



Research Day 2011 Schedule

All Talks will be held in the Moody Science Auditorium, Room 110. The Poster Session will be in the first floor hallway.

- 1:00 – 1:10 Welcome Address and Acknowledgements Dr. Herb Grover, Dr. Andrew Kasner
- 1:10 – 1:25 Talk 1.....*Garrett Breazeale, Elida Arsiaga*
DNA fragmentation patterns associated with apoptosis in 4T1 breast cancer cells
- 1:30 – 1:45 Talk 2..... *Desiree Luevano*
Effectiveness of wildlife cameras on Burrowing Owls in the Southern High Plains
- 1:50 – 2:05 Talk 3..... *Christa Day, Kimberli Harger*
Water purification using permanent magnetic fields
- 2:10 –2:25 Talk 4..... *Jarrett Ross, Libby Saultz*
Development of a western blot assay of caspase-3 to indicate apoptosis in 4T1 breast cancer cells

2:25 – 2:30 Break

- 2:30 – 3:15 **Poster Session I** (MSB First Floor Hallway) - See Poster List on next page
- 3:20 – 3:35 Talk 5..... *Jacob Kemmer*
Effects of fish color on zebrafish school preference
- 3:40 – 3:55 Talk 6..... *Jacob Hinojosa and Jenna Wilson*
Using a single-nucleotide polymorphism to predict bitter-tasting ability
- 4:00 – 4:15 Talk 7..... *Rick Ross*
Basic graph theory: The three cannibals and three missionaries problem
- 4:20 – 4:35 Talk 8..... *Adam Hilliard*
Comparing physical and mathematical models of a medieval trebuchet
- 4:40 – 5:15 **Poster Session II** (MSB First Floor Hallway) - See Poster List on next page

5:30 – 7:00 Dinner and Awards Ceremony (Van Howeling Education Building Basement)

Research Day 2011 Posters

- 1) *Jeffrey Coleman and Hailey Budnick*
Relationships of obesity and child poverty with four health indicators

- 2) *Rosemary Ribera, Tonia Perez, Timothy Ballinger, Patrick Hernandez, Trevor Burrow, Regan Waters, Dr. Adam J. Reinhart, and Dr. Gary O. Gray*
Purification and characterization of 4T1 murine breast cancer cell cytotoxin from *Withania somnifera*

- 3) *Christa Day, Patrick Hernandez, Stephanie Whitaker, Danielle Arnold, Garrett Breazeale, David Gary, Austin Howard, Jessica Howard, Luke Ingraham, Desiree Luevano, Erica Raymond, Rosemary Ribera, Dr. Robert Moore, and Dr. Adam Reinhart*
Isolation and characterization of mushroom tyrosinase from various anatomical regions of *Agaricus bisporus*

- 4) *Ivy G. Sustaita, Tana D. Saul, Natividad Sandoval and Dr. Andrew C. Kasner*
Effects of land use on playa invertebrate richness and abundance

- 5) *Cody McClary, Victoria Chavez and Demetrice Gilliam*
Variability in seed viability between honey locust (*Gleditsia triacanthos L.*) trees on the Wayland Baptist University campus, Plainview, Texas

- 6) *Josh Lucas, Rebekah Slentz and David Gary II*
Variability in seed pod and seed production between honey locust (*Gleditsia triacanthos L.*) trees on the Wayland Baptist University campus, Plainview, Texas

- 7) *Tana D. Saul, Ivy G. Sustaita and Jessica L. Poole*
Seed germination requirements for honey locust (*Gleditsia Triacanthos L.*)

Acknowledgments

2011 Research Day was organized by the officers and members of the Wayland Baptist University Student Chapter of the Texas Academy of Science.

Committee Members

Tana Saul, TX Academy of Science - WBU Chapter President

Jessica Poole, TX Academy of Science – WBU Chapter Vice President

Ivy Sustaita, TX Academy of Science – WBU Chapter Secretary

Corin Olivas, TX Academy of Science – WBU Chapter Treasurer

Faculty Advisors: Dr. Andrew C. Kasner, Associate Professor of Biology and WBU-TAS Chapter advisor; Dr. Scott R. Franklin, Associate Dean

Special Thanks:

- WBU Student Chapter of the American Chemical Society for assistance with poster setup and other tasks associated with the organization of Research Day.
- WBU Student Chapter of the Mathematics Association of America for providing desserts for the dinner.
- Dr. Herb Grover, Dean of the School of Math and Sciences for logistical and financial support.

