 PM

Biology

“Epithelial-Mesenchymal Transition in Prostate Cancer Progression”

Carrie Johnson

Faculty Advisor: Steven Murphree, Ph.D.

Epithelial-mesenchymal transition (EMT) is the process by which a cell rearranges itself into a spindle like morphology. This transition results in a decrease of cell-to-cell adhesiveness, which allows for increased cellular motility. Therefore, EMT is essential for tissue development and wound healing which both rely on the migration of cells. Not only do normal cells participate in EMT for motility, but so can many types of cancer cells as they become metastatic, which refers to the ability of tumor cells to spread to other parts of the body. It was hypothesized that prostate cancer cells undergo EMT to acquire increased metastatic potential. Two proteins that function in EMT are transforming growth factor β 1 (TGF- β) and epidermal growth factor (EGF). In this study, a prostate cancer cell line that was isolated from brain tissue where the cancer had metastasized showed EMT-like changes when treated with TGF- β and EGF. These changes included transitions to a spindle like morphology; and a decrease in E-Cadherin, a molecule important in cell adhesion, as detected in Western Blot analysis. These data may suggest a role of the EMT transition in the cancer progression of metastatic prostate cancer, which may provide helpful information on how to prevent metastases. It may provide helpful information on how to prevent metastases.

“Analysis of adhesion molecules in cell lines that express Human papillomavirus proteins E6 and E7”

Lindsay Smith

Faculty Sponsor: Jennifer T. Thomas, Ph.D.

Human papillomavirus (HPV) is the most common viral sexually transmitted infection with 5.5 million new cases seen each year in this country alone. HPV infection is characterized by genital lesions found on internal and external genital tissue. For females, internal lesions on the cervix are especially dangerous because they have

participants who were mentally fatigued would show a greater use of belief-bias when making logical decisions than participants that were not mentally fatigued. However, there was no significant difference found between the two groups ($t(51) = 0.59$ and a $p = 0.72$). These findings did not support previous research by Hockey and colleagues in 2000, which indicated that mental fatigue negatively affected the use of logic in decision making. Discussion focuses on the importance of further research to determine which mood state may affect the use of belief-bias in order to understand logical decision making.

6:15 – 6:30

“The Relationship between Parental Attachment and Social Interactions in Young Adults”

Sarah Miles

Faculty Advisor: Lonnie Yandell, Ph.D.

Young Adults learn how to interact with others and maintain relationships through their interactions with their parents. The relationship between child and parent serves as a model for children as they progress through life and grow into young adults. Therefore, parental attachment plays a role in the social interactions of young adults. The purpose of this study is to examine the relationship between parental attachment and social interactions in young adults. Fifty undergraduate students between the ages of 18 and 33 who were enrolled in General Psychology were given three different surveys. The Parental Attachment Questionnaire (Kenny, 1985) was given in order to assess the parent-child relationship. The Emotional Intelligence Questionnaire (Schutte, 1998) and the Basic Need Satisfaction in Relationships Scale (LaGaurdia, Ryan, Couchman, & Deci, 2002) were given to determine the social interactions of the young adults. This correlational study addresses the hypothesis that there will be a direct relationship between: 1) Parental Attachment and Emotional Intelligence 2) Parental Attachment and Basic Need Satisfaction 3) Emotional Intelligence and Basic Need Satisfaction. This hypothesis was partially supported in that there was a significant correlation between Parental Attachment and Basic Need Satisfaction ($r(56) = .42, p < .001$). However, the correlations between Emotional Intelligence with Parental Attachment ($r(56) = .02, p > .05$) and Basic Need Satisfaction ($r(56) = .08, p > .05$) were not significant. This was perhaps due to unexamined gender implications.

5:45 – 6:00

“The Perceived Favorableness of Personality in Attractive and Non-Attractive Cigarette Smokers”

Tyne Whitten

Faculty Advisor: Lonnie Yandell, Ph.D.

