**Report to the Science and Math Advisory Board**
**Biology Department Sept 2015**

## Departmental Improvements

There were major changes to the Biology department curricula designed and approved in 2014-2015 including revision to the three existing Biology majors Biology, Biomedical Science, Life Sciences and the introduction of a new Environmental Science program. For the Biology, Biomedical Science, and Life Science degrees there is now a Biology Core all our majors share that consists of General Biology I (molecules to cells, genetics and physiology), General Biology II (plants and animals, systematics, ecology, and evolution), Genetics, Junior Seminar (for introduction to scientific literature, diagnostic testing to determine the effectiveness of our first two years of courses, career exploration, and introduction to options for completing their capstone experience), and finally the Senior Capstone (either internship, research, or Honors research).

For the Environmental Science Program, current faculty are qualified to teach the courses and will do so initially since we have no Geoscience/Geology expertise at this time. Currently the program is biology focused with a built in chemistry minor. We anticipate that when such expertise is hired, we will transition the program to be more Geoscience-focused. **T.J. Boyle**, **Joel Brant**, and **Gary Wilson** have worked closely with **Alicia Wyatt** to see to design this degree and see it through to approval at the first faculty meeting in August 2015. Another element of the Environmental Science program's revitalization is McMurry's support provided to **Steve Davis** (Finch-Gray lab manager) for completion of his master's degree in Environmental Management. With his degree, he will assume the position of Environmental Health and Safety Officer for the campus, will still coordinate lab support on campus, and will teach occasional courses for the Environmental Science Program.

**Larry Sharp** completed an articulation agreement for pre-admission with the Texas Tech Pharmacy School and 1 student is applying this semester.

The Biology department and McMurry University was very fortunate to receive a 160 acre land donation from Rev. Bill Libby. This land in Callahan County has a home on it that will be converted to a Biology field station for teaching and research. **Joel Brant** and **T.J. Boyle** have been managing the property and are invested in its transition to a more fully-capable research station. **Joel Brant** and the herpetology class conducted a survey in Spring 2015, and we fully believe this property represents an exciting opportunity to enhance our biology and environmental science programs by providing a resource for students to conduct original research. With renovation planned for 2015-2016, the facility will be able to support other campus programs outside of the sciences.

## Research

All biology faculty members were very active in their research this past year and included undergraduates in most projects. Four members published their research as described below, and many received research grants to initiate new projects.

Lee, T. E., Jr., and **J. G. Brant**. 2014. The first distribution record of *Sciurus pyrrhinus* Thomas, 1898 (Rodentia: Sciuridae) from Ecuador. Check List 10: 663-664.

**Benoit, T. G.** 2015. Increase the visibility of microbial growth in a Winogradsky column by substitution diatomaceous earth for sediment. Journal of Microbiology and Biology Education 16: 85-86.

**Lee, D. N.,** R. Stark, W. Puckette, M. J. Hamilton, D. M. Leslie, Jr., and R. A. Van Den Bussche. 2015. Population connectivity of endangered Ozark big-eared bats (*Corynorhinus townsendii ingens*). Journal of Mammalogy 96: 522-530.

**Saghatelyan A.** 2015. Phytogeographical relationships and analysis of the flora of South Central Texas, U.S.A. Journal of the Botanical Research Institute of Texas 9: 259-294.

**Dana Lee** was awarded a KIVA grant to initiate a project to survey species of bats in Texas for the presence of Coronaviruses. Sophie Southwell, this year's Beasley Research Fellow, is currently assisting with this study as part of her Honors project. The two retrieved intestines from 30 bats that were previously rabies tested negative by the state health department. They also received a sample of mouse hepatitis virus from SMAB member Drew Hillhouse to serve as a positive control which was very integral to beginning this project.

**Dana Lee** and **Joel Brant** have been collaborating on a project to generate molecular analysis of relationships among subspecies of the eastern mole. Dr. Lee's Molecular Biology class assisted in preliminary data collection by isolating and sequence DNA from 40 individuals. Joel Brant and Dana Lee submitted Sam Taylor research proposals to continue the molecular work on the eastern mole.

**T.J. Boye** received a KIVA grant to complete a macrobenthic survey of 12 Big Country reservoirs. Data collection began in July 2015, and this project will involve many undergraduate assistants over the next 4 years. He also submitted a Sam Taylor research proposal for additional funding to support this study.

**Joel Brant** worked with Mitchell Crittenden to complete his 2014 Beasley Award research on the geographic distribution of the eastern mole on the Southern Rolling Plains. Mitchell presented his project at 2 regional scientific meetings and was awarded the outstanding poster presentation by an undergraduate at the Texas Society of Mammalogists meeting in February.

**Anna Saghatelyan** has been working since spring 2015 on her new research project entitled "South Texas Plains flora, its relationships and analysis". This project will conclude the cycle started by her two previous projects. The outcomes of first two analyses were published in 2009, on the Flora of Big Bend region of Texas, and this summer, on the Texas Edwards Plateau. Texas is dissected by the continental divide, being also close to the Neotropical Kingdom, and several major floristic boundaries meet here. The goal of these 3 projects is to specify the boundaries based of the detailed comparative analyses of southern regional floras in TX, which, though almost adjacent to each other, each have a different floristic core. She submitted a Sam Taylor 2015 Award proposal to help fund this research.

