



School of Mathematics and Sciences

6th Annual Spring Research Day - April 24th, 2015



1:00 - 1:10 Welcome Address and Acknowledgments ...Drs. Franklin, Parker, and Thornhill

1:10 - 1:25 Presentation 1.....Sharon Robinson et al.

“Salt addiction is gender specific in satisfied athletes: Male athlete displays signs of salt addiction while female athlete avoids salty foods”

1:25 - 1:40 Presentation 2.....Ashley Rivera

“Social interaction prevents salt addiction in group-housed animals”

1:40 - 1:55 Presentation 3.....Jake Brozek et al.

“Episodes of repeated dehydration induce hypothalamic gene expression plasticity I: Transient receptor potential cation channel (TRPV4) and vasopressin (AVP) transcripts”

1:55 - 2:10 Presentation 4.....Catherine Wiechmann et al.

“Episodes of repeated dehydration in rats induce hypothalamic gene expression plasticity II: sodium channel, voltage-gated, type I, alpha subunit (Scn1a), rabaptin, RAB GTPase binding effector protein 2 (Rabep2), jun proto-oncogene (Jun), and interleukin 1 alpha (Il1a)”

2:10 - 2:25 Presentation 5.....Jessica Kenneson

“Examining binding affinity of RecA to mutation sites known to cause drug resistance in Mycobacterium tuberculosis with a homemade DSLR documentation system”

2:25 - 2:40 Presentation 6.....Krista Duffield et al.

“Soxhlet extraction of capsaicinoids from habanero, piquin, and serrano peppers”



2:40 - 4:35 Poster Session

- 4:35 – 4:50 Presentation 7.....Lauryn Bruggink
*“Winter habitat occupancy by longspur (*Calcarius Spp.*) and other grassland birds, in Hale and Floyd County, Texas”*
- 4:50 – 5:05 Presentation 8.....Victoria Solis
*“Habitat use by ladder-backed woodpecker (*Picoides scalaris*) in the Caprock Canyonlands in Floyd County, Texas”*
- 5:05 – 5:20 Presentation 9.....Trudi Cooke
“Meso-mammal presence and habitat associations of bobcats and American porcupine”
- 5:20 – 5:35 Presentation 10.....Kaylee Lawrence
“Hydroclimatological and environmental factors affecting volume fluctuation of Lake Theo, Caprock Canyons State Park, Texas”
- 5:35 – 5:50 Presentation 11.....Thomas McElwain
*“Purification of components from *Inula helenium* (elecampane) which are cytotoxic to the 4T1 murine breast cancer cell line”*
- 5:50 – 6:05 Presentation 12.....Emileigh Willems
“Coloring graphs, $G^{3/n}$, with fractional powers”
- 6:30 - 8:00 Dinner and Awards Ceremony (Multipurpose Room)**



Research Day 2015 - Posters

- 1) Rivera, A.M.; Kelly, S.C.; Kenneson, J.R.; McCutcheon, R.T.; McElwain, T.E.; Capps, D.W.; Reinhart, A.J.; Gray, G.O.

“4T1 murine breast cancer cell cytotoxins in Rumex crispus (Yellow Dock)”

- 2) Capps, D.W.; Kenneson, J.R.; Moore, R.L.

“Newly established documentation and imaging system detecting DNA hybridization serves as a potential POC device”

- 3) Brozek, J.A.; Gonzales, K.; Patch-Bradley, M.

“Discovering trends in the %GC content of extremophile DNA sequences”

- 4) Riza, C.; Pruett, C.; Aguilera, N.; Tavares, J.

“Exploring the possibilities of DNA mutations”

- 5) Davis, A.; Farrington, B.; Rohlf, A.; Willems, E.

“Analyzing GC% by position on the genome in pathogens”

- 6) Kenneson, J.; Taylor, M.; Moore, R.

“Challenges in visualizing RecA-DNA interaction in chemiluminescent electrophoretic mobility shift assays”

- 7) Kelly, S.; McElwain, T.E.; Rivera, A.M.; Kenneson, J.R.; Burrow, T.; Gray, G.O.; Reinhart, A.J.

“Purification of components from Inula helenium (Elecampane) which are cytotoxic to the 4T1 murine breast cancer cell line”

- 8) Avila, J. M.; Brown, J.; Capps, D.; Duffield, K.; Januta, J.; Kelly, S.; Kenneson, J.; McCutcheon, T.; McElwain, T.; Phillips, W.; Rivera, A.; Rosales, V.; Westerman, A.; Wiechmann, C.

“Kinetics of tyrosinase in various mushroom tissues”

- 9) Taylor, M.; Manning, C.; Morales, J.; Soriano, L.

“Gram-positive hemolytic bacteria in the oral cavity: Homo sapiens tend to display higher bacteria colony-forming units than Canis lupus”

- 10) Switzenberg S.; Jerome J.; Januta J.; Moreno C.; Pereira-Derderian D.T.B.

“Battle of the sexes: a comparison of gram-negative lactose-fermenting enteric bacteria collected from male and female bathrooms”

- 11) Savage, G.; Monreal, S.; Simpson, D.

“Analyzing and comparing the feces of different animals: Is all poop created equal?”