We especially thank the faculty in the School of Math and Science for logistical support, judging of presentations and posters, and tireless support and encouragement of the research students in our program.

Abstracts for Research Day Talks

1:10 – 1:25 Talk 1..... Garrett Breazeale and Elida Arsiaga
Advisor: Dr. Adam Reinhart, Professor of Biology and Chemistry

DNA fragmentation patterns associated with apoptosis in 4T1 breast cancer cells

Cancer is a disease that claims the lives of hundreds of thousands of people every year. Drug companies spend billions of dollars each year on research that could lead to the cure. Why try to invent something that nature may already possess? Extracts from different plants were collected and applied to 4T1 breast cancer cells in vitro. One common feature of cells undergoing apoptosis is that an endonuclease becomes active which fragments the DNA in the cell. Some of the DNA is relatively protected by its association with histone complexes, so the DNA between the histone complexes is much more susceptible to attack from the endonucleases. This results in DNA in some cells undergoing apoptosis to exhibit a fragmentation ladder with "rungs" of the ladder in multiples of 200 nucleotides, which is amount of DNA associated with one histone. We have isolated nuclear DNA and subjected it to electrophoresis to determine if this fragmentation ladder pattern was exhibited in 4T1 cells after exposure to various plant extracts.

1:30 – 1:45 Talk 2..... Desiree Luevano
Advisor: Dr. Andrew Kasner, Associate Professor of Biology

Effectiveness of wildlife cameras on Burrowing Owls in the Southern High Plains

There is limited information on population demographics and the ecology of burrowing owls (*Athene cunicularia*) in the Southern High Plains, especially during times of limited vision and crepuscular periods. Various methods of detection have been used thus far. Double observer and infrared cameras are among the few detection possibilities that have been tested. We examined the effectiveness of game cameras (snapshot and video capable) at individual burrows of Burrowing Owls during all hours of the day and night. In order to determine the efficiency of the cameras and quality of the data collected, various burrows were sampled from 21 February 2011 to 10 April 2011. This approach permits the capture of observable burrow activity and owl abundance through a twenty-four hour period over several days. The study resulted in 1239 camera snapshots consisting of 118 animal captures, and 173 one-minute videos capturing 13 separate animal sightings. Twenty-eight mammal sightings were captured in snapshots, and six mammal recordings on video. The camera resulted in ninety snapshots of various species of birds and eight-one minute videos including: Burrowing Owls, Meadowlarks, and Lark Buntings. One predation event on Burrowing Owls was captured on video and camera along with various nighttime sightings of Burrowing Owls, coyotes, and jack rabbits.

1:50– 2:05 Talk 3..... Christa Day and Kimberli Harger
Advisor: Dr. Randy Craig, Associate Professor of Biology

Water purification using permanent magnetic fields

Families in underdeveloped countries travel miles every day to gather contaminated water. They have to boil their water to make it safe to drink. To make every day life easier an alternate energy less water purification system could be used. High powered magnetic fields have been shown to kill bacteria. A system of high powered magnets was set up to study the effects on local pond water and *E. coli*. At twelve hour intervals, water samples were cultured to quantify bacteria growth. With the pond water sample a decrease in bacteria was noted as time elapsed. However, due to outside complications, *E. coli* data could not be analyzed within reasonable error margins. It is obvious that magnetic fields have some effects on bacterial growth; however, more research is required to collect and validate data.

2:10 – 2:25 Talk 4..... Jarrett Ross and Libby Saultz
Advisor: Dr. Adam Reinhart, Professor of Biology and Chemistry

Development of a western blot assay of caspase-3 to indicate apoptosis in 4T1 breast cancer cells

Human breast cancer is the second leading cause of death in females worldwide. Surgery, radiation and chemotherapeutic treatments are most commonly used to fight breast cancer. Previous studies have identified a number of plant extracts which are cytotoxic to the 4T1 breast cancer cell line, but the mode of death has yet to be elucidated. To test the hypothesis that the cells were dying through apoptosis, we have developed a western blot assay to determine the activity of a major mediator of apoptosis, the caspase-3 protein. Caspase-3 is synthesized as an inactive procaspase form (34 kDa) and activated through cleavage, yielding a smaller fragment (17 kDa). We have treated 4T1 cells for 12 or 24 hr with ethanolic extracts chosen through previous research and their ability to act as anti-inflammatory agents. We extracted proteins and size fractionated them using SDS-polyacrylamide gel electrophoresis. The proteins were then transferred using an electroblotter to an immobilon-P membrane. The membrane was washed, blocked in 5% nonfat milk and incubated with an antibody raised in rabbit against caspase-3. The blot was then washed and reprobbed with a secondary antibody conjugated to alkaline phosphatase enzyme, and developed using a BCIP/NBT staining procedure. Through these procedures we were able to visualize full length procaspase and the cleaved 17 kDa fragment of caspase-3 protein. By analyzing the caspase-3 bands (34 and 17kDa), the presence and activity of caspase-3, and thus apoptosis can be determined in response to a wide range of treatments applied to 4T1 cells.

