



# Program

### Research Day Committee Members

Dr. Scott R. Franklin, Associate Dean  
 Dr. Joel Boyd, Associate Professor of Chemistry  
 Dr. Tim Walsh, Associate Professor of Geology

Dr. Andy Kasner, Associate Professor of Biology  
 Dr. Robert Moore, Adjunct Professor  
 Mr. Zach Hawkins, President of Pi Sigma Sigma

### 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 ..... <i>Dr. Scott R. Franklin</i>
1:10 – 1:25	Talk 1..... <i>Tonia M. Perez</i> <b>Solar Photocatalytic Disinfection</b>
1:30 – 1:45	Talk 2..... <i>Zackery Gibson</i> <b>On the Deployment of a Low Cost Computational Cluster for Integration in Undergraduate Education</b>
1:50 – 2:05	Talk 3..... <i>Hailey Clark</i> <b>Isotopic Analysis and Paleoenvironmental Interpretation of the Plainview Archeological Site</b>
2:10 – 2:15	Break
2:15 – 4:00	Poster Session (MSB First Floor Hallway) See Poster Abstracts on page 4 for details
4:00 – 4:15	Talk 4..... <i>Jarrod Alford, Zackery Gibson and Clayton Miller</i> <b>To Jump or Not to Jump</b>
4:20 – 4:35	Talk 5..... <i>Aaron Anderson, Luke Ingraham and Stephanie Whitaker</i> <b>Gas Chromatographic Evaluation of Febreze as an Odor Eliminator</b>
4:40 – 4:55	Talk 6..... <i>Adam Hilliard, Jarrod Lindsey, Victor Martin, and Corben Waters</i> <b>The Collapse of the Galloping Gertie</b>
5:00 – 6:30	Dinner and Awards Ceremony for Participants (Multipurpose Room)

***A special thanks to Pi Sigma Sigma for providing the refreshments!***

## Abstracts for Research Day Talks

1:10 – 1:25      Talk 1..... *Tonia M. Perez*  
*Advisor: Dr. Joel Boyd, Associate Professor of Chemistry*

### **Solar Photocatalytic Disinfection**

A technique known as solar photocatalytic disinfection was investigated to assess the effectiveness in removing both chemical and biological contaminants from drinking water. Poly(methyl methacrylate) (acrylic) and polyethylene terephthalate (PET) bottles each with and without an internal layer of titania photocatalyst, were compared for their ability to sterilize *E. coli* K-12, and degrade methyl orange and the algal toxin Microcystin-LR. The bottles contained 650 mL of water for each experiment. Both the coated and uncoated acrylic bottles inactivated 3,000,000-5,000,000 colony forming units per mL of *E. coli* within 40 min of sunlight exposure. Five hours of sunlight were sufficient to reduce a 10 ppm concentration of methyl orange by 61 % using the titania coated acrylic bottles. Using the acrylic-titania bottle, an 87 ppb solution of aqueous Microcystin-LR was reduced by 70 % after 7 hours of solar illumination. The UV transparency of the acrylic materials is significantly greater than that of the PET bottles used, making acrylic bottles an extremely attractive alternative to the PET bottles that are conventionally used for solar disinfection of microbiologically contaminated water. The addition of a photocatalytic titania layer to the bottle interior provides the capability for the degradation of chemical contaminants which is lacking in ordinary solar disinfection applications designed solely for microbial inactivation.

1:30 – 1:45      Talk 2..... *Zackery Gibson*  
*Advisor: Dr. Scott R. Franklin, Assistant Professor of Mathematics*

### **On the Deployment of a Low Cost Computational Cluster for Integration in Undergraduate Education**

Present-day applied mathematics and engineering depends heavily on computer modeling on high end computational systems. A quality educational program for students planning on careers in these areas should introduce them to such technologies. Utilizing recycled CPUs and open source software, known as ROCKS, we were able to assemble at low cost a computational cluster to integrate high performance computing into Wayland Baptist University's undergraduate curriculum. We designed the system with the following expectations and goals: to teach students how to perform parallel computational tasks, to provide students with a learning environment for high performance computing, to provide a test bed for parallel code that might run on more advanced systems, and to deploy bioinformatics tools available through the Bio Roll included in the ROCKS software. Upon deployment of the system, we developed programming skills in C and created basic code for parallel processing using the Message Passage Interface, or MPI. We then used tools available in the ROCKS Bio Roll which allow for genetic sequence alignment: NCBI BLAST (serial) and MPI BLAST (parallel). We executed both packages and compared timings for small scale BLASTS and large scale genome wide reciprocal BLASTS. Comparisons were made between the plant gene sequences of Cotton (*Gossypium arboreum*), Poplar (*Populus trichocarpa*), and Thale Cress (*Arabidopsis thaliana*). Following the completion of this project, Wayland Baptist University will be equipped with the resources to introduce mathematics and engineering students to high end computational systems and their use of those technologies.