**Anna Saghatelyan** was a coinvestigator with **Dr. Hyunshun Shin** (chemistry dept) and **Gary Wilson** in their proposal supported by a Sam Taylor 2014 award "Evaluation of Extracts from

West Texas Plants as Antitumor and Antimicrobial Agents". Kara Black performed work on her Honors project by testing for antibacterial properties chemicals she extracted from regional plants. She did antibiotic testing using a novel assay technique. Kara mixed test bacteria with liquefied agar and poured this directly onto the TLC plate, then incubated the plates overnight. Results were demonstrated by using a vital stain and checking for areas without live bacteria. Kara Black was a Bloomer Award winner, and worked on this project for the last three semesters. Kara performed publication worthy research, presented several times to different student conferences with great success and won two first place prizes, including the top undergraduate presentation at the Texas Tech Association of Biology Students Symposium research competition this spring.

**Anna Saghatelyan** and **Dana Lee** have been generating DNA sequences from 2 chloroplast genes in approximately 12 species of Transcaucasian plants in the Hyacinthacea family. They will add this data to existing published DNA sequences and provide a phylogenetic hypothesis for relationships among genera in the family. This project is funded by a Kiva Research Award and is planned to be finished in the next year.

## New Courses

**TJ Boyle** introduced Freshwater Ecology course which included taking the students on several field trips to surrounding lakes to learn different survey techniques. He is currently teaching a new course titled Marine Biology and will take the class on a field trip to Port Aransas where students will boar the University of Texas Research Vessel Katy for a chance to sample organisms from various aquatic habitats. He will also teach Invertebrate Zoology in Fall 2016 adding yet another elective for biology students to take.

**Dana Lee** tweaked the existing Genetics course and developed a new laboratory portion where students extracted DNA from various fruits, breed fruit flies to study Mendelian traits, and learned how to perform polymerase chain reaction. She also designed a new Cell and Molecular Biology course and laboratory where the students participated in a semester long research project on eastern moles described earlier. This year she is teaching a new Forensics course and laboratory. Students in this class will learn how to perform blood typing, blood stain analysis, hair and fingerprint analysis, and DNA analysis from their own hair samples.

## Student Accomplishments

Mitchell Crittenden '15 is currently pursuing a M.S. in Wildlife Management at Angelo State University.

Kara Black '15 was accepted to the D.O. program at UNT-TCOM after graduating with honors from McMurry.

Recent graduates in the process of applying to professional schools are Nicole McGunegle and Bradley Rowland (medical), and Katlyn Tarbet and Kelly Croci (PA). Current senior Taylor Russell is applying to dental school.

Shayna Hoag '15 is working in biotechnology in Massachusetts. Collin Valdez '15 is working on the science side of the petrochemical industry.

The following students completed internships:
Kristen Bath – San Antonio Zoo
Collin Valdez – Dr. Cameo Harvey, Optometrist
Katlyn Tarbet – Clay Bulls, Physician Assistant
Kelli Croci – Clay Bulls, Physician Assistant
Faten Khayati – Clinical Laboratory, Hendrick Medical Center
John Keith – Personal Training, D1 Sports

There are currently 15 students in the Health Professions Prep course: 10 declaring Pre-Medical, 1 Pre-Dental, 1 Pre-Pharmacy, 3 Pre-Physical Therapy, and 1 Pre-Physician Assistant.

**Faculty Promotions**

**Larry Sharp** was elected to the Executive Committee of the Texas Association of Advisors for the Health Professions.

**Joel Brant** has stepped down as Faculty Athletic Representative but was elected Faculty Chair this year and promoted to Full Professor.

**Biology Club**

**T.J. Boyle** and **Dana Lee** reinvigorated the biology club which was minimally active. The club raised $300 in the Pie-A-Professor fundraiser and together with help from SMAB were able to purchase 5 recycling bins for plastic and aluminum cans. These were placed in the Science Building, Old Main, and Ryan. Nick Helgerson was inducted into the national chapter of Tri Beta (biological honor society). The group also hosted some guest speakers including a genetic counselor from DFW and a family practice physician from Abilene. Please contact Dr. Lee if you would like to speak with our students.

**Goals**

There is a high degree of certainty that **Alicia Wyatt** and **Gary Wilson** will be writing a very significant, multi-year grant proposal for strengthening science programs in the education of Hispanic students. **Alicia Wyatt** and **Gary Wilson** are also developing a concept for creation of a Center for Responsible Science, which combines a practical science education with a passion for serving others. It will be structured much like the Honors Program and will have elements of research, moral and social conscience, missions and servant leadership, and the expectation that graduates will be capable scientists who want to make a difference for their fellow man.

The Firebase Libby Research Station will need some renovation to bring it up to safety code and the Biology club is working toward bringing in more guest speakers and purchasing more recycling bins with a goal of installing them in every building on campus.

Recent discussions with Vice President for Enrollment David Heringer and the Admissions team has provided ideas for how to pro-actively pursue more science majors. Biology is willing to help in any ways possible to make science recruiting a success.

Department of Chemistry and Biochemistry
Report to SMAB
September 10, 2015

The department is happy to introduce two new graduates: Chenny Nguyen and Arianna Salinas! Chenny and Arianna took quite a few classes together last year and shared the Outstanding Senior award. Arianna is from Round Rock, Texas and worked with the IT department on campus while going to school. She also did an internship at the City of Abilene Environmental Laboratory during her senior year. Chenny is originally from Vietnam and came to the US as a child. She has a young son. Both graduates are currently looking for positions in the Abilene area.

The McMurry University Student Affiliates Chapter of the American Chemical Society (ACS) hosted 4$^{th}$ grade students from Jim Ned elementary during homecoming. Last year was the second year in a row that 4$^{th}$ grade students from Jim Ned were hosted by our chemistry club. What began as a simple chemistry show for the classmates of Dr. Pyenta's children has grown to a more substantial event. The students participated in several science activities in addition to a visit to teepee village. The chemistry club is already making plans for this year's event!