Despite health concerns and reported negative stigmas surrounding smokers, people continue to smoke. The purpose of this study was to determine if different levels of attractiveness changed people's perceptions of a smoker's personality. The Big Five Personality Inventory and a scale measuring attraction were used to record participant's opinions of pictures of models in a PowerPoint presentation. It was predicted that attractive cigarette smokers' personalities would be perceived more favorably than non-attractive cigarette smokers' personalities. It was also predicted that attractive female cigarette smokers' personalities would be perceived more favorably than attractive smoking males' personality. However, attractive smokers' personalities were not perceived more favorably than non-attractive smokers based on five personality characteristics: extroversion, agreeableness, conscientiousness, neuroticism, and culture. Attractive cigarette smoking females' personality was not found to be more favorable than that of men's. It was found, that despite smoking orientation, attractive people's personalities were perceived more favorably than non-attractive smokers. The Halo Effect regarding attraction had a stronger influence over perceived personality than smoking behavior. Future research might include studying overall acceptability of smokers rather than personality characteristics.

6:00 – 6:15

“The Collegiate Life: The Effect of Belief-Bias on Daily Decision Making”

Emily Sheffer and Sarah DeNeal

Faculty Advisor: Lonnie Yandell, Ph.D.

Belief-bias, the use of prior experience rather than the rules of logic to make decisions, has been found to negatively affect logical decision making. The purpose of the present study was to determine if the mood state of mental fatigue has an effect on daily decision making requiring the use of logic. Fifty-four participants from Belmont University were randomly assigned to either a mental fatigue group, which completed a group task in order to produce mental fatigue, or a no mental fatigue group, which was not mentally fatigued. Following a thirty minute period, all participants then completed a belief-bias questionnaire. It was predicted that those

the potential to progress to cervical cancer. The cancerous tissue that can result from an HPV infection has the potential to metastasize, or spread to the rest of the body. Metastasis occurs when adhesion molecules (which join cell to cell and cell to matrix) of the cancerous tissue are expressed less or become non-functional allowing the malignant cells to break off and migrate through the bloodstream. It is possible that the decrease in function of adhesion molecules is due to viral proteins, specifically E6 and E7, of HPV. Two adhesion molecules, E-cadherin and alpha catenin, have been previously investigated in our lab using a tissue culture model. Results demonstrated a decrease in alpha catenin expression in cells expressing E6 and E7; E-cadherin was undetectable. In our study, we propose to examine two additional adhesion molecules, ICAM-1 and desmoglein, to see if HPV viral proteins have an effect on their expression in our tissue culture model. There appears to be no difference in ICAM-1 levels between cells that express E6 and E7 together and E7 alone. Studies of desmoglein, another adhesion molecule, are underway.

“Exotic Plants at Shelby Bottoms Greenway”

Kristin Furman

Faculty Advisor: Darlene Panvini, Ph.D.

In the last few decades, a new method of land conservation has arisen—the greenway movement. Greenways are linear tracts of land set aside to protect native ecosystems and provide recreational opportunities. Important to environmental conservation, the long, thin areas of greenways connect natural areas together, allowing for species movement and dispersal. However, some ecologists and naturalists have expressed concern that greenways might not be as beneficial to the environment as was first thought. The linear shape of a greenway might lend itself to environmental problems such as “edge creep” and the spreading of exotic plants. Exotics are non-native species that have the possibility to be invasive and disrupt native ecosystems. The purpose of this study was to explore the connection between greenways and exotic plants by asking five questions about the Shelby Bottoms Greenway in Nashville, TN: 1) To what extent have exotic plants invaded the greenway? 2) Do path type (paved or unpaved) and percent coverage of exotic plants correlate? 3) Is there a relationship between successional stage and percent coverage of exotic plants? 4) Is the mowing cycle connected to the successional stage and the presence of exotic plants? and 5) What greenway management strategies would be effective in reducing the presence of exotic plants? The data collected suggest that exotics have invaded the mature

successional stages more than the younger successional stages and that there is no difference in percent coverage of exotic plants on paved and unpaved paths.

“Differences in Photosynthetic Rates: Exotics vs. Natives”

Crystal Wilbourn

Faculty Advisor: Darlene Panvini, Ph.D.

Exotic plants have become a major problem in the United States by invading natural areas and having adverse effects on native plant populations. This research focused on a possible reason why exotic plants are so successful in invading natural areas. We proposed that exotics have higher photosynthetic rates than native plant species. We compared the photosynthetic rates of *Lonicera maackii*, an exotic bush honeysuckle, and *Symphoricarpos orbiculatis*, a native coralberry bush, by measuring CO₂ uptake. Preliminary analysis of the results indicates that there was a significant difference between CO₂ uptakes of the two species and that the exotic species had a higher rate of photosynthesis. These results suggest that photosynthetic rates could play a role in the invasibility of exotic plants. Knowing more about rates of CO₂ exchange and photosynthesis in exotic plants could lead to ways of treatment or even prevention of the spread of invasives in natural areas.

