State of the Department: The Department of Biological and Agricultural Engineering has had a very successful and active year of growth during 2017-2018. Research and extension funding has continued to develop, with an average of about $120,000 ($136,000 this year) awarded per faculty member over the last six years. Total awards, on an annual basis, were $1,358,000 with the majority being from Dr. Boldor’s NSF EPSCoR award and Dr. Reichel’s DHH funding, both AgCenter projects. These two awards add up to more than $4.4 million in total grant amounts. In the last six years, BAE faculty has obtained, on average, approximately $2 million per year in research funds. Total refereed journal publications for 2017 were 17 (being a net number), only counting publications by more than one departmental faculty member once.

Enrollment and graduation numbers continue to increase in the undergraduate program, and positive changes have occurred in the graduate programs. The new PhD in Biological Engineering was approved by the Board of Regents on Dec. 11, 2017, after a long reviewing process at many levels. The independent BE PhD is a major accomplishment that has been proposed a number of times in the past. This new degree is linked to the Fast Path Program, established early in 2015, coupling LSU’s BS and PhD in BE with the MD at the Health Sciences Center – New Orleans. This program has generated significant interest since 2015, with 12 students now enrolled in the BS part of the program, and one student starting the MD part in Fall 2018.

Graduate enrollment has declined somewhat in 2017, with seven MS and six PhD students currently enrolled. We expect this drop from the typical 20 students to increase rapidly as three new faculty have startup funds for GAs, and faculty are pursuing additional grants. We saw more than 110 freshmen arrive in August 2017, with total undergraduate enrollment increasing to 326 in Fall 2017.

Three excellent hires were made in 2017-18. Dr. Yongchan Kwon has joined us from Northwestern University. His area includes synthetic biology, an exciting new area of molecular modeling and construction. In addition, two full-time TAs were added to the
Meet Some of the Faculty & Staff Members

Faculty Member
Claudette Reichel

Non-Faculty Members
Donna Elisar
Angela Singleton
Ashley Flynn
Sumit Libi
Thomas McClure
Sara Navarro
Charles Malveaux
Haley Moore
Debra Langlois
Bobbie Shaffett
Shandy Heil
Paul LaGrange
Glenn Ray
Bill Robinson
Pranjali Muley

department to assist with multiple labs and sections. BAE Instructor Nick Totaro guides the TAs within his role to including development, undergraduate program leadership, recruiting, and IT/lab support.

In May 2018, an offer was made to Dr. Kevin Hoffseth at UC Santa Barbara, who will join us in August.

Dr. Monroe was awarded an Alumni Professorship, and Dr. Theegala received an Outstanding Faculty Award from LSU Campus. Dr. Constant received the Zaki Bassiouni Distinguished Professorship in the College of Engineering. In December 2017, several of our faculty received the Tipton Team Award from the AgCenter. At present, all of our teaching/research tenured faculty hold one or more professorships, and while we are a relatively small department, faculty hold three Alumni Professorships.

Based on our student exit surveys, the BAE Department has now taken a very active role to engage LSU resources, BAE alumni, and the local industry to enhance our students’ experiences both before and after graduation. In partnership with the Olinde Career Center, activities such as career discovery, resume building, Handshake (previously Careers2Geaux) account creation, personality test and SWOT analysis, and a mock interview have been incorporated into the curriculum. The student organization BESO remains very active and should become a BioMedical Engineering Society (BMES) member in 2018.

The BAE Advisory Council has established officer positions and an enrichment fund to be used for council directives. With the council’s influence, more outside companies and partnerships with LSU-HSC have been established. With the support of BE alumni, many classroom visits and some video conferences occurred in several upper level design electives. We believe that with recent changes to a more independent Advisory Council, with their own charter and agenda, that these interactions will produce more development results and increased contacts. The target for growth of this fund is $135,000, to be on par with a couple of the other similar funds in the College of Engineering departments.

We expect 2018-2019 to be an exciting year in BAE, with new faculty, students, and projects at both the graduate and undergraduate levels. Feel free to contact us and visit the BAE Department in E.B. Doran Hall.
Student Highlights

Summary of Senior Design Projects

Vacuum-Operated Modular Micro-FloTec Device for Analysis of Sperm (VOMMDAS)

Faiz Alan, Christian Lemoine, Mykola Sereda, Mitchell St. Pierre, Evan Wilson

Faculty Advisor: W. Todd Monroe, PhD

Department of Biological and Agricultural Engineering

Introduction

Sperm (Sper) are a primary male organ in developmental biology due to the optical clarity of their
motions and the ability to use them as invertebrates to explore vertebrate-specific genetic problems. The
wide use of radiation has resulted in thousands of radiation lines, but sperm is the most difficult and variable
to measure, and genetic cryopreservation as a means of long-term storage and
preservation of the