Summer Research Symposium – Oral Presentations
Friday, September 26, 3:20-5:00pm, Carver Science

The symposium will start with everyone gathered in Jordan Lecture Hall for the Welcome (3:20-3:25) and the first presentation. The remaining presentations will be held concurrently. Audience members will have five minutes to switch rooms between presentations.

Carver 215 (Jordan Lecture Hall)

3:25 - 3:40 Louis Joslyn
3:45 - 4:00 Alec McIntosh
4:05 - 4:20 Nathan Schneider
4:25 - 4:40 Amy West
4:45 - 5:00 Peter Rietgraf

Carver 231

3:45 - 4:00 Erin Boggess and Kyle Jensen
4:05 - 4:20 Matt Christen
4:25 - 4:40 Geoff Converse, Jared Grove, and Kylie Pape
4:45 - 5:00 Sara Reed

Summer Research Symposium – Poster Presentations
Friday, October 3, 3:30-4:30pm, Carver Science Atrium

Emma Jones
Zach Lindeberg
Rachel Rice
Rebecca Thornton
Kelsey Wittorf
Unable to Present
Holly Baitto
Jordan Parra

Abstracts:

Geoff Converse, **Jared Grove,** and **Kylie Pape**
Dr. Albert H. & Greta A. Bryan Summer Research Program – Simpson College
Maximizing Potential in a Fantasy Football Draft
In a fantasy sports league, the draft is the first opportunity for team managers to gain an advantage over their opponents. We created a computer program in R that can maximize a team's projected value gained from a fantasy football draft. The key feature of our program is its ability to predict when players will be taken in future rounds. This enables our team to draft the best players being considered by opposing teams in a given round and also draft players before there is a drop in value at a given position. Our program is able to learn the strategies of opposing teams as the draft progresses and therefore adjust its predictions for future rounds to increase its accuracy. Thus, even when our program starts with very little knowledge of the strategies used by the competing teams, it is able to finish with a competitive edge. We completed this project during the Dr. Albert H. & Greta A. Bryan Summer Research Program in Mathematics at Simpson College.

Matt Christen
Dr. Albert H. & Greta A. Bryan Summer Research Program – Simpson College
Educational Economics
I examined how liberal arts colleges could increase revenue from two main sources: tuition and alumni donations. Using data from the US News and World Report and the Integrated Postsecondary Education Data System, I generated a demand curve that can be used to accurately price college tuition. In addition, I generated a simple model that identifies geographical areas from which prospective college students are more likely to travel greater distances for education. Finally, using alumni donation data provided by Simpson College's Office of Advancement, I identified donation patterns that suggest how liberal arts colleges can more efficiently solicit donations from alumni.

Kyle Jensen and Erin Boggess
Dr. Albert H. & Greta A. Bryan Summer Research Program – Simpson College
DNA Hairpin Simulation using the Peyrard-Bishop Model
Progressions in the field of nanotechnology have opened the door to new and innovative means of drug delivery. By understanding the dynamic nature of the DNA hairpin structure and modeling the bistable tendencies of the molecule, a melting curve can be established promoting the future manipulation of the hairpin between open and closed states. Theoretical simulations are used to obtain numerical results and characterize the hairpin molecule in preparation of its future adhesion to the DNA tetrahedron.

Emma Jones
Summer Institute in Biostatistics - University of Minnesota
Polypill HEART Study: Designing a Protocol for an International CVD Clinical Trial
The Summer Institute of Biostatistics at the University of Minnesota is a program designed to introduce undergraduate students to the world of public health, including epidemiology, study design, clinical ethics, and Bayesian and Frequentist statistics. SIBS participants wrote complete protocols for international and smaller scale clinical trials, as well as conducting in depth statistical analyses on real-world clinical data sets using SAS programming.

Louis Joslyn
Biology – Simpson College
Examining earthworm escape reflex: Lab activity and neuron modeling
Due to the expensive nature of neurophysiology labs, undergraduate neuroscience courses generally lack labs. Over the summer, we have demonstrated how a simple, two channel amplifier provides a cheap, easy method of demonstrating classroom concepts in lab. Using the amplifier, a basic earthworm and a program called Neuron, students should be able to analyze recordings and relate these recordings to underlying physiological processes within an axon.

Alec McIntosh
Simpson College Ecological Research Program– Simpson College
Freshwater ponds in Warren and Marion County
This summer, I examined the impact that land usage had on both the algae diversity and the overall health of freshwater ponds. I equally grouped nine freshwater ponds into three categories of land usage based on the frequency of human interaction, the possibility of pollution, and the dominant surrounding vegetation. A trawl net was used to collect algae samples and diversity was estimated by examining samples under a microscope. Furthermore, water chemistry tests were performed at each site to obtain a measure of the overall health of the ponds. In the end, the data were analyzed using regressions and ANOVAs on Microsoft Excel.