Abstracts for Research Day 2015 Presentations

1) ***"Salt addiction is gender specific in satisfied athletes: Male athlete displays signs of salt addiction while female athlete avoids salty foods"***. Robinson, S.; Phillips, W.; Derderian, D. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Increased salty food is seen in sodium-depleted human. Vigorous physical activities cause sodium depletion. Thus, we investigated if WBU athletes crave more salt rich foods than non-athletes. Four hundred ninety-one healthy college student volunteers completed a food survey. Pleasantness of twenty-nine foods was ranked from 0 (not pleasant) to 10 (extremely pleasant). Subjects endorsing either satiety (0-4 answer in a 0-10 scale) or hunger (5-10 answer) were divided by gender into two groups, athlete and non-athlete. Data was analyzed based on ranked food pleasantness and salt content (high, intermediate, or low). Satisfied female athletes [n=38] showed a decreased preference for ham ($4\pm 1^*$), bacon ($5\pm 1^*$), and peanut butter ($6\pm 1^*$) versus non-athletes (6 ± 0 , 7 ± 0 , 7 ± 0 , respectively) [n=104, *p<0.05]. Hungry female athletes [n=34] showed decreased preference for pickles ($5\pm 1^*$), peanut butter ($6\pm 1^*$), salad ($6\pm 0^*$), milk ($5\pm 1^*$), celery ($3\pm 1^*$), and carrots ($5\pm 1^*$) versus non-athlete (6 ± 0 , 7 ± 0 , 8 ± 0 , 7 ± 0 , 5 ± 0 and 7 ± 0 , respectively) [n=49]. Satisfied male athletes [n=69] have an increased preference for ham ($8\pm 0^*$) and spaghetti ($8\pm 0^*$) versus non-athlete [n=61] (6 ± 0 and 7 ± 0 , respectively). The male hungry athlete [n=80] has an increased preference for rice ($7\pm 0^*$) and orange ($8\pm 0^*$) versus non-athlete [n=41] (6 ± 0 and 7 ± 0), respectively). Results suggest that the satisfied and hungry female athlete avoids salty foods; the satisfied male athlete preferred salty foods; and the hungry male athlete craved foods rich in polysaccharide, protein, and vitamin C.

2) ***"Social interaction prevents salt addiction in group-housed animals"***. Rivera, A.M.; Perez, M.M.; Pereira-Derderian, D.T.B. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Social interaction positively drives reward behavior. Salt intake enhancement is a behavioral sensitization due to repeated sodium deficiency adaptation, like water deprivation (WD)-partial rehydration (PR)-sensitization in individually-housed (IH) animals. We investigated if repeated WD-PR would affect salt addiction in group-housed (GH) animals. Adult male Sprague-Dawley rats were GH (five/cage) or IH (one/cage) and had access to chow, water, and 0.3 M NaCl. Spontaneous salt intake was recorded for four weeks. Daily sodium intake in GH dep did not alter (3.9 ± 0.1 , 4.0 ± 1.1 , 4.9 ± 1.1 , 4.6 ± 0.7 mL/week, respectively). Daily salt intake in IH dep increased after the first WD-PR (1.7 ± 0.5 , $2.5\pm 0.7^*$, $3.3\pm 0.8^*$, $2.6\pm 0.6^*$ mL/week, respectively, *p<0.05). Blood biochemistry was similar between GH dep and GH non-dep (145 ± 1 Na⁺ mEq/L, 6.6 ± 0.1 K⁺ mEq/L, 7.3 ± 0.2 g% total protein, 289 ± 1 mOsmol/kg). Serum sodium decreased in IH dep compared to IH non-dep ($144\pm 1^*$ vs. 140 ± 1 Na⁺ mEq/L). The other parameters were similar between both groups (6.7 ± 0.2 K⁺ mEq/L, 6.8 ± 0.2 g% total protein, 288 ± 2 mOsmol/kg). All groups presented more taste bud open-pores ($62\pm 9^*$ %) than closed-pores (16 ± 3 %). There was no difference on open- or closed-pores between IH or GH groups. Stomach epithelium analysis (A=rosy, B=reddish, C=deep reddish, D=pinpoint ulcers) among groups showed similar pigmentation (IH dep: A/B=50%; IH non-dep: A=70%, B=30%; GH dep: A=30%, B=70%; GH non-dep: A=40%, B=60%). Thus, spontaneous sodium intake enhancement impairment in GH animals was not dependent on changes in blood homeostasis, taste bud pore count, or stomach pigmentation. Therefore, salt addiction in IH animals may be driven by long-term changes in the brain.

3) ***“Episodes of repeated dehydration induce hypothalamic gene expression plasticity I: Transient receptor potential cation channel (TRPV4) and vasopressin (AVP) transcripts”***. ¹Brozek, J.A.; ²Menani, J.V.; ²De Luca Jr L.A.; ³Chiavegatto, S.; ¹Pereira-Derderian, D.T.B. ¹School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA; ²Sao Paulo State University, Sao Paulo, Brazil; ³University of Sao Paulo, Sao Paulo, Brazil.