1:50– 2:05      Talk 3..... *Hailey Clark*  
*Advisors: Dr. Tim Walsh, Associate Professor of Geology and Dr. David Schmidt, Assistant Professor of Geology*

**Isotopic Analysis and Paleoenvironmental Interpretation of the Plainview Archeological Site**

The Plainview Site, an ancient bison kill site, in Plainview, Texas is an area of interest to those studying ancient taxa of the region, and how the indigenous peoples of the Pleistocene Epoch lived. Since the original excavations in 1945, extensive quarrying has destroyed the original site. A nearby quarry (caliche pit) approximately a quarter of a mile downstream from the original site presented an ideal location for geochemical analysis. This study is a preliminary stable isotope investigation to interpret paleoclimatic and paleoenvironmental conditions. Stable carbon and oxygen isotope values were obtained from carbonate and organic samples collected at stratigraphic intervals equivalent to the original kill site. Results from isotopic data of carbonate nodules, paleosols and fossil molluscs assisted in the interpretation of the paleoenvironment. This investigation is supplemented by sedimentological and paleontological data as well as previous studies of the Plainview Kill Site.

4:00 – 4:15      Talk 4.....*Jarrod Alford, Zackery Gibson and Clayton Miller*  
*Advisor: Dr. Scott R. Franklin, Assistant Professor of Mathematics*

**To Jump or Not to Jump**

If you have ever been bungee jumping, the first thought that comes into your mind before you jump is "What if the cord is too long?" Using a simple model involving the jumper's weight, air resistance, and the flexibility of the cord, we produce and solve a differential equation that not only tells how long the cord must be, but can also calculate how much time the jumper is in free fall and even the top speed of descent. We expand this model to include bungee cords of varying strengths and to take into account jumpers of different weights. The facilitators of bungee jumping attractions must make similar calculations and include all of these factors in order to avoid accidental injury and death, as well as the lawsuits that come with them.

4:20 – 4:35      Talk 5.....*Aaron Anderson, Luke Ingraham and Stephanie Whitaker*  
*Advisor: Dr. Joel Boyd, Associate Professor of Chemistry*

**Gas Chromatographic Evaluation of Febreze as an Odor Eliminator**

The ability of Febreze fabric refresher to eliminate or alter chemical odors was investigated using gas chromatography. The chemical odors that were used include  $\beta$ -Mercaptoethanol, ethylamine, and pyridine.

4:40 – 4:55      Talk 6.....*Aaron Anderson, Luke Ingraham and Stephanie Whitaker*  
*Advisor: Dr. Joel Boyd, Associate Professor of Chemistry*

**The Collapse of the Galloping Gertie**

The purpose of our research is to exemplify the main problem dealing with the collapse of The Tacoma Narrows Bridge. The bridge collapse was quite a predicament in 1940. What caused the strange oscillations in the bridge? How have today's engineers learned to compensate for the unexpected behaviors of structures? Analytical models are used to understand this phenomenon. The approach is to take two different equations. The first equation took into account the mass of the cables, its compressions, stretching, and the force due to the wind. The second included a damping constant, and acceleration due to gravity. After we find these two equations we apply many different initial value conditions. Plotting the solutions will generate a curve describing the oscillations of the bridge. We then determine what caused the bridge to oscillate and collapse. The two models are also compared to show which better describes the motion of the bridge. From our results we see that since dampening and acceleration due to gravity were not taken into account in the construction of the Tacoma Narrows Bridge, the structural integrity was compromised. We also see that the second differential equation is better qualified to illustrate the motions and forces applied to the bridge.

## Abstracts for Research Day Posters

The poster session takes place from 2:15 – 4:00. For those unfamiliar with a poster session, students have prepared a presentation of their project for display on a large poster. Attendees are invited to view the 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 you might have.

(A map of the poster locations is included following the abstracts.)