Sara Reed with Levi Boxell (Taylor University), Yihang Du (Lafayette College), Dr. Jeffrey Liebner (Lafayette College), and Dr. Julie Smith (Lafayette College)
Summer 2014 REU in Mathematics/Economics – Lafayette College in Pennsylvania
Finding NAIRU
The non-accelerating inflationary rate of unemployment (NAIRU) is a fundamental concept in macroeconomics. Defined as the rate of unemployment at which the inflationary rate does not change, NAIRU is widely used by policymakers to help determine fiscal and monetary policy. However, NAIRU presents a challenge in that one cannot directly observe NAIRU in the same manner that one can observe the unemployment rate. This challenge also makes it difficult to determine how accurate one's estimates of NAIRU are. In our approach to estimate NAIRU, we employ various univariate smoothers and filters in order to extract the underlying trend from the cyclical unemployment rate. We also use a state-space model and the Kalman Filter along with an EM Algorithm to extract the unobserved state of NAIRU. We expand upon current methods used to estimate NAIRU by utilizing a more general multivariate autoregressive state-space model (MARSS) that incorporates structural changes in the labor market. When assessing the predictive ability of our estimates of NAIRU using the Phillips curve, we find that our estimates perform as well or better than those provided by the Congressional Budget Office.

Rachel Rice
Marshall Space Flight Center – NASA
Dayside Aurora Modeling
Dayside aurorae are caused by magnetosheath plasma penetrating to the ionosphere along the Earth's magnetic field lines. Energetic electrons excite atomic oxygen and nitrogen in the atmosphere, producing the characteristic auroral glow. The boundary between open and closed field lines, called the separatrix, is a primary location for magnetosheath plasma penetration and auroral emissions. The separatrix is located on the dayside of Earth, making visual observation difficult due to day glow unrelated to the emissions caused by plasma penetration. The GLOW model was used to observe a wide range of dayside auroral displays without interference from day glow emissions. Electron and ion precipitation data was acquired from the Defense Meteorological Satellite Program (DMSP) satellites and used for input to GLOW to model auroral emissions. From the resulting outputs, the location of separatrix can be identified in the auroral emissions.

Rebecca Thornton
Stowers Summer Scholar Program
Lysine-to-Methionine Mutation Alters Histone Protein Interactions
Lysine-to-methionine mutations in histone tail regions act as dominant inhibitors of histone lysine methylation. Lysine-to-methionine mutation at H3K27 results in severe pediatric glioblastoma. To discover the effects of such mutations, we created mutants at every lysine residue across histone H3 and performed proteomic analysis of associated complexes. We purified nucleosomes by micrococcal nuclease digest and FLAG precipitation. Interacting proteins were identified by mass spectrometry. Comparing H3WT and H3K9M data revealed changes in the levels of several interacting proteins. The H3K9 deacetylase SIRT6 was found in greater association with H3K9M mutants. His-tagged SIRT6 was expressed in E. coli and bound to Ni-NTA beads. Protein pull down experiments analyzing the binding of bacterially expressed SIRT6 to H3.3WT and H3.3K9M histones revealed little difference in association between the histones despite increased binding in mammalian cells. Future work will examine the mechanisms underlying these differences and explore additional interacting proteins such as KDM3B.

Amy West
Simpson College Ecological Research Program– Simpson College
Parental Response to Predation in Shrub-Nesting Prairie Birds Based on Stage of Nestling Development
My research this summer examined how parent birds defend their nests, and if that behavior changes as the chicks grow older. My research took place on the Riley Property, which is mostly restored prairie. Thus, my research focused on ground and shrub nesting passerine birds that live on the prairie. I hypothesized that as the nestlings grew older, parental investment would increase. My experiment looked at what the parent's behaviors were and how far the parents were willing to travel from the nest to measure investment. Stage of development was divided into four categories: incubation, early, mid, and late nestling. I found that whether or not stage of development has an effect on behavior varies based on species and gender.

Kelsey Wittorf
University of Nebraska Medical Center Summer Undergraduate Research Program
Platelet Factor 4 (PF4) upregulates MUC4 expression during progression of pancreatic cancer
Pancreatic cancer (PC) is the fourth leading cause of cancer-related deaths in the USA. MUC4 is aberrantly over expressed early during PC and its expression continues to increase throughout the progression of the disease. MUC4 is proposed to play a key role in PC progression and metastasis. Factors that could upregulate MUC4 expression include, retinoic acid, IFN-gamma, PF4 and CCL12. I hypothesized that PF4 would upregulate the MUC4 expression in pancreatic cancer cell lines. I did an *in vitro* treatment of two pancreatic cancer cell lines (CD18/HPAF and Capan1) with three different concentrations of PF4. The cells were lysed and probed for MUC4 and β-actin. I also did a Luciferase Assay on CD18/HPAF cells which were transfected with truncated MUC4 promoter constructs and vector containing β-galactosidase using lipofectamines. After the transfection, the cells were treated with PF4. The lysates were assayed for luciferase and β-galactosidase activity. The promoter region of promoter construct 3 had a 2.5 fold increase in luciferase activity after the PF4 treatment. After doing an *In Silico* analysis, I was able to propose a possible mechanism for the PF4 signal transduction pathway. In conclusion, I found that PF4 upregulates the expression of MUC4 in pancreatic cancer cell lines CD18/HPAF and Capan1.