Repeated cycles of water deprivation-partial rehydration (WD-PR) induce body-fluid balance-associated behavioral changes, such as sodium intake enhancement. We investigated the effect of repeated WD-PR on hypothalamic gene expression of Trpv4, Trpv6, Avp, and Avp (Avpr1a, Avpr1b, and Avpr2) and oxytocin (Oxtr) receptors by quantitative real-time PCR. Adult male Holtzman rats (n=6-11/group) were individually housed with chow, water, and 0.3 M NaCl. Rats were subjected to zero, one, or three cycles of 36h WD followed by 2h PR (only water available) at 7-day intervals. Sodium appetite test was performed after each cycle (2h access to NaCl and water). The hypothalamus of partially rehydrated (pr) animals was dissected at the end of cycles zero (control), one (1WD-PRpr), or three (3WD-PRpr) of repeated WD-PR. In 3WD-PRpr, Avp transcripts were up-regulated 16 or 10 fold versus control or 1WD-PRpr, respectively (p<0.05). Oxtr, Avpr1a, Avpr2, and Trpv6 transcripts were down-regulated by -79, -70, -50, and -54%, in 3WD-PRpr versus control (p<0.05). In 1WD-PRpr, Oxtr and Trpv6 transcripts were down-regulated by -77 and -60% versus control (p<0.05). Hydrated (h) animals in which the hypothalamus was collected four days after cycles zero, one (1WD-PRh), or three (3WD-PRh) of repeated WD-PR were also evaluated. In 3WD-PRh, Trpv4 transcripts were up-regulated by 52% or 73% versus control or 1WD-PRh (p<0.05). Avp transcripts were up-regulated 1.8 fold in 3WD-PRh versus control (p<0.05). Our data suggest that repeated episodes of dehydration in male rats induce plastic responses in hypothalamic genes coding for osmotic pressure regulation (Avp, Avpr1a, Avpr2, and Trpv4).

4) ***“Episodes of repeated dehydration in rats induce hypothalamic gene expression plasticity II: sodium channel, voltage-gated, type I, alpha subunit (Scn1a), rabaptin, RAB GTPase binding effector protein 2 (Rabep2), jun proto-oncogene (Jun), and interleukin 1 alpha (Il1a)”***. ¹Wiechmann, C.; ¹Herrera, M.; ¹Westerman, A.; ²Menani, J.V.; ²De Luca Jr, L.A.; ³Chiavegatto, S.; ¹Pereira-Derderian, D.T.B. ¹School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA; ²Sao Paulo State University, Sao Paulo, Brazil; ³University of Sao Paulo, Sao Paulo, Brazil.

Repeated cycles of water deprivation-partial rehydration (WD-PR) induce body-fluid balance-associated behavioral changes, such as sodium intake enhancement. We investigated the effect of repeated WD-PR on hypothalamic gene expression of Ptn, Ddn, Tac3, Grm4, Syt9, nNOS, Nmu, Ntrk1, Plat, Crh, Crhr2, Il3ra, Il1a, Il6, Scn1a, Scn1b, cFos, FosB, Rabep2, Jun, Ywhag, and Ywhaz by qPCR. Adult male Holtzman rats (n=4-11/group) were individually housed with chow, water, and 0.3M NaCl. Rats were subjected to zero, one, or three cycles of 36h WD followed by 2h PR (only water available) at 7-day intervals. Sodium appetite test was performed after each cycle (2h access to NaCl and water). The hypothalamus of partially rehydrated (pr) animals was dissected at the end of cycles zero (control), one (1WD-PRpr), or three (3WD-PRpr) of repeated WD-PR. In 3WD-PRpr, Rabep2 and Jun transcripts were up-regulated by 6% and 42% versus 1WD-PRpr, respectively (p<0.05). Rabep2, Ptn, nNos, Plat, Syt9, and Crhr2 transcripts were changed by 72%, -91%, 61%, 21.4 fold, and 1.9 fold in both 3WD-PRpr and 1WD-PRpr versus control (p<0.05). Hydrated (h) animals in which hypothalamus was collected four days after cycles zero, one (1WD-PRh), or three (3WD-PRh) of repeated WD-PR were also evaluated. In 3WD-PRh, Il1a and Scn1a transcripts were up-regulated by 150% and 45% versus both 1WD-PRpr and control (p<0.05). Grm4 transcripts were down-regulated by -36% in 3WD-PRh and 1WD-PRh versus control (p<0.05). Our data suggest that repeated episodes of dehydration in male rats induce plastic responses in hypothalamic genes coding for neuronal excitability, survival, and inflammation.

5) ***“Examining binding affinity of RecA to mutation sites known to cause drug resistance in Mycobacterium tuberculosis with a homemade DSLR documentation system”***. Kenneson, J. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

A high-end DSLR camera was employed for analysis of protein-DNA interaction using chemiluminescent electrophoretic mobility shift assays (EMSAs) in order to study binding affinity of DNA repair protein, RecA, and selected Mycobacterium tuberculosis oligomers. Mini-format chemiluminescent, fluorescent, and large-format chemiluminescent EMSAs were used to determine percent RecA binding. Decrease in free DNA signal indicates RecA did bind to DNA, though a bound DNA band was not resolved in any of the three types of EMSAs. Future research will involve further examination of this protein-DNA interaction in order to determine why the complex is not migrating into the EMSAs. The culmination of the last three years of research has shown that the DSLR documentation system has a multitude of applications not known that could prove to be beneficial to many people.