An agreement was finalized with the University of North Dakota (UND) that allows McMurry students to obtain an ABET-certified B.S. Degree in Chemical Engineering through mostly online courses from UND while obtaining a B.S. Degree in Chemistry from McMurry. Obtaining two bachelor's degrees simultaneously will take five years to complete and students will have to spend two summer terms at UND taking engineering laboratory courses, but the agreement represents the first certified engineering program in Abilene. One current student is taking the first online chemical engineering course this fall. It is challenging, but seems to be going well so far. Two incoming freshmen have indicated they also plan to do chemical engineering.

The two first year chemical engineering students join five other students in general chemistry who have declared majors in Chemistry or Biochemistry for a total of 7 out of 36 in the class this fall. The admissions office would like to continue to increase the number of science majors and have designed new McMurry University periodic tables that will be sent to interested high school science students.

American Chemical Society (ACS) Science Coaches are chemistry professionals who share their expertise and enthusiasm for science with an elementary, middle, or high school teacher over the course of one school year. They enhance science education, and secure a $500 donation for the school where they volunteer. Dr. Donnay worked as a Science Coach with the 5$^{th}$ grade McMagnet teacher, Ms. Sharlyn Bammel, to develop a CSI afterschool program for the gifted students in her class last year. The students investigated unknown white powders, dusted for fingerprints, analyzed drinks for the amount of yellow food dye present, made casts of their footprints, and photo-documented a "murder" scene in the laboratory. The final project was to solve an art burglary and present the results to the public. Two chemistry club members served as the crime suspects.

A group of students joined Drs. Donnay and Shin when they attended the 70$^{th}$ Southwest Regional Meeting (SWRM) of the ACS in Fort Worth Nov. 19-22, 2014. The chemistry club thanks SMAB members for their support that helped cover the cost of the trip. Senior honors biology major/chemistry minor Kara Black presented a poster about her work with Dr. Shin and Dr. Anna Saghatelyan (biology) entitled "Antibacterial Activity and Chemistry of Five West Texas Plants." The work was made possible through a $2000 grant from the Sam Taylor Foundation that Dr. Shin and Dr. Saghatelyan received. Dr. Donnay organized a symposium "The Flexible Chemist: Teaching Outside of Your Specialty or Discipline" in the Chemical Education division. He gave a talk entitled "An Instructor Crams for a Year Long Organic Chemistry Test" about his experiences teaching organic chemistry when Dr. Shin was taking a leave of absence in 2013-14.

This past summer the department had seven undergraduate students conducting research on the Welch Foundation Departmental Grant, all of them part-time or for only part of the summer. Dr. Hyunshun Shin worked with 5 students: Daniel Kent, Lucy Rashiwala, Lizbet Miller, Dialfin Hammond, and Genna Hart. They worked on projects targeting two enzymes: ornithine decarboxylase and histone deacetylase or working on the joint project with biology developing antibacterial compounds from West Texas plants. Dr. Ed Donnay supervised Armen Norman and Ralph Cadet on synthetic projects to make new ligands that may allow metal complexes to bind better to DNA than current ligands.

Drs. Veltkamp and Pyenta applied for and received sabbaticals for this year with Dr. Veltkamp's leave occurring during the current fall semester and Dr. Pyenta's in the spring term. Dr. Veltkamp has chosen to focus her scholarship in the area of chemical education and will be working on two projects. The first is examining ways to increase the rate of success in our general chemistry sequence. The second project is working with a colleague to disseminate materials from the ACS General Chemistry textbook in other formats, such as laboratory experiments and workshops. Previously Dr. Pyenta conducted his research in the biochemistry teaching laboratory during the summers, but this caused a major disruption every school year when his research needed to be "put away". His sabbatical will be used to restart his biochemistry research in lab space previously occupied by Dr. Veltkamp. The department is currently shuffling the locations of some equipment to make the space more useable for this type of research. Dr. Ed Donnay will serve as chair on an interim basis this spring while Dr. Pyenta is on sabbatical.

Dr. Hyunshun Shin attended the recent 250$^{th}$ National ACS Meeting in Boston from Aug. 16-20. She gave a presentation in the Division of Chemical Education entitled "The Feasible Screening Method for Antimicrobial Activity of Natural Products for the Interdisciplinary Research Project at a Small Liberal-Arts College" concerning the work she did with recent graduate Kara Black and Dr. Anna Saghatelyan in Biology. She received positive feedback and encouragement to publish the details soon so that others can adapt the technique to their own teaching and research.

Dr. Donnay is busy organizing two upcoming events sponsored by McMurry University and the local section of the ACS. The first is an all-day workshop for high school chemistry teachers on October 1$^{st}$ and the second is a dinner followed by a presentation to the general public about the history of scientific discovery in Texas on October 2$^{nd}$. Both events feature Dr. Diana Mason, Professor Emeritus in the Department of Chemical Education at the University of North Texas. All 12 chemistry teachers from Abilene ISD are planning to attend along with a handful of teachers from other districts in Region 14. The talk on October 2$^{nd}$ will take place in Old Main and is entitled "What Started in Texas has Changed the World".

Respectfully submitted,
Dr. Edward Donnay

# Computer Science Activity Report
# SMAB – September 2015

### Dr. Robert Watson

This year Dr. Watson is teaching a special topics course, "Mobile and Wearable Applications". In this course students learn how to write applications for Android devices. A previous course on mobile applications programming was popular among students. This semester student interest has been greater and the course exceeded its initial enrollment limit by 50%.