Poster 1.....Tonia M. Perez

Advisor: Dr. Joel Boyd, Associate Professor of Chemistry

### Photocatalytic Enhancement of the SODIS Method

The conventional solar water disinfection (SODIS) method was modified with the solvent deposition of a Titania layer to the interior surfaces of 650 mL acrylic and polyethylene terephthalate (PET) bottles. Both the coated and uncoated acrylic bottles removed 3,000,000-5,000,000 colony forming units per mL of E. coli within 40 min of sunlight exposure. The addition of the Titania layer to both PET and acrylic bottles increased the degradation of chemical contaminants which is minimal with the conventional SODIS approach. The UV-transparency of the acrylic materials is greater than that of the PET used, resulting in dramatically faster SODIS and modified SODIS degradation/inactivation rates. The titania-coated acrylic bottles effectively reduced the methyl orange concentration in a 10 ppm aqueous solution by 61% after 5 h of solar illumination. An initial 87 ppb solution of aqueous Microcystin-LR was reduced by 70 % after 7 h of solar illumination in an acrylic-titania bottle.

Poster 2.....Elida G. Arsiaga

Advisor: Dr. Joel Boyd, Associate Professor of Chemistry

### Photocatalytic Degradation of Algal Toxins

TiO<sub>2</sub> photocatalysis was investigated as a means of degrading the algal toxins, anatoxin-a (ATX) and microcystin-LR (MLR). A compact fluorescent blacklight was used to illuminate titania-acrylic coil-shaped reactors for all experiments. The reactors were constructed with a uniform layer of photocatalytically active titania on the interior surfaces of the reactor. 850 mL of 170 ppb ATX was completely degraded within 300 min in the acrylic-titania coil reactors. 850 mL solutions of MLR with initial concentrations of 93 ppb were successfully degraded within 540 min in the acrylic-titania coil reactors.

Poster 3.....Kasandra Hughes

Advisor: Dr. Gary Gray, Professor of Chemistry

### Partial Characterization of a 4T1 Cell Cytotoxin from *Withania somnifera*

*Withania somnifera* (Ashwaganda), and herb commonly used for Ayurvedic medicine, is known to contain bioactive plant steriods. Powdered root was rinsed with Hexane to remove lipids, dried and subjected to Methanol soxhlet extraction for 6 hours. The resulting extract was resolved into multiple bands via silica gel TLC. Bands on TLC plates were scraped, eluted in DMSO and analyzed using HPLC. Eluted bands were also tested on cytotoxicity using MTS Assays on cell cultures of 4T1 breast cancer cells. Withaferin A and Withanolide A had no effect on 4T1 cells. However, 4T1 cell death was observed with a single band eluted from TLC plates. HPLC and subsequent MALD-MS revealed the single band to contain a single steroidal species with a molar mass of 493.231. Additional characterization of the active component is ongoing.

Poster 4.....*Aaron Anderson*  
*Advisors: Dr. Tim Walsh, Associate Professor of Geology and Dr. David Schmidt, Assistant Professor of Geology*

**South Tule Creek Road Cut; Field Studies and Interpretation of Depositional Environments**

Three miles east of Tulia, Texas, a road cut south of South Tule Creek exposes Tertiary sedimentary strata. This section was measured and described in detail to interpret possible depositional environments. The strata consist of alternating paleosols interbedded with the Lava Creek B ash bed. Within the paleosols, cross-beds and burrows were found, and many of the burrows extend through the Lava Creek B ash. This suggests that the sediments above the ash and the ash were contemporaneously unconsolidated. Based on sedimentological data, probable depositional environments of the original sediments include lacustrine, fluvial or eolian systems.

Poster 5.....*Jarrod Alford, Daniel Ballinger, Cody Detweiler and Erika Raymond*  
*Advisor: Dr. Robert Moore, Adjunct Professor*

**Possible Causes of Global Warming**

The increase in average global temperature has become a serious concern over the past decade. The start of this global warming and its continuation is believed to be caused by increasing concentrations of greenhouse gases through burning fossil fuels, by-products of industry, even natural phenomena. In this study we evaluated if certain factors such as CO2 emissions, gas consumption, coal consumption, and sunspots could be causes for the steady rise in the average global temperature. Comparing historical data of each of the factors to average global temperatures, CO2 emissions, coal consumption, gas consumption and sunspots showed a correlation with rising temperatures.

Poster 6.....*Catherine Leubner, Corrine Martin, Ivy Sustaita and Maria Hurtado*  
*Advisor: Dr. Robert Moore, Adjunct Professor*

**Effects of Global Warming**

Data sets from natural disasters, water levels, and tree rings were compared to yearly mean temperatures across the globe to determine if there is correlation between them. We found that as global mean temperatures increase, natural disasters have become more prevalent as a whole. While yearly named storms and hurricanes have increased over the past century earthquakes with a magnitude greater than 7.0 however, have generally decreased. These unusual weather patterns, along with thermal expansion and melting ice caps, are leading causes of sea level increases. Although increases in global temperature affect climates around the world, temperature increases do not have a significant effect on tree growth, as observed by tree ring studies.