3:20 – 3:35 Talk 5..... Jacob Kemmer
General Biology Class Project Advisor: Dr. Andrew Kasner, Associate Professor of Biology

Effects of fish color on zebrafish school preference

This experiment was performed to determine whether zebrafish showed schooling preference, if any, for fish schools of the same color over fish schools of different color. To test this, we placed individual wildtype zebrafish in the middle of a divided aquarium with a wildtype school on one side and a GloFish school (genetically modified to exhibit fluorescent color) on the opposite side. We recorded the amount of time (out of 5 minutes) each individual wildtype zebrafish spent nearest the 2 fish schools. In a second experiment, we placed a mixed school of wildtype and GloFish in one of the sides and wildtype school in the other side and recorded the time individuals spent nearest each school. In both experiments, individual wildtype zebrafish spent significantly more than half of the allowed 5-minute time nearest the side of the aquarium with the wildtype school. Thus, wildtype zebrafish in our experiment exhibited a strong preference for the wildtype school.

3:40 – 3:55 Talk 6..... Jacob Hinojosa and Jenna Wilson
Cell and Molecular Biology Class Project Advisor: Dr. Adam Reinhart, Professor of Biology and Chemistry

Using a single-nucleotide polymorphism to predict bitter-tasting ability

It has been understood that humans have the capability to differentiate from five tastes: such as sour, bitter, umami (the taste of monosodium glutamate), salty and sweet. The four basic tastes of sweet, sour, salty and bitter have been widely recognized for hundreds of years, but it wasn't until the 1980's that various studies proved that umami, found in glutamate, actually constituted a legitimate fifth basic taste. Although the TAS2R38 gene varies within the human population, numerous people do have receptors for L-glutamate. The tasting allele is different from the non tasting allele by a single nucleotide polymorphism which produces an HaeIII restriction site for people who can taste PTC. In order to determine the tasting ability of eight different students, a sample of cells were obtained from each student by saline mouthwash. DNA was then extracted from cell samples by boiling them in Chelex resin, which binds contaminating metals ions. Polymerase chain reaction (PCR) was then use to amplify a short region of the TAS2R38 gene. Next, the amplified PCR product was digested with the restriction enzyme HaeIII. Later, the samples were electrophoresed through a 2% agarose gel, to determine if HaeIII enzyme cut the PCR produce for each student. The agarose gels were examined to determine genotype. Phenotypes were determined using a PTC taste test and compared with their genotypes.

4:00 – 4:15 Talk 7.....Rick Ross
Advisor: Dr. Emilia Moore, Assistant Professor of Mathematics

Basic graph theory: The three cannibals and three missionaries problem

As a part of my undergraduate research, I have been looking into the fundamentals of Graph Theory. One of these fundamentals is a problem entitled "The Three Cannibals and Three Missionaries Problem." This problem consists of three missionaries and three cannibals on a river bank. The goal is for all of the people to cross the river in a two person boat, however, the cannibals may not at any time outnumber the missionaries or they will be eaten. By using basic graph theory we will be able to look at this question and solve it in an optimal manner.

4:20 – 4:35 Talk 8.....Adam Hilliard
Advisor: Dr. Scott Franklin, Associate Professor of Mathematics

Comparing physical and mathematical models of a medieval trebuchet

In this project, two scale models of working trebuchets were built and tested with the main goal of determining the similarities and differences between a real scale model and a mathematical model. Specially designed software called Atreb was used to identify an optimal set of parameters including the release angle, mass of the counterweight, mass of the projectile, and length of sling. Performance data was collected using a video camera and was then compared to the output of the computer simulation. Using the computer simulation of the mathematical model, we were able to alter or change the values to obtain the most effective trebuchet within our design parameters.

Abstracts for Research Day Posters

Poster Sessions: 2:30-3:15pm and 4:40-5:15pm – See map of poster locations on last page of program

Attendees are invited to view the research posters and discuss the research project with the authors. The students involved with the project will stand near the poster during this session and answer any questions.