In October, Dr. Watson will attend the Amazon Web Services conference.

### Mr. Rich Brozovic

Mr. Brozovic continues to serve as the Faculty Sponsor for the McM AITP Student Chapter. A team of 6 students participated in the AITP Region 3 Student Conference in Lawton, OK last October and their success was shared in a report following that conference. Planning is currently underway to attend the AITP Region 3 Student Conference in San Marcos, TX in late October. Attendance at the AITP National Collegiate Conference in Chicago, IL in April is not being planned due to the expected cost of air travel on top of the relatively high cost for conference registration and lodging. Mr. Brozovic also served as the Director of the UIL Region II-A Computer Science contest hosted at ACU in April 2015 and expects to serve again this coming spring. He supervised an honors thesis for an Information Technology major titled “McMurry Mobile: A Mobile Tool to Campus Life”. That student is currently employed as an IT specialist at Funeral Directors Life Insurance Corp. here in Abilene.

With the return of Dr. Wyatt to the department, Mr. Brozovic will assume responsibility for the database course taught during the spring semester and required for CS, IT, and CIS majors and minors.

### Dr. Alicia Wyatt

Dr. Wyatt has returned to the Computer Science Faculty after the University embarked on a reorganization process at the end of the previous academic year. She is involved in two new projects—creating a Digital Studies program with other interested faculty members, and assisting with a large grant proposal to support STEM fields. Dr. Wyatt supervised an honors thesis for a Business Marketing major titled “VIRAL SOCIAL MEDIA: Designing an Instrument to Create More Viral Content”. That student is currently attending graduate school at TAMU.

### Department Initiatives

Dr. Wyatt and Mr. Brozovic both completed the McMurry Online Readiness Course as preparation for future development of online courses. Mr. Brozovic already offers an introduction to management systems for the School of Business as a summer online course.

Four Computer Science majors, one Information Technology major, one Computer Science minor and one Business Computer Information Systems major graduated this past spring. We expect ten Computer Science majors and 2 Information Technology majors to graduate this next spring. The department continues to experience a positive growth trend and a summary of current enrollment data is attached.

## 2015-16 Enrollment Data for Computer Science Department

New students to McM

- 11 Computer Science majors
  but 4 not currently taking any courses in major due to need for developmental math
- 1 Information Technology major
- 2 Business Computer Information Systems majors
  but 1 not currently taking any courses in concentration

Returning students

- 19 Computer Science majors continuing in program
  plus 2 existing McM students just starting program
- 5 Information Technology majors continuing in program
  plus 1 existing McM student just starting program
- 1 Business Computer Information Systems major continuing in program
  plus 1 existing McM students just starting program

Course Taught by Department

- 66 unique students taking 1 or more courses (includes non-majors)
  with 12 of those taking 2 courses and 11 taking 3 or more courses
- 104 seats filled in 10 sections plus 1 directed study
- 28 Computer Science majors taking 1 or more courses
- 7 Information Technology majors taking 1 or more courses
- 3 Business Computer Information Systems taking 1 course

Department of Mathematics
Box 668, McMurry Station
Abilene, Tx 79697

# Department of Mathematics SMAB Update

September 10, 2015

## FACULTY NEWS

Dr. Flores continues to serve as Department Chair of the Mathematics Department. Dr. Flores attended the Texas Association of Academic Administrators in the Mathematical Sciences (TAAAMS) conference in Waco on October 17-18, 2014. Representatives from the Dana Center discussed alignment of required math courses to programs of study (majors). Also, online courses were discussed, particularly in regards to the state's definition of online courses and the use of testing services such as testing centers and online proctoring services.

Dr. Flores attended the TAAAMS meeting in San Antonio on April 10, 2015. Online courses were again discussed. Since online courses have low completion rates, it was suggested that the online format could be used for upper-level courses that have schedule conflicts. Concerns with online proctoring services include: the added cost to students, the requirement for students to have the necessary technology, and the fact that the Department of Defense will not cover these added costs for active duty students.

Dr. McCoun made a presentation and held a workshop for ATEMS (Academy of Technology, Engineering, Math, and Science) students entitled, "Cryptography with Python for ATEMS" on August 29, 2014. Roxana Dita presented mathematical card tricks at the workshop.

Dr. Cindy Martin is serving as one of the university liaisons in the Foundations of Excellence Program. McMurry applied and was accepted by the John N. Gardner Institute to participate in the Foundations of Excellence Program (FOEP). The FOEP is a self-study and improvement planning process. During the 2014-2015 academic year McMurry University conducted a comprehensive systematic effort to evaluate our institutional performance in delivering an exceptional first year experience and developed a comprehensive plan for improvement that will support the achievement and persistence of first-year students. This academic year the Foundations of Excellence team is working with the John N. Gardner Institute to implement the comprehensive plan. Dr. Martin traveled to North Carolina in June 2015 with a team from McMurry to work with the John N. Gardner Institute to review the self-study process conducted and to receive training on the implementation phase of the program.