Poster 7.....*Ivy Sustaita and Jessica Poole*  
*Advisor: Dr. Herb Grover, Professor of Biology*

**Effects of temperature on seed germination**

For our experiment we wanted to examine the effect of temperature on various types of seeds such as maize, peas, and spring wheat. If temperature was the main cause for seed germination then more seeds would germinate in a certain temperature. Seeds were obtained through WBU's Biology Department stock and were imbibed for 8 hrs. We placed 20 pea, 25 maize, and 25 wheat seeds into their respective 9 cm petri dishes that had two layers of filter paper. We then placed 10 ml of RO water in each petri dish and made five replicates for each temperature. The temperatures we tested our dishes in were 40, 55, 75, and 95 degrees. For maize and peas 75 degrees was the optimum temperature for germination. Spring wheat germinated about the same number of seeds for every temperature but 95 degrees.

Poster 8..... *Tana Saul and Kimberley Stafford*  
*Advisor: Dr. Herb Grover, Professor of Biology*

### **Scarification Effects on Germination of *Gleditsia triacanthos* (Honey Locust)**

Scarification Abstract In this project, we used different methods of scarification to promote germination in Honey Locust seeds. Scarification is the process of softening the seed coat in order to encourage germination. Seedpods were collected on campus and other various places around town. After shelling the pods to obtain the seeds, the different scarification techniques were applied. Some seeds were placed in water that was almost boiling and allowed to imbibe in the water until it cooled to room temperature. Other seeds were scarified using a file to scratch the seed coat and were imbibed for 6 hours. Another group of seeds were soaked in sulfuric acid for 1 hour and then imbibed in water for 6 hours. The last group of seeds was soaked in 3% hydrogen peroxide for 2 ½ hours and imbibed in water for 3 hours. We found that after 4 days, mechanically filing the seeds or soaking them in sulfuric acid had the highest germination rates, with germination percentages of 48% (filing) and 46% (acid). Hydrogen peroxide had the lowest germination rate with zero seeds germinating after 5 days.

Poster 9..... *Jacob Hinojosa and Andrew Pruitt*  
*Advisor: Dr. Herb Grover, Professor of Biology*

### **Effects of ABA on seed germination**

We experienced the effects of varying Abscisic Acid (ABA) concentrations on the seed germination of peas, cotton, maize, wheat, and honey locust. The experiment involved placing a pre-determined number of seeds to five different petri plates each containing a different concentration of ABA. After researching the effects of ABA on seeds, we anticipated that as the strength of ABA increased, the greater the inhibition of the seed germination. The honey locust seeds were retrieved from the city grounds, while the other seeds were provided by the science department. The seeds were first imbibed from 8-50 hours, depending on the seed type, and then separated into the different petri plates with concentrations of ABA. The nine centimeter petri plates contained two layers of filter paper before adding ABA and then the seeds. Ten milliliters of each concentration of ABA were added to the plates, the concentrations used were 1uM, 5uM, 10uM, and 20uM. All the plates were placed in a seventy five degree growth chamber and monitored at the same times over the next several days for seed germination. The results indicated that for each concentration there was germination but as the concentration increased more inhibition occurred and less seeds were able to germinate. After researching the inhibiting effect of ABA on seed germination, our anticipated results became the actual results.

Poster 10..... *Beronica Griego and Victoria Chavez*  
*Advisor: Dr. Herb Grover, Professor of Biology*

### **Effects of Gibberellic Acid on Seed Germination**

The Effects of Gibberellic Acid on Seed Germination The experiment was performed to examine the effects of gibberellic acid on seed germination on the following species: wheat, cotton, maize, and peas. The study began by obtaining seeds from stock in the Biology department and imbibing them in water for six hours. Next, they were placed in germination chambers (depending on the species either twenty or twenty-five seeds) consisting of a nine centimeter Petri dish with two layers of filter paper and ten millimeters of gibberellic acid solution of either 1, 5, 10, or 20 micromoles. Water was used as a control. Subsequently, all Petri dishes were placed at 75 degrees Fahrenheit and the number of germinated seeds for each species was recorded daily. The hypothesis was stated to be that gibberellic acid would stimulate seedling growth at increased concentrations and decreased at lower concentrations of the solution. The major results indicated where that all wheat seeds germinated at about the same average as the control and cotton seeds increased with the increased concentrations of the solution. The species of maize also germinated at high concentrations but leveled off at higher concentrations; whereas, pea seeds grew at averaged concentrations and decreased at higher concentrations. In conclusion, gibberellic acid enhanced seed germination in all of the species at a reasonable average at low and high concentrations of the acid.

# Poster Locations