6) ***“Soxhlet extraction of capsaicinoids from habanero, piquin, and serrano peppers”***. Duffield, K.; Rivera, A.; Sandoval, E. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

The Scoville Scale is a subjective scale obtained through individual taste tests that ranks peppers based on the amount of sugar water it takes to take the heat out of capsaicin extracted from a pepper. This test is performed on individuals, and is subject to variances in sensitivity and amount of heat receptors from person to person, causing it to lose representative aspects. Capsaicin is an alkaloid chemical that is the principal pungent constituent of hot peppers that are widely used as food additives. But how much capsaicin is contained in your average pepper, and is that relatable to the number of Scoville units assigned to each pepper? Capsaicin was extracted from serrano, habanero, and piquin peppers using a Soxhlet extraction. Each pepper extraction along with a capsaicin standard were dissolved in methanol and further characterized via HPLC (C18-0-75% methanol gradient over 45 min). The capsaicinoid masses were then compared and ranked based on percent of capsaicin by weight. It was predicted that, based on Scoville units, the Habanero pepper would have the most capsaicin content followed by the Piquín and Serrano peppers. Results showed that predictions were correct based on the Scoville scale. Using soxhlet extraction combined with HPLC methods demonstrates a more chemically analytical approach to determine how spicy peppers truly are.

7) ***“Winter habitat occupancy by longspur (Calcarius Spp.) and other grassland birds, in Hale and Floyd County, Texas”***. Bruggink, L. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Longspur species (Calcarius Spp.) populations are declining from habitat loss, however, there is no current literature on these species' wintering habitat associations. Understanding their wintering habitat would help the overall conservation efforts for this species. From December 2014-March 2015, 6 roadside point-count surveys were conducted at 20 sample points to determine the presence and habitat associations of longspurs and other grassland species in the agricultural landscape of Hale and Floyd counties, Texas. Preliminary results, show that sites with at least two categories of habitat heterogeneity have higher occupancy of longspurs than sites having only crop fields surrounding them. Presence and abundance of individual longspur species varied over the winter season. Finally, there does not appear to be any correlation between site characteristics and occupancy of other grassland bird species recorded.

8) ***“Habitat use by ladder-backed woodpecker (Picoides scalaris) in the Caprock Canyonlands in Floyd County, Texas”***. Solis, V.K. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Observations of Ladder-backed Woodpeckers (*Picoides scalaris*) in various tree species were recorded in Floyd County at a site located in Blanco Canyon, near Floydada, TX to determine the habitat associations of males and females. Transects were established and observation data was collected six times over the course of three weeks from March 13th to April 8th of 2015 with a total of 12 female sightings and 12 male sightings. Association with certain tree species and perch locations on trees were recorded for males and females to determine any differences in foraging habitat use. Males and females differed in the species of trees used for foraging. For male observations, 50% were in hackberry trees, 25% were in mesquite trees, 25% were in elm trees, 0% were in chinaberry or cottonwood trees. For female observations, 75% were in mesquite trees, 9% were in cottonwood trees, 8% were in hackberry trees, 8% were in chinaberry trees, and 0% were in elm trees. For perch location in males, 41% were on secondary limbs, 25% were on tertiary limbs, 17% were on canopy limbs, and 17% were on primary limbs. For female locations, 42% were on primary limbs, 33% were on tertiary limbs, 25% were on secondary limbs, and 0% on canopy limbs.

9) ***“Meso-mammal presence and habitat associations of bobcats and American porcupine”***. Cooke, T.H.; Kasner, A. C. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Surveying was done from April 2014 to February 2015 at a site in Briscoe County near Quitaque, Texas using automatically triggered cameras to identify the presence of meso-mammals, estimate relative meso-mammal abundance, and determine habitat associations of bobcat (*Lynx rufus*) and the American porcupine (*Erethizon dorsatum*). Cameras were active for 4 2 week trapping periods or 448 total trap nights (TN) on the 1,862 ha ranch resulting in 35 capture events (0.078 Meso-mammals/TN). Grey fox (37%) were the most relatively abundance species followed by porcupine (28%), coyote (20%), bobcat (6%), raccoon (6%), and badger (3%). Both the bobcat and American porcupine showed similar associations for higher percent of shrub canopy cover, distance from roads, lower elevation, and nearness to creek bed while porcupine showed addition associations for nearness to water source, and hardwood stand.