The mathematics department is also participating in recruitment initiatives. Dr. Martin had the opportunity to spend a day visiting the math classes of Gerri Boggs at Hawley ISD. Gerri Boggs graduated with a degree in Mathematics 8-12 in 2011 from McMurry University. Dr. Martin

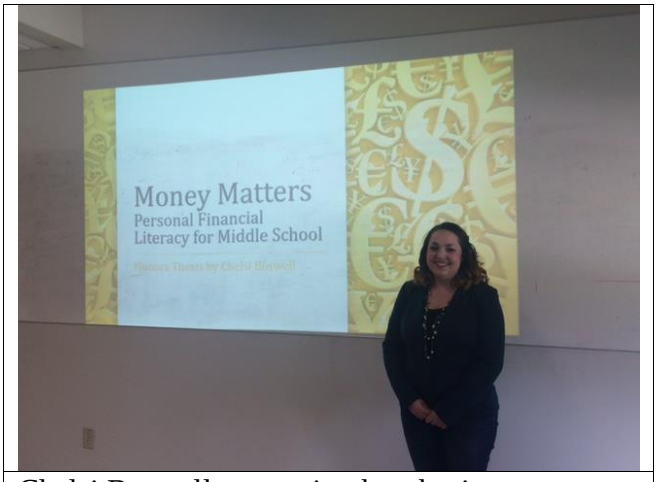
spent the day visiting with the students and answering questions about college and career opportunities in the field of mathematics. Faculty members from mathematics also participated in phone-a-thons to recruit students.

Dr. Thornburg, Dr. Flores, Dr. McCoun, and Roxana Dita successfully completed the MORC training for online courses in Spring 2015.

Members of the mathematics department continue to be representatives and/or sponsors of one or more academic or social clubs (Kappa Mu Epsilon, Math Club, Theta Chi Lambda, Gamma Sigma, McMurry Women's Club, and McMurry Freshman Leadership Challenge).

## STUDENT RESEARCH

Last year Dr. Martin worked with Departmental Honors student, Chelsi Boswell. Chelsi presented her honors thesis, *Money Matters: Personal Financial Literacy for Middle School*, in the Spring of 2015. Chelsi graduated with honors in May 2015, and is currently teaching 8th grade mathematics at Hutto ISD.



Chelsi Boswell presenting her thesis.

Dr. Martin is currently working with University and Departmental Honors student Carissa Terry (Thesis topic: *Mathematics Education, A study of education methods to present themes from Trigonometric and Hyperbolic Trigonometric Functions*).

Department of Mathematics
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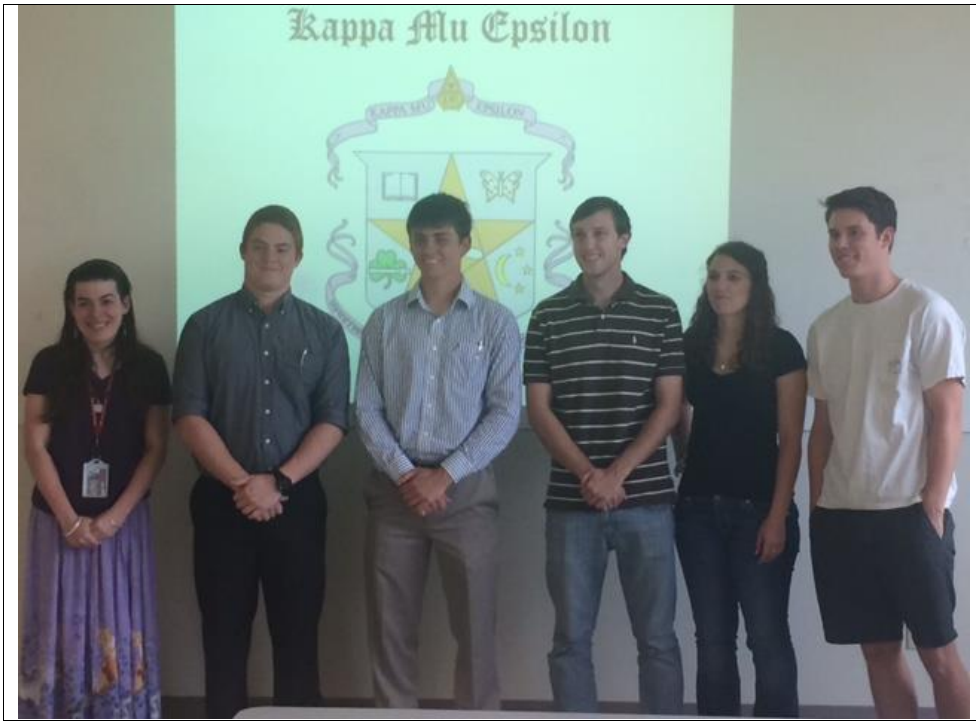
## KME

Eight McMurry students were inducted into the Texas Iota section of KME (Kappa Mu Epsilon) National Mathematics Honor Society in April 2015. Chelsi Boswell, Alyssa Fields, Taylor Freehauf, Kent Grimes, Casey Hurt, Marcus Medellin, Carissa Terry, and Michael Von Ende-Becker are the newest members of the Texas Iota section of KME. The officers of KME for Spring 2015 were Jacob Howdeshell (President), Richard Barton (Vice President), and Trevor May (Secretary).




KME Induction

Casey Hurt, Kent Grimes, Taylor Freehauf, Michael Von Ende-Becker, and Alyssa Fields with President, Jacob Howdeshell

## SPRING 2015 GRADUATING STUDENTS IN MATHEMATICS

- Chelsi Lynae Boswell, Mathematics Grades 4-8
- Michael Edward Dowd, BS Mathematics
- Melanie Brooke Hotchkin, Mathematics Grades 4-8
- Brittany Lyn Houghton, BS Mathematics

Respectfully Submitted,

Dr. Kelly L. McCoun

**Physics Department Update Fall 2015:**

**Student Population and Student Research Projects**

Throughout 2014-2015 academic year our seniors, Richard Garcia and Jacob Howdeshell, have been working on their senior research projects.