Poster 1..... Jeffrey Coleman and Hailey Budnick
Advisor: Dr. Robert Moore, Assistant Professor of Chemistry

Relationships of obesity and child poverty with four health indicators

Relationships between specific health issues have become a popular topic within the scientific community and the general public. In the research conducted, children in poverty and prevalence of obesity were compared with four health indicators: cancer deaths, cardiovascular deaths, infant mortality rate and teen pregnancy. The data evaluated was collected from America's Health Rankings, and contained information from years 1990-2010, in states Louisiana, Oklahoma, Mississippi, and Arkansas. The relationships between child poverty with teen birthrates and infant mortality, suggested an observed correlation. It was also noted the data from obesity (%) with cardiovascular deaths and teen pregnancy suggested an observed correlation.

Poster 2..... Rosemary Ribera
Advisor: Dr. Gary Gray, Professor of Chemistry

Purification and characterization of 4T1 murine breast cancer cell cytotoxin from *Withania somnifera*

Withania somnifera (Ashwagandha), a herb used in Ayurvedic medicine, contains bioactive plant steroids. Previous work in our laboratory identified and partially characterized a compound from *W. somnifera* with cytotoxic effects on 4T1 murine breast cancer cells. The objectives of this study were to improve methods for purification and further characterize this compound. Powdered root was rinsed with hexane to remove lipids, dried, and subjected to methanol Soxhlet extraction for 6 h. The resulting extract was concentrated and slurry absorbed onto silica gel. After washing the gel slurry, adsorbed material was eluted with chloroform-methanol and resolved into multiple bands via silica gel TLC. Bands on TLC plates were scraped, eluted in DMSO and analyzed via UV-visible spectroscopy, HPLC and mass spectrometry. Cytotoxicity of eluted TLC bands was determined using MTS assays on cell cultures of 4T1 cells. Commercially available Withaferin A and a single TLC band were observed to cause 4T1 cell death. HPLC and MALD-MS analysis revealed the band to contain a steroidal species (molar mass of 493.231). Additional characterization of the active component is ongoing.

Poster 3..... Christa Day, Patrick Hernandez, and Stephanie Whitaker
*Biochemistry Class Project Advisors: Dr. Robert Moore, Assistant Professor of Chemistry
Dr. Adam Reinhart, Professor of Biology and Chemistry*

Isolation and characterization of mushroom tyrosinase from various anatomical regions of *Agaricus bisporus*

Tyrosinase is an enzyme involved in pigmentation of plant and animal cells via the oxidation of tyrosine to melanin precursors. Its wide availability in mushroom makes mushroom tyrosinase a common enzyme for study for cosmetic purposes for individuals with skin coloration disorders. In order to determine the region in which mushroom tyrosinase is most concentrated and to determine if all mushroom tyrosinase is equivalent, samples of the mushroom *Agaricus bisporus* were dissected into four anatomical regions: the cap, cap skin, gills, and stalk. These regions were homogenized into liquid extracts and centrifuged. Activity in the extracts was verified by colorimetric change following the addition of L-DOPA to a sample of each. Kinetic parameters were determined by measuring diphenol oxidase activity with the substrate L-DOPA via monitoring dopachrome formation at 475 nm. These parameters were then compared to those obtained from manufacturer-produced mushroom tyrosinase to estimate actual enzyme concentrations and to distinguish isoforms.

Poster 4..... Ivy Sustaita

Advisor: Dr. Andrew Kasner, Associate Professor of Biology

Effects of land use on playa invertebrate richness and abundance

The purpose of this study was to determine landscape level patterns of invertebrate richness and abundance in 8 playas of the Southern High Plains in Floyd and Hale Counties, Texas. Invertebrates were collected from 20 July 2010-21 July 2010 from 8 playas surrounded by landscapes with different land uses. Land uses included urban (2 playas), grazed pasture (2 playas) and Conservation Reserve Program grasslands (CRP; 4 playas). Invertebrates were collected using dip net (30.5 cm diameter, 800x900 micron) sweeps and a hand-tossed plankton tow net (25.4 cm diameter, 400 micron; towed for 8 meters) and identified to family. Water chemistry was measured in the field (temperature, secchi transparency, pH) and samples were collected and measured in the lab (dissolved oxygen, hardness). Water chemistry in playas ranged as follows: temperature 23-29°C, pH 7.0-9.0, dissolved oxygen 5-10 mg/L, hardness 51.369-102.739 mg/L. Urban playas had the lowest total invertebrate richness (13 species), followed by grazed playas (16 species), with CRP playas having the highest richness (25 species). Richness was also lower in playas with obvious sources of pollution (urban and agricultural runoff). Grazed and CRP playas had multiple families of aquatic Coleoptera, but urban playas had only one family represented. Taxonomic diversity was also high for Odonata and Hemiptera in CRP playas compared to grazed and urban playas. Our results suggest that land use may be a determining factor in patterns of playa invertebrate diversity in the Southern High Plains.