10) ***“Hydroclimatological and environmental factors affecting volume fluctuation of Lake Theo, Caprock Canyons State Park, Texas”***. Lawrence, K.; Walsh, T.R. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Lake Theo at Caprock Canyons State Park has visually fluctuated over the past few decades. In order to quantify volumetric changes, monthly Landsat imagery was obtained and analyzed with Image J software. The total monthly surface areas from 1999 to 2014 were determined and compared. Bathymetry was acquired with a sonar unit from a boat with 254 depth readings paired with GPS locations taken throughout Lake Theo. The topography surrounding Lake Theo was mapped by utilizing a rangefinder with a laser target. 634 points were recorded with slope distance, vertical inclination and horizontal azimuth. All of this data was combined in a 3D triangulated irregular network (TIN) model and used in conjunction with the spatial analyst tool in ESRI ArcMap 10.2 to calculate the monthly volumes of Lake Theo. Variables playing a role in volume fluctuation may include precipitation, ground water influx, evaporation rates, soil infiltration, siltation, water runoff and various biological factors. Soil type was examined to evaluated infiltration rates along with conducting several hydrologic stream flow tests on the streams affecting Lake Theo. Precipitation and climate history from the surrounding areas were analyzed primarily with data from the Texas Tech Mesonet System. Although a correlation between precipitation and lake volume may be present, other factors, especially ground water contribution and stream flow, play a large role in controlling lake volume in this area.

11) ***“Purification of components from Inula helenium (elecampane) which are cytotoxic to the 4T1 murine breast cancer cell line”***. McElwain, T.E.; Kelly, S.C.; Rivera, A.M.; Kenneson, J.R.; McCutcheon, R.T.; Gray, G.O.; Reinhart, A.J. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

The plant *Inula helenium* (elecampane), is a medicinal plant that is found widely throughout England. It has been used as a diuretic, antiseptic, skin cream and has been used in treating pulmonary diseases. Previous studies in our laboratory have shown elecampane to be toxic to 4T1 murine breast cancer cells. Powdered elecampane root powder was refluxed in dichloromethane for 1 hour, the dichloromethane was distilled off and the extract was resuspended in ethanol. The resulting ethanolic extract was size fractionated on a Sephadex LH20 column with 75% ethanol as the mobile phase and initially analyzed through absorbance at 280nm. Fractions from the column were assayed for cytotoxic effects on 4T1 cells. Cytotoxic fractions were further characterized using HPLC (solid phase: C18, mobile phase: 0-75% methanol gradient over 30 minutes). One peak was identified through HPLC from the most cytotoxic fraction. This peak was collected and further characterized using mass spectroscopic analysis (MALDI TOF). Based on the mass spectroscopic analysis, the most likely size of the cytotoxic molecule isolated through this study was determined to be 440g/mol. Further research is ongoing to identify this cytotoxic component of elecampane. Also planned is the use of soil analysis of the area to more effectively define the relationship between precipitation and lake fluctuations while considering lake bottom infiltration.

12) ***“Coloring graphs, $G^{3/n}$, with fractional powers”***. Willems, E.; Moore, E. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Mathematicians studying Graph Theory have invested a great deal of time in exploring graph colorings. Recently (2010), Moharram Iradmusa investigated and published a study concerning the chromatic number of fractional power graphs. His paper consists of a few valuable theorems and lemmas which find the chromatic number of specific fractional power graphs. Iradmusa concluded his investigation by stating a conjecture regarding the chromatic number of fractional power graphs.

Conjecture A(m): Let G be a connected graph with $\Delta(G) \geq 3$ and m be a positive integer greater than 1. Then for any positive integer $n \geq m$, $\chi(G^{(m/n)}) = \omega(G^{(m/n)})$ ([8], p. 1556).

Iradmusa proved some special cases of this conjecture. This paper intends to extend progress towards proving the conjecture by demonstrating that $\chi(G^{(3/n)}) = \omega(G^{(3/n)})$ when n is a natural number greater than 3. The proof to this claim requires four cases, $n = 4, 5, 6,$ and 7 , and is finished by repetitively utilizing a lemma provided by Iradmusa to inductively demonstrate that $\chi(G^{(3/n)}) = \omega(G^{(3/n)})$ for $n \geq 4$.

Abstracts for Research Day 2015 Posters

1) ***“4T1 murine breast cancer cell cytotoxins in Rumex crispus (Yellow Dock)”***. Rivera, A. M.; Kelly, S.C.; Kenneson, J.R.; McCutcheon, R.T.; McElwain, T.E.; Capps, D.W. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Rumex crispus (yellow dock), an herbal remedy used in Turkey and the Far East, has been shown to possess anti-microtubulin, anti-inflammatory, and antimalarial activity. It is used to treat constipation, diarrhea and eczema, and it has been shown to be cytotoxic and/or induce apoptosis in T47D, MDA-MB-231 and MDA-MB-436 breast cancer cells and other cancer cell lines. Studies in our laboratory have shown that plant species (e.g., Ginger, Turmeric) with anti-inflammatory activity have cellular components cytotoxic for 4T1 murine breast cancer cells. To our knowledge, the cytotoxicity of yellow dock against 4T1 cells has not been investigated. Yellow dock root powder was subjected to dichloromethane reflux (1 hr), and the resulting extract was resolved by Sephadex LH20 chromatography (75% ethanol). Fractions were pooled based upon UV-visible spectroscopic analysis (280 nm), and pooled fractions were assayed for 4T1 cell cytotoxicity (MTS assay). Pooled cytotoxic fractions were further characterized via HPLC (C18, 0-75% methanol gradient over 30 min). Six HPLC peaks were identified as cytotoxic to 4T1 cells (MTS assay). None of the six peaks co-migrated with emodin or chrysophanol, known bioactive components of yellow dock. Mass spectroscopic analysis (MALDI TOF) of the six HPLC peaks is shown in Table 1. None of the six HPLC peaks contained species that corresponded to emodin (270.24), chrysophanol (254.21), nepodin (216.13) or known bioactive anthraquinones. Further studies are underway to characterize these 4T1 cytotoxins.