Ricky was working on his project under the supervision of Drs. Bykov and Renfro. The project entitled **"**Characterization and development of the ideal baseball batting tee" has been devoted to the study of how to improve baseball batting tee to make fundamental batting practice easier and more productive for baseball players. Baseball batting tees are known to be vital in the development of a hitter's swing, but also unstable and inconvenient. Current tees on the market are incapable of addressing two main concerns: 1) The tendency for the tee to fall over after contact with the bat, and 2) The extra work those hitters must perform to change the pitch location while using the tee. In this project design and analysis of a mechanical system capable of withstanding the force of the bat and moving to each location of the plate with ease have been undertaken, resulting in the construction of a final prototype. The prototype has taken advantage of an x-y table which allows the shaft of the tee to slide to any location in the hitting zone. Video analysis has been performed on the motion of the prototype, showing that the system successfully absorbs the force acted upon it by the bat, remaining upright at all times. Three designs were implemented and tested in the batting cage by the McMurry Baseball team. The study resulted in the successful construction and analysis of a final, working prototype ready for the batting cage. Ricky presented his project to the public in late April.

Ricky Garcia has been accepted and this fall has started the course of study in the MS program in Mechanical Engineering at Texas A&M University in College Station. After finishing his Master's degree Ricky ultimately hopes to find work in the field of research and development of athletic equipment and products.

Texas A&M School of Engineering is not completely new for Ricky. Last summer (2014) he was working there as part of a Summer Research Experience for Undergrads (REU) program. In the course of that experience he was able to apply his knowledge of CAD SolidWorks he gained in the McMurry Engineering Drafting class towards the real engineering project of "Development and characterization of irrigation runoff sensor". The project was addressing the issue of water being lost during the irrigation process as runoff. It is known that current irrigation system technologies are incapable of managing water-loss in a time effective manner. The research group in which Ricky was working performed design and analysis of mechanical devices capable of detecting excessive runoff resulting in the construction of three different prototypes including a conductivity design, a float design, and a paddle-wheel design. Prototypes were calibrated to determine their working flow rates by measuring the flow rate at which the sensors were activated and remained stable. This study resulted in the successful construction and calibration of three runoff sensor prototypes ready for field testing. Ricky was able to present this work as a poster at a special REU symposium in Texas A&M at the end of the summer. He has also given a talk on the same subject to a group of science faculty and students at McMurry last fall.

Yet another poster presentation Ricky made under the supervision of Dr. Bykov at the McMurry Academic Conference this April was based on the project he completed as part of the Classical Mechanics II course last spring. In this work knowledge of classical mechanics was applied to analyze the behavior of a baseball in flight. More specifically, the projectile motion of a baseball in flight was analyzed to determine which external forces effect the trajectory of the baseball. While the force of the bat and initial angle are important, there are several different factors which also contribute throughout the flight path, such as drag forces. Through the analysis of the drag forces, a FORTRAN programming language code was written, using the RK4 numerical method, capable of predicting the trajectory of a baseball in flight for given initial conditions. Trajectories produced by this numerical model were then compared to those produced through video analysis to confirm the codes' reliability.

Another senior research project this year has been completed by Jacob Howdeshell, who was working under the supervision of Dr. Keith. Jacob's project is entitled "Conversion of combustion engine

generator from gasoline to syngas". The goal achieved through this project is running a gasoline generator off of an alternative fuel, in this case syngas produced from wood chips, using low cost readily accessible parts. The original gasifier made in one of the previous senior research projects by Alistair Adams has been used, but unfortunately it has not been able to produce a large enough volume of syngas to power the generator for long periods, so natural gas has been substituted for load testing because of its similar molecular makeup. While running on natural gas, the generator's voltage was measured at different resistances and a load line has been created and compared to a load line for gasoline. The low cost of materials encourages the use of this process by the general public allowing for a practical conversion of biomass into energy. Jacob presented his project to the public in late April.

In May Jacob graduated from McMurry. He is planning to go directly into the job market after leaving McM.

A record high number of six junior physics students have started working on their senior research proposals this year.

Taylor Freehauf working under the supervision of Dr. Bykov has made a proposal for an Honors Thesis entitled "Dual Axis Solar Tracking System". It is known that with the growing concern of fossil fuels depleting and alternative energy interest increasing, solar panels have become progressively more utilized in not only residential instances but in commercial applications as well. Often these panels are not being used to their maximum potential if the sun is not directly angled at the solar panel. By incorporating a dual axis solar tracking system into these panels, rather than a fixed or single axis system, the panels become more efficient and in turn, produce more energy. Many solar panels do not utilized this more efficient method, as they are expensive to produce and require more difficult and more frequent maintenance than fixed or single axis solar panels. The purpose of this project will be to design and build a working apparatus, at a small and individual scale, in order to prove such a concept is possible. The final product proposed to be delivered is a functioning prototype addressing the issues of the larger scale models. We are grateful to the Science and Math Advisory Board for awarding one of the two 2015-2016 Bloomer's Student Research Stipends to this project. Currently Taylor has started his work on the project.