“Occurrence of Exotic Plants at Warner Parks: A Decade Later”

Aleksandra Grzeszczak

Faculty Advisor: Darlene Panvini, Ph.D.

Invasive exotic plants are increasingly threatening Middle Tennessee's ecosystems. Their rapid growth rate and absence of natural predators and parasites within their new environment, as well as habitat fragmentation, are the primary reasons exotic plants are increasing in number. As the non-native exotic plants proliferate, they can pose a threat to local biodiversity, causing a decline in native plant populations. The purpose of this study was to determine whether the numbers of exotic plants have increased over a ten-year period in a biodiverse area. In 1992, a vegetation study was conducted in Warner Parks, Nashville, TN to inventory plant species growing in the park. The vegetation study consisted of inventorying the plants in 120 randomly selected plots throughout the park. Each plot was 20m×50m, or one-tenth of a hectare. Percent cover was also assessed within specific modules in each the first hypothesis, a significant negative relationship was found

between maternal competence and attitudes toward nonmaternal care ($r(55) = -.37, p = .005$), showing that as maternal competence increases, attitudes toward nonmaternal care decrease, meaning they become increasingly negative. The remaining two hypotheses, which considered age, were not supported due to a restricted age range. Discussion focuses on the importance of understanding the relationship between these three variables to help women choose care for their infants that are most appropriate for both them and their children.

5:30 – 5:45

“The Relationship between Political Attitudes and Religious Fundamentalist Belief Systems”

Peter Terwilliger

Faculty Advisor: Lonnie Yandell, Ph.D.

Religious fundamentalism is a belief system “based on a literal interpretation of the Bible and regarded as fundamental to Christian faith” (2004) *Webster's New World Dictionary*. Politically liberal values emphasize a belief in progress, individual autonomy, and the protection of political and civil liberties. Political conservatism generally emphasizes a belief in tradition and social stability, as well as the importance of established institutions and gradual change. The purpose of the present study was to examine if when presented with opposing political views, if individuals with strong religious fundamentalist beliefs would be less likely to alter their political attitudes than the people without religious fundamentalist beliefs. To test this, each participant first completed a pretest political questionnaire. Next, the participants were given *The Religious Fundamentalist Scale* to rank their level of religious fundamentalism. Participants then read an essay biased to a conservative or liberal view of taxation and completed a posttest political questionnaire. It was predicted that the people with strong religious fundamentalist beliefs would alter their political opinions to a lesser extent than those without religious fundamentalist beliefs. The hypothesis was not supported, because fundamentalism was weakly related to political beliefs $r(65) = -.11, p > .05$. Upon further analysis, the results suggested that people with conservative beliefs were less likely to alter their political attitudes than liberals, $r(65) = -.37, p < .05$. Future research should consider replacing the political essay with a video or lecture that combines a number of issues, as opposed to just discussing taxation.

PAPERS

Beaman Student Life Center Meeting Room A

5:00 – 6:30

Mathematics & Computer Science

5:00 – 5:15

“Petersen’s Planarity: An Exploration of the Crossing Numbers of Generalized Petersen Graphs”

Joanna Oakland

Faculty Advisor: Mike Pinter, Ph.D.

In mathematics, the search for truth is the driving force behind every problem. Sometimes trying to find the answer to a math problem is like peeling an onion. There are many pieces that can be eliminated, it is a difficult process to get to the center, and you may shed a tear or two. One of these onion-like subjects in mathematics is graph theory. This presentation will discuss research and findings about the crossing numbers of Generalized Petersen graphs, a specific section of graph theory. Finding the crossing numbers involves a process of bringing the upper and lower bounds on the crossing number closer together and, ideally, finding its exact value. This is by no means easy, and provides interesting challenges which catalyze the experimentation and usage of various methods and equations. This pursuit of an exact value for $CN\{G\}$ when G is a generalized Petersen graph will be the focus of this presentation.

Psychology

5:15 – 5:30

“Relations between Maternal Competence, Attitudes toward Nonmaternal Care, and the Age of Women”

Sarah DeNeal

Faculty Advisor: Lonnie Yandell, Ph.D.

Nonmaternal care for infants has received considerable amounts of attention due to its increasing occurrence among today’s families. In order to examine the factors contributing to this increase, this study investigates the relationship between maternal competence, attitudes toward nonmaternal care, and a woman’s age. A study was conducted with 57 female volunteers from Belmont University. These participants completed a demographic form and two questionnaires, the first measuring maternal competence and the second measuring attitudes toward nonmaternal care. In support of

plot. The purpose of the 2004 vegetative study was to inventory 5 of these plots for the occurrence and percent cover of invasive exotic plants and compare the data to that collected in 1992 and 1993. Four exotic plant species were inventoried: *Lonicera maackii* (Bush Honeysuckle), *Ligustrum sinense* (Chinese Privet), *Lonicera japonica* (Japanese Honeysuckle), and *Ailanthus altissima* (Tree of Heaven). The results show an increase in the number of *Lonicera maackii* and *Ailanthus altissima*; however, the increase was not statistically significant. Further analyses of the data will examine the relationship between the occurrence of exotic plants and habitat features such as fragmentation and native biodiversity.

C. elegans and Chemotaxis

Katie Saba

Faculty Advisor: Robert T. Grammer, Ph.D.

The *tax-2* and *tax-4* genes of *C.elegans* encode two subunits that form a heteromeric channel used for sensory transduction. The *tax-2* gene product acts as the beta subunit and *tax-4* product acts as the alpha subunit in this cyclic nucleotide-gated channel (Komatsu, et.al). The amphid, located in the head of the worm, is the main sensory transduction organ of *C.elegans*. There are 12 neurons that grow to the amphid: 4 of these neurons (AWA, AWB, AWC, and AFD) are encoded within the amphid sheath cell, so these are not directly exposed to the environment, showing that they most likely sense odorants. Previous studies have shown that *tax-2* mutants affect the sensory capabilities of one of these four neurons, named AWC. The AWC neuron is sensitive to certain chemicals such as benzaldehyde and isoamyl alcohol. These studies show that *tax-2* mutant worms lose much of their capability to sense these two chemicals. However, *tax-2* mutants were still able to sense AWA sensitive chemicals, such as diacetyl and 2,4,5-trimethylthiazole (Coburn, Bargmann). This research will focus on *tax-4* mutants and their capabilities to sense these chemicals. It will extend the research of Coburn and Bargmann, allowing us to further understand the function of *tax-2/tax-4* gene products and how their presence/absence affect the AWC neuron and its sensory capabilities.

“Chemotaxis with *Caenorhabditis elegans*”

Burgandy Moss

Faculty Advisor: Robert T. Grammer, Ph.D.

Caenorhabditis elegans are non-parasitic, free-living soil worms of the phylum nematode. *C. elegans* can be one of the two sexes: hermaphrodites and males each of which are about one millimeter in length with transparent bodies. Their short lifespan of two weeks also makes them good study specimens.

Interaction with their environment is stimulated by chemical cues which bring about behavioral modification. Chemosensory structures in the head known as amphids are the essential receptors in chemotaxis assays. Chemotaxis experiments provide an excellent way to observe the worm's responsiveness and movement toward or away from a chemical gradient. A main focus of the present chemotaxis experiments is working with known attractants and repellants in order to develop and improve the methodology of the assay.

Chemistry & Physics

“Type III Silica Samples Implanted Sequentially with Sc, O and Ag Ions”

Alison McCommons

Faculty Advisor: Robert H. Magruder, III, Ph.D.

Ion implantation provides a method of achieving non-equilibrium concentrations of dopant ions by modifying the optical properties of silica without the need for glass modifiers. This implantation process prevents phase separation of the glass and yields high purity materials with accurately determined dopant concentration. These dopants can be used to modify both the linear and nonlinear optical response.

An increase in Sc concentration results in smaller particles with greater density. This result suggests that the implantation of Sc aids in the creation of nucleation sites for Ag nanocrystals. Additionally, an increase in Sc concentration produces a red shift of the low wavelength peak. The ability to affect particle microstructures and subsequent optical properties may be useful for device applications.