2) ***“Newly established documentation and imaging system detecting DNA hybridization serves as a potential POC device”***. Capps, D.W.; Kenneson, J.R.; Moore, R.L. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

The need for point of care devices, or POC's, has been high for medical purposes. With the need of ease of access tools within the medical field, more efficient and cost effective ways to diagnose and treat people has been a main priority. A multi-application imaging and documentation system has been recently developed for imaging multiple biochemical techniques with varying needs including bioluminescence, chemiluminescence, fluorescence, and transluminescence. This documentation system is cost effective and can be stored easily while being transported. Recognizing this documentation system as a potential POC device for detecting genetic susceptibility to diseases such as chronic myelogenous leukemia, its ability to detect DNA hybridization via fluorescent labelling was evaluated. The detection limits for fluorescein and fluorescent labelled DNA probes were found to be 2.94×10^9 and 4.69×10^{10} probes/mm² respectively. This demonstrates that the imager would be able to detect DNA hybridization used in techniques such as fluorescent in situ hybridization, or FISH, and would be particularly powerful if coupled with microfluidic based hybridization protocols.

3) ***“Discovering trends in the %GC content of extremophile DNA sequences”***. Brozek, J.A.; Gonzales, K.; Patch-Bradley, M. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Extremophiles are a class of bacteria which are capable of surviving in environments not normally known to be capable of sustaining life. The base pairing of Guanine (G) to Cytosine (C) contains three hydrogen bonds and is more stable than the bonding of Adenine (A) to Thymine (T) that only has two hydrogen bonds between them. Methanopyrus Kandleri and Dienococcus Radiodurans, which live in high heat and radiation environments, respectively, were shown to have higher GC content than the other bacteria which lived in milder conditions. This led to the belief that an organism that can survive in a more chaotic environment requires a higher GC content to stabilize their genetic sequence. The genomes of four extremophiles, Dienococcus Radiodurans, Methanopyrus Kandleri, Methanobacterium, and Chloroflexus Aurantiacus were analyzed for GC content as a function of position on the bacteria's genome. The GC percentages relative to the genomic position of the bacteria were compared to each other to identify areas in the genome that may be more critical to survival (high GC) and areas that may be more open to beneficial mutations (low GC).

4) ***“Exploring the possibilities of DNA mutations”***. Riza, C.; Pruett, C.; Aguilera, N.; Tavares, J. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

When dealing with DNA there are two sets of base pairs, A(Adenine) with T(Thymine) and G(Guanine) with C(cytosine). The AT pair has two hydrogen bonds while GC has three. Because of this, GC has a stronger bond. Areas of a genome with a high GC% may have a decreased probability for mutation in that region. The average GC% of consecutive 70 base pair sequences of Anaerobmyxobacter dehalogenans, Acrobacter, Cellulomonas fimi, and Pseudomonas putida was determined to be able to see sections that exhibit a high or low GC%. For our high GC organisms (Anaerobmyxobacter dehalogenans, Cellulomonas fimi) their average mean is in the mid 70% range with some notable variation from the average. This allows for sections to be subject to mutation while other areas are more rigid in their structure. The low GC organisms (Acrobacter, Pseudomonas putida) average in the mid 20% range and low 60% range. With these lower percentages the whole genome is more susceptible to mutation with fewer areas that are rigid in their structure.

5) ***“Analyzing GC% by position on the genome in pathogens”***. Davis, A.; Farrington, B.; Rohlf, A.; Willems, E. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Areas of a DNA sequence with a high GC% are more stable and less likely to mutate than areas with a low GC%. Since mutation of the genome of a pathogen may lead to drug resistance, areas of high or low GC% are of interest to drug companies. Therefore, we wanted to see if the DNA sequences of four pathogens have areas of high or low GC%. Genomes were analyzed to determine the GC% of 210 base pairs at every 70 base pair interval. Mycobacterium tuberculosis did not show much deviation from its relatively high overall mean GC% which means that is more stable, while Escherichia coli O157:H7, Salmonella Enterica and Yersinia pestis each had a great deal of deviation from each one's mean. This information can be used to determine areas on genomes that are susceptible to mutation.

6) ***“Challenges in visualizing RecA-DNA interaction in chemiluminescent electrophoretic mobility shift assays”***. Kenneson, J.; Taylor, M.; Moore, R. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

A high-end DSLR camera was employed for analysis of protein-DNA interaction using chemiluminescent electrophoretic mobility shift assays (EMSAs) in order to study binding affinity of DNA repair protein, RecA, and selected Mycobacterium tuberculosis oligomers. This alternative method for EMSA visualization offers a low-cost benefit over using a phosphorimager with radioactively labeled DNA. Mini-format chemiluminescent, fluorescent, and large-format chemiluminescent EMSAs were used to determine percent RecA binding. Decrease in free DNA signal indicates RecA did bind to DNA, though a bound DNA band was not resolved in any of the three types of EMSAs. Future research will involve further examination of this protein-DNA interaction in order to determine why the complex is not migrating into the EMSAs.