Kent Grimes working under the supervision of Dr. Bykov has made a proposal for a senior research project entitled "Hydroelectric Generator". It is known that alternative energy sources have increased greatly in importance in recent years. One such alternative energy source is hydropower. Hydro energy has been known and used by humans from ancient times, but in the age of the industrial revolution mega scale hydroelectric power plants have become dominant. The purpose of this project is to build a hydroelectric generator that could be used in a common household. Questions arise, such as, how much energy can such generator produce; can it be used to meet energy needs of the household? This hydroelectric generator will be constructed using the principle of electromagnetic induction known to any undergraduate physics student. Strong permanent magnets will be attached to a hydro wheel, while copper wire coils will be housed on a stationary frame. The project will start with the drafts of the hydro wheel, magnet and coil housings. These parts will be printed on a 3D printer, and then a frame will be constructed to be sturdy and hold various parts aloft. Once the construction process is completed, the generator's electric output will be studied. We are also grateful to the Science and Math Advisory Board for awarding the second of the two 2015-2016 Bloomer's Student Research Stipends to this project. Currently Kent is actively working on the project as well.

Kristopher Valdez working under the supervision of Dr. Bykov has made a proposal for an Honors Thesis in physics and math entitled "Study of the Electro-magnetic Generator Pickup". The goal of this project is to create a numerical model of the magnetic field created by the "Electro-Magnetic Generator" active pickup for electric guitars, as well as to examine the electronics involved with the sound processing of the pickup. This everyday application of Faraday's Law will be studied to find a mathematical model of the field produced by the magnetic configuration specific to the EMG-85 active pickup. The model can then be used to predict inputs to the circuitry of the pickup, and by testing the circuit for voltage inputs and outputs, the model can be checked for accuracy. Once this accuracy is achieved, a detailed examination of how the circuit affects the final sound we hear will take place.

Another project that Kris was involved with this year was a numerical project of finding the electric potential and electric field of a two-dimensional cylindrically-symmetrical boundary problem as part of the Electricity and Magnetism II course taught by Dr. Bykov. In this project electric potential was first measured experimentally, but then a series of numerical finite difference methods for solving Laplace's equation for electric potential were used. Both numeric and experimental results were found to be in very good agreement. The practical experience with programming in FORTRAN gained by Kris while working on this project will be essential when he starts the numerical modeling of the magnetic field for his senior research project next year.

D. Jordan Nix working under the supervision of Dr. Keith has made a proposal for a senior research project entitled "Coil Gun (Gauss rifle)". A coil gun is a device that uses an electromagnetic coil to create a magnetic field to attract ferromagnetic objects. The goal of the project is to build and working prototype of such a coil gun. With this apparatus, it is not creating the magnetic field attracting to the metal object that's difficult, but getting multiple coils to work in series to achieve maximum velocity. In order to achieve that, one has to address the circuitry of the coils, and have them turn on and off at certain times. To reach maximum velocity of the coil gun, Jordan will have to study the bullet to coil ratio, meaning the length of the bullet in comparison to the length of the coils; and how long the wire is able to hold the specific amount of current being used.

Robert Schmidt working under the supervision of Dr. Keith has made a proposal for a senior research project entitled "A Study of the Torque Link". This project grew out of Robbie's passion for stock car racing. In the project he will be creating two different types of torque links for race cars and comparing the two against one another. A torque link connects the rear end to the chassis above the driveshaft; under acceleration the torque link pushes down on the rear end, and under deceleration, the torque link tries to lift up the rear end. The two types of torque links, also known as pull bars, being used are a progressive coil spring torque link and a urethane bushing torque link. By comparing the force vs. displacement exerted at each end of the pull bar, one can see which pull bar would be more effective creating force pushing down on the rear end of the race car so that it can load the rear tires, ultimately helping produce better acceleration.

Marco Flores working under the supervision of Dr. Keith has made a proposal for a senior research project entitled "Theory of the Evolution of Baseball Bats". The purpose of the project is to compare the efficiency and dynamics of several different types of baseball bats (Wood bat non composite one piece, BESR one piece aluminum bat, and BBCOR one piece aluminum bat). Experimental data collected from the study of the bats will be compared to the analytical data found in literature. The three different ways that the bats will be tested are: Stationary Ball vs. Bat swing (Batting Tee), Stationary Bat vs. Pitched Ball (Pitching Machine), and Bat Swing vs. Pitched ball (Live Pitching). The goal for this project is to see if experimental data are consistent with the known information for these types of bats.

There are several other student projects being performed by our students as parts of their regular courses that are worthy of mention here.

In the Automated Experiments course in the fall the project was to conduct an experiment using National Instruments LabVIEW, Elvis, and an Arduino Uno in conjunction with an automated x-y table, built by a previous class. The x-y table was used to move a photo sensor across a sheet of paper with a design drawn on the paper. The outcome of the experiment was to produce a digital image of the paper using the contrast between light and dark spots on the paper. This technique is heavily used in academia and industry for collecting spatial data.

In the Engineering Statics course last fall all students were required to design a "spaghetti bridge" as a final project for the course. The tasks in this project were to design a bridge made of spaghetti that had a road bed wide enough for two hot wheels to pass on the roadbed, span a gap of two feet, hold a weight of at least twice the bridges weight, and write an engineering report giving geometric details of the design using Solid Works 3D CAD software as well as a calculation as to how much the bridge could actually hold. The model bridges were tested with a toy car.

In the Engineering Dynamics course in the spring the students were to design a lifting engine that would be able to lift a weight of 5 kg for a distance of 0.50 m off its resting surface using a small 3V

electric motor with the torque of 15 gcm. Students also had to write an engineering report giving the geometric specifics of their engine using Solid Works 3D CAD as well as show the calculations as to how much their engine should be able to lift. All of the students in this class used the department's 3D printer to produce parts for their engines.