Silica samples were implanted with Sc and O ions at 160 and 53 keV, respectively, and annealed at 900°C for two hours in oxygen. The samples were then implanted with Ag ions with doses ranging

Psychology

“Musicians and Handedness”

Jessie Angel and Nathan Kosiba

Faculty Advisor: William N. Bailey, Ph.D.

Handedness is an intriguing area of interest, in part because it is difficult to define. People use both of their hands for such a wide variety of tasks that it is helpful to think of handedness along a continuum from extreme sinistrality (left-handedness) to extreme right-handedness, with many people falling somewhere in between. People who score in the area of extreme sinistrality do show some marked differences from those on the other end of the continuum. Sinistrality corresponds to better recall of stimuli that are difficult to encode verbally (Christman & Propper, 2001). Left-handed people and their relatives have larger corpus callosa and display a greater degree of hemispheric communication (Christman & Propper, 1998; Gowalb, 2001). The left hemisphere primarily integrates verbal information and the right hemisphere integrates primarily visuo-spatial information (Kalat, 2004). Because each hemisphere controls the contralateral side of the body, handedness has been studied from the perspective that extreme differences may correspond to differences in certain abilities that rely heavily on one hemisphere or the other (Springer & Deutsch, 1993). For instance, Mebert and Michel (1980) found higher incidences of sinistrality and familial sinistrality among visual art students, when compared to students in other fields. Aggleton, Kentridge, & Good (1994) found that orchestral musicians also show higher incidences of sinistrality and mixed-handedness than non-musicians. As Belmont University has a large population of music students, we chose to make a similar comparison. It was hypothesized that there would be higher incidences of sinistrality and familial sinistrality among music students than among non-music students. Ninety-eight students (55 music students and 43 non-music students) completed the Edinburgh Handedness Inventory (Oldfield, 1971) and supplied information on familial sinistrality. A Two Sample T Test for comparison between music and non-music students revealed a higher incidence of sinistrality among music students, with a p -value of 0.018. The results supported the hypothesis, with respect to sinistrality. However, there was no difference in the incidence of familial sinistrality. This area of interest could be pursued to determine if the incidence of sinistrality is higher among musicians with a certain type of principle instrument.

marvels, the Parthenon? While it is difficult to prove either way, this project is designed to show typical methods of Ancient Greek architecture and "visual correction" that have striking parallels to modern concepts and constructs of calculus and advanced mathematics. Topics discussed include the entasis method of column design and its relation to the Riemann sum, as well as the use of cambering and its parabolic/hyperbolic nature. The Parthenon is referred to throughout as a familiar example of the architecture, and a model of the various topics discussed.

"Solutions with Genetic Algorithms"

Stuart Childs

often find a solution much faster than other methods. The traveling salesman problem, in which a salesman must travel to a given number of cities using the shortest path, is a problem for which genetic algorithms can be applied. An interesting possibility for research would be to add extra variables to this problem, such as monetary and temporal cost of traveling to the cities as well as the projected earnings from a city based on population, and then examine the effects these restrictions had on the performance of the algorithm.

"The Zen of Computing"

Joshua Reynolds

Faculty Advisor: Joyce Blair Crowell, Ph.D.

The majority of the population of America relies on computers for daily activities. From communicating to finding a new recipe for dinner, computers have become an integral part of our culture. However, the prevailing sentiment towards computers is highly negative. The common user struggles with their computing environment, storing files, setting preferences, dealing with hardware and software issues. This investigation takes observations from real world settings in which people are pitted against machines, and looks into research and findings on how to improve the computer-user interaction and environment within existing means. The goal is to help users achieve the "zen of computing" through understanding how set-up, organization, and even climate factors feed into an overall level of comfort and usability in a computing environment.

from 7.5×10^{16} to 22.5×10^{16} . Optical measurements of the samples were made using a dual beam spectrometer at wavelengths from 900 to 200 nm, using an unimplanted sample in the reference beam. The absorption spectra were measured at two different positions on each sample.

"Optical Absorption of Ge Implanted Type III and Type IV Silica and Si Implanted Type III Silica"

David Coss

Faculty Advisor: Robert H. Magruder, III, Ph.D.