7) ***“Purification of components from Inula helenium (Elecampane) which are cytotoxic to the 4T1 murine breast cancer cell line”***. Kelly, S.; McElwain, T.E.; Rivera, A.M.; Kenneson, J.R.; Burrow, T.; Gray, G.O.; Reinhart, A.J. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

The plant *Inula helenium* (elecampane), is a medicinal plant that is found widely throughout England. It has been used as a diuretic, antiseptic, skin cream, and has been used in treating pulmonary diseases. Previous studies in our laboratory have shown elecampane to be cytotoxic to 4T1 murine breast cancer cells. In this study, we sought to isolate and purify specific cytotoxic molecules from elecampane. Powdered elecampane root was refluxed in dichloromethane for 1 hour, the dichloromethane was distilled off and the extract was resuspended in ethanol. The resulting ethanolic extract was size fractionated on a Sephadex LH20 column with 75% ethanol as the mobile phase and initially analyzed through absorbance at 280 nm. Fractions from the column were assayed for cytotoxic effects on 4T1 cells. Cytotoxic fractions were further characterized using HPLC (solid phase: C18, mobile phase: 0-75% methanol gradient over 30 minutes). One peak was identified through HPLC from the most cytotoxic fraction. This peak was collected and further characterized using mass spectroscopic analysis (MALDI TOF). Based on the mass spectroscopic analysis, the most likely size of the cytotoxic molecule isolated through this study was determined to be 440 g/mol. Further research is ongoing to identify this cytotoxic component of elecampane.

8) ***“Kinetics of tyrosinase in various mushroom tissues”***. Avila, J. M.; Brown, J.; Capps, D.; Duffield, K.; Januta, J.; Kelly, S.; Kenneson, J.; McCutcheon, T.; McElwain, T.; Phillips, W.; Rivera, A.; Rosales, V.; Westerman, A.; Wiechmann, C. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Tyrosinase, a commonly found enzyme, catalyzes chemical reactions in animals that lead to distinctive pigmentation in skin, eyes, and hair. In humans, such pigmentation could indicate a sign of skin cancer. Based on previous studies, tyrosinase has been shown to have differences in activity in varying parts of mushroom tissue. In this study, the pigmentation, protein amount, and enzymatic activity of tyrosinase of different mushroom tissue sections were analyzed in order to determine if a darker pigmentation and high protein amount is indicative of high tyrosinase activity. Protein was isolated from the various tissue types of store-bought mushrooms – cap, gills, skin, and stalk. The amount isolated was quantified spectrophotometrically and subjected to kinetic analysis. The results suggest that darker pigmentation is indicative of tyrosinase activity and a high amount of protein present. A better understanding of tyrosinase activity can have dermatological applications.

9) ***“Gram-positive hemolytic bacteria in the oral cavity: Homo sapiens tend to display higher bacteria colony-forming units than Canis lupus”***. Taylor, M.; Manning, C.; Morales, J.; Soriano, L. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

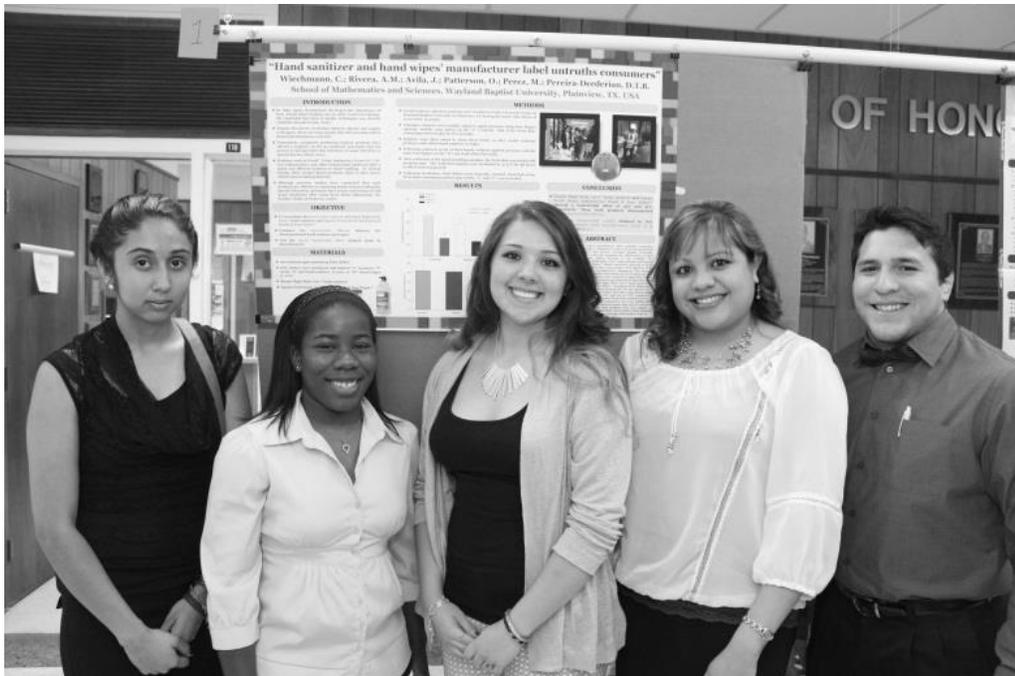
It is often said that dogs have cleaner mouths than humans. However, there has been no scientific proof of this popular fact. In the oral cavity, the most common gram-positive bacteria found are Streptococcus spp (mitis, oralis, sanguis, mutans, and gordonii species) and Staphylococcus spp (aureus and epidermidis species). Hemolysis is the breakdown of the RBC membrane by a bacterial protein (hemolysin). Many types of bacterial possess hemolytic proteins and are pathogenic due to tissue invasion. The aim was to investigate the growth of gram-positive hemolytic bacteria in the mouth of humans and dogs. Mannitol salt agar (MSA) petri dishes, differential and selective media, containing 5% sheep blood were incubated (3 days at 37.5°C) with samples from oral cavity of humans and dogs. Samples were obtained swabbing the mouths with sterile cotton swab. Samples from humans showed a tendency to a greater number of gram-positive hemolytic bacteria (24±7 CFUs, n=16) than dogs (9±5 CFUs, n=11) [p=0.053]. The pattern of α-, β-, and γ-hemolysis also differed between humans (12%, 38%, and 50%, respectively) and dogs (56%, 16%, and 26%, respectively). The whole-colony appearance (circular and entire), number of different bacteria per sample (2±0 CFUs), diameter (3±0 mm), and severity of hemolysis (±± out of ±±±) were similar between humans and dogs. The results showed that different populations of hemolytic gram-positive bacteria colonize the oral cavity of humans and dogs with humans displaying a higher trend for bacterial growth than canines. Therefore, it is scientifically proven that dogs have cleaner mouths than humans.