In the Advanced Physics Lab in the spring the project this year was to conduct video analysis of the Millikan Oil Drop Experiment instead of using a manual approach of measuring time while observing droplets moving across a grid. In the course of the project a student group was able to attach a video camera to the Millikan Oil Drop apparatus and analyze the motion of droplets using the "Tracker" video analysis software. To succeed with this task students had to design an adapter for a GoPro 3 camera in Solid Works 3D CAD and print it on the department's 3D printer. With this adapter, the students mounted the camera on to a microscope.

In the Electronics course in the spring the project was to repair an old non-working microwave oven donated by a student. The problem was determined to be with a control chip and the challenge was successfully resolved by converting the microwave to manual control.

Our freshman class was not as strong last fall as it was a year before that. Three physics majors and two minors have continued into this year. However, this fall we have a record high enrolment among incoming freshmen. The new physics class of 22 students is the largest since 2004. This allowed the Physics major to become the third largest major chosen by freshmen on McMurry campus this year. Even though we realize that not all of the students may keep the major they have chosen, we are looking forward to working with this large group and hope that this will become a beginning of the stable trend.

**Department Activities**

Last fall we were very glad to see some of our recent graduates; including Austin Wegner and Jeanette Schofield, as well as a somewhat older generation of physics alumni, represented by Adam Davidson during the Science Homecoming Reception. Adam, who is currently working with oil and gas facility development in Midland, has graciously agreed to become the Homecoming speaker for the 2015 Homecoming Reception. Please mark your calendars for this year's reception which will take place on Saturday, October 10$^{th}$ at 9 am in room S105. Our other special guest for the Homecoming this year will be Mr. Roger Ward, who has agreed to meet and talk to physics and other science students on Thursday, October 8$^{th}$ from 11 am to 12 pm and will also join us during the reception on October 10$^{th}$.

One of the biggest news last fall was that in November the Physics and Chemistry Departments were able to sign an articulation agreement with the University of North Dakota (UND) to deliver full scope engineering degrees in Mechanical and Chemical Engineering to students on the McMurry Campus. University of North Dakota is the only school in the country that has a complete ABET accredited engineering program delivered online. Therefore, through this collaboration McMurry students will have a unique opportunity to combine the solid foundation of a small liberal-arts school education with professional preparation at a large university. McMurry will deliver foundational courses in physics, chemistry, math and even some introductory level engineering courses, while UND will provide upper division engineering courses online. Moreover, even when students are taking online courses from UND during their junior and senior years they will still receive assistance from McMurry faculty and will not be left completely on their own. This program is designed as a five year program. At the end of the program students will receive two BS degrees. Mechanical Engineering track will lead to a BS degree in Physics with minor in Mathematics from McMurry and an ABET accredited BS degree in Mechanical Engineering from UND. Chemical Engineering track will lead to a BS degree in Chemistry with minors in Physics and Mathematics from McMurry and an ABET accredited BS degree in Chemical Engineering from UND. Students will therefore be getting a much broader education compared to one they would have gotten by completing a standard engineering program. This will open up more career paths to these students including the possibilities of going to graduate programs in physics or engineering as well as employment in technical fields and teaching. This program may be especially attractive to the local Abilene population, since currently it is the only way to obtain an ABET-accredited engineering degree

almost without leaving Abilene. (This program would require students to travel to UND for a several week period during one summer (ME program) or two summers (ChE program,) to complete laboratory portions of some courses). We are looking forward to this recruitment opportunity, but as usual we are also asking you, our alumni and friends, to spread information about this new program to people who might be interested in engineering preparation at McMurry.

Last October all physics faculty traveled to the Texas Section of the American Physical Society (APS), American Association of Physics Teachers (AAPT) and Society of Physics Students (SPS) joint meeting at Texas A&M University in College Station. The meeting included several interesting talks in the areas of high energy physics and physics education.

Also last October all physics faculty and a group of physics students took a tour of the Wind Farm near Snyder TX. During that tour we were able to learn about basic operations of a wind farm. We are grateful to Dr. Renfro for organizing this tour.

In March all physics faculty and two physics students Kent Grimes and Kirk Hodel attended the National Meeting of the American Physical Society in San Antonio. It is not very often that our students have a chance to attend such a big professional meeting and it was a unique experience for them to be able to interact with physics professionals as well as other physics students from all over the United States and abroad. Several talks at that meeting were especially interesting. In particular, one devoted to the History of Physics and common misrepresentations about the scientific contributions of famous physicists such as Galileo and Einstein. There was also a surprisingly interesting set of talks on biomechanics which included a good deal of mechanical engineering. While visiting San Antonio, we were also able to take a tour of the Southwest Research Institute main campus. During that tour we had a chance to attend several research facilities including the lab which works on designing the future generation of cars that will be able to drive automatically without significant input from human drivers. We also visited the Space Science Division working on various sensors to be placed on satellites. Finally, we attended the nondestructive testing laboratory headed by Dr. Glenn Light. We are grateful to Dr. Keith for organizing this tour as well as to Dr. Light for hosting our group while at Southwest Research Institute.

In the spring semester, the department received a donation of two new high quality telescopes (a Meade ETX-125EC Astro, an Orion Astroview 90mm EQ, and associated accessories). Dr. Keith has already begun to use these telescopes to conduct observations with his Astronomy students and for other local groups such as the Boy Scouts, Girl Scouts, and the Cisco Science Club. We are grateful to Rebecca DeVore (in memory of her late husband Larry DeVore) for this generous gift.

The physics faculty and students are looking forward to a new productive academic year in front of us.