The purpose was to determine the effects on the optical properties of germanium and silicon implantations in different types of high purity silica. The silica samples were implanted at an energy of 500keV, with ion concentrations of 3×10^{15} ions/cm², 1×10^{16} ions/cm² and 3×10^{16} ions/cm². Silicon was implanted only in Type III silica. The optical absorption of various samples of germanium and silicon implanted Type III and Type IV silica were measured. The optical absorption was measured with photon energies ranging from 1.8eV to 6.5eV and is reported as optical density. The optical density increased with concentration, as well as having a higher magnitude in Type IV than Type III silica for all concentrations. The Ge implanted samples in all cases exhibited higher absorption than the Si implanted samples for all concentrations. The shape of the absorption curves was observed to be depend on the type of silica implanted as well as the ion species implanted. These results indicate a variation in the formation of intrinsic defects depending on silica type and ion implanted.

Mathematics & Computer Science

"Finding a Better Democracy through Better Voting Systems"

Yves Toleno

Faculty Advisor: Glenn Acree, Ph.D.

The presentation will offer a brief introduction to basic voting systems, the questions that arise, the criteria by which voting systems are judged, and scenarios that violate these criteria. The goal is to find a system that meets most of the criteria, and establish rules that dictate which voting system is used in a given situation to give the 'best' results. The poster will explore some of the open questions in voting systems and define areas of specific interest for advanced study and research

“The Quest for Patterns: An Exploration into the $3x + 1$ Conjecture”

Kacie Kleja

Faculty Advisor: Glenn Acree, Ph.D.

This presentation will look into the patterns that develop when you map out the path an integer takes according to the $3x + 1$ conjecture. Much of my concentration has been on prime numbers, 5^n , and integers divisible by three.

“Chomping on Math”

Jake Eichenberger

Faculty Advisor: Glenn Acree, Ph.D.

Chomp is a game for 2 players on a chomp board with some number of rows and columns. Players take turns chomping a piece. The piece they pick is removed, as well as all pieces below and to the right. The player who takes the last piece loses. Winning strategies for this game are not well developed. The bigger the chomp board, the harder it is to find a winning strategy. This presentation will investigate winning strategies for various board sizes and propose questions for further research.

“Well-Covered Graphs: An overview of the work of Dr. Mike Pinter”

Lucy Watson

Faculty Advisor: Glenn Acree

Graph theory is a fairly new area of research and discovery in mathematics. Recently, in particular, well-covered graphs have been a topic of popularity. A well-covered graph is a graph where every maximal set of independent vertices has the same size. Dr. Mike Pinter's research focused on graphs with girth 4, as well as, graphs that remain well-covered when a vertex is knocked out ($W2$). A summary of this research will be presented, as well as, a proposal for further research opportunities in this area.

“A Partitioning Problem”

Sergei Temkin

Faculty Advisor: Glenn Acree, Ph.D.

My research proposal will explore the ideas of partitioning. The proposal will mostly be examining partitions of integers as integer

sets, but will also look at partitions of integers in a tree structure. The proposal will also contain some examples of partitions with different restrictions. Different methods of partitioning will also be explored, as well as, different kinds of restrictions on the partitions.

“Restrictions within Well-Covered Graphs: An Overview of the Research of Dr. Stephen Campbell”

Emmy Scott

Faculty Advisor: Glenn Acree, Ph.D.

Recent exploration in graph theory has revealed a new classification of graphs called well-covered graphs. A well-covered graph is a graph for which every maximal independent set is a maximum set. Detailed research by Dr. Stephen Campbell has proven the existence of exactly 4 well-covered graphs that are cubic, planar, and 3-connected. An overview of this research is presented along with possible areas for further research with these graphs.

“The Past, Present, and Future of Goldbach's Conjecture”

Renee Torres

Faculty Advisor: Glenn Acree, Ph.D.

Goldbach's Conjecture has been “teasing” mathematicians for centuries. This proposal contains a brief history of the conjecture including how it all began, what has been accomplished, and what has failed since the beginning. It also looks at possible patterns, which I have found within the conjecture. The proposed research for the future will look at how these possible patterns may help in proving or disproving Goldbach's Conjecture.

“Advanced Math: How the Greeks perfected Imperfection?”

Nathan Davis

Faculty Advisor: Keeley Hutchison, M.S.

Could the Ancient Greeks of the 5th Century B.C. have understood basic concepts of calculus and advanced mathematics? Did they then use them to engineer one of their greatest architectural