10) ***“Battle of the sexes: a comparison of gram-negative lactose-fermenting enteric bacteria collected from male and female bathrooms”***. Switzenberg S.; Jerome J.; Januta J.; Moreno C.; Pereira-Derderian D.T.B. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

Enteric bacteria play vital role in our everyday lives, especially in the bathroom where certain strains are becoming more drug resistant and pathogenic. The purpose was to determine the presence of gram-negative lactose-fermenting bacteria on male and female bathrooms from across Wayland Baptist University, Plainview, TX. Petri dishes-containing MacConkey agar was used to select and differentiate the presence of gram-negative lactose-fermenting bacterial growth. Collection of 56 toilet flusher samples (28 per gender) from the first two stalls closest to the bathroom door was performed. Another 28 samples (14 per gender) from the door handles exiting the bathrooms were also collected. Samples were incubated at 37.5°C for 5-7 days. Colonies that presented growth on the MacConkey plates were inoculated onto triple-sugar-iron (TSI) slants and incubated for 5 days at 37.5°C. MacConkey results showed that while male flusher bacterial growth was a greater percentage (40%) compared to the female (18%), t-test result [p>0.05] indicated that the difference was not statically relevant enough to suggest a difference between genders. MacConkey results showed that similar bacterial growth was obtained from male (7%) and female (14%) exiting door handles. MacConkey bacterial growth from the flusher and door handle in the male and female consisted of red, 1 mm diameter, circular, entire, and convex. TSI bacterial growth consisted of positive sugars fermentation (±± out of ±±±) and beaded. Therefore, similar colony-forming units of similar populations of gram-negative lactose-fermenting bacteria colonizes the flusher and exiting door handle of male and female bathrooms at the same rate.

11) ***“Analyzing and comparing the feces of different animals: Is all poop created equal?”*** Savage, G.; Monreal, S.; Simpson, D. School of Mathematics and Sciences, Wayland Baptist University, Plainview, TX, USA.

The purpose of this research is to identify bacteria of the gastrointestinal tract by taking samples of birds, cats, and dogs waste. The gastrointestinal tract is composed of both the stomach and intestine as they function as one in a unit. The first phase of the project involves gathering and storing the feces of the three types of animals that were mentioned above (birds, cats, and dogs) on a MacConkey Agar petri-plate. We also took swab samples of the area in which the animals eliminated waste and plated them on MacConkey Agar plates as well. The final phase after incubation of the triple sugar iron slants (TSI), we examined the bacteria that grew within the slants. The most common morphology found on the MacConkey Agar from dogs was; irregular in whole-colony appearance, entire in margin, and raised in elevation. For the cats was; circular in whole-colony appearance, entire in margin, and convex in elevation. Lastly the most common morphology in the birds that were sampled was; circular in whole-colony appearance, entire in margin, and raised in elevation. From the TSI slants that were incubated the most common morphology found in the dog samples were; filiform in growth, yellow in color, acid was present, and gas was present. Most common morphology from TSI samples from the cats were; spreading in growth, yellow in color, acid was present, and gas was present. Most common morphology from TSI samples from the birds were; echinulate in growth, brown in color, acid was present, and gas was present. By identifying the color and the presence of gas we determined the similarities and differences of the waste samples collected from the different types of animals. This will allow a more in depth view of different bacteria of the gastrointestinal tract.



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