Poster 5.....Cody McClary, Victoria Chavez, and Demetrice Gilliam

Advisor: Dr. Herb Grover, Professor of Biology

Variability in seed viability between honey locust (*Gleditsia triacanthos L.*) trees on the Wayland Baptist University campus, Plainview, Texas

In this study seed germination data was collected for seeds from six honey locust (*Gleditsia triacanthos L.*) trees located on the main campus of Wayland Baptist University. The seeds were collected in the fall of 2010 by a general ecology class, who did a study on tree-to-tree variability in seed pod and seed production. The main goal of our study was to determine if there was a difference in seed viability between trees. Seeds collected in the fall of 2010 were harvested from their seed pods and only the apparently viable seeds were kept. Apparently viable seeds were then pretreated by soaking in the concentrated sulfuric acid. With the exception of 2 trees, for which seed supply was limited, there were at least 100 seeds for each tree for the study. Seeds were placed in a germination chamber and the numbers of seeds that germinated was recorded over a 9 day period. Based on total percent germination, the six trees included in this study fell into three groups of two trees each. The first group ranged from 51%-53% germination, the second group ranged 23%-28% germination, and the third group ranged 1%-5% germination. Our data also suggested an inverse relationship between the total number of seeds produced and the total number of apparently viable seeds per tree. No correlation was found between percent germination and the number of apparently viable seeds, or percent germination and the total number of seeds produced per tree. The results of this research will be used to refine further research on the reproductive biology honey locust.

Poster 6.....Josh Lucas

Advisor: Dr. Herb Grover, Professor of Biology

Variability in seed pod and seed production between honey locust (*Gleditsia triacanthos L.*) trees on the Wayland Baptist University campus, Plainview, Texas

This study quantified variability in seed pod and seed production between Honey Locust (*Gleditsia triacanthos L.*) trees on the campus of Wayland Baptist University in Plainview, Texas. The study was conducted as part of the laboratory requirements for a course in general ecology in the fall, 2010, semester. Eight trees were selected for the study based on their location and evidence of seed pod production. Ten, 0.5 m² permanent quadrats were located in a radial pattern extending from the trunk to the canopy edge under each tree selected for study. Pods were collected weekly from each tree for nine weeks beginning in mid-September. Data collected included number of seed pods, number of seeds per pod, and number of seed compartments per pod. The results of this study indicate that trees could be separated into two groups, 2 high-yield and 6 moderate-yield trees; a high-yield group producing per-tree, per-collection averages of 3.95 pods, 36.58 seeds, and 62.70 seed compartments; and a moderate-yield group producing per-tree, per-collection averages of 0.90 pods, 8.55 seeds, and 14.21 seed compartments. Field observations confirmed a third group of Honey Locust trees - those that produced no pods. These findings may corroborate the reported polygamo-dioecious character of this species; a finding that will be discussed in greater detail in our presentation.

Poster 7.....Tana Saul

Advisor: Dr. Herb Grover, Professor of Biology

Seed germination requirements for honey locust (*Gleditsia Triacanthos L.*)

Honey Locust (*Gleditsia triacanthos L.*) is native to the eastern deciduous forests of North America and is commonly grown as a shade tree in communities throughout the region. It is known for its rapid growth, dense wood, and drought hardiness. Although there are many honey locust trees growing on the campus of Wayland Baptist University in Plainview, Texas, we noticed that seedlings were seldom observed, even though seed production was abundant from many trees. For this study, seeds of honey locust were collected from trees located on or near the Wayland campus. The seed coats of this species are known to be resistant to imbibition and it has been suggested that seed germination in nature is favored by ingestion and exposure of the seeds to stomach acid. We examined the effects of boiling water, hydrogen peroxide, and mechanical and acid scarification treatments prior to imbibing the seeds to confirm that seed coat impermeability was effective in delaying seed germination. Seed germination was less than 10% for all treatments except acid scarification (soaking the seeds in concentrated sulfuric acid for one hour), which yielded germination percentages in the range of 48%. Additional studies examining the effect of temperature and hormone treatments on seed germination were conducted and will be included in our presentation as well.

Poster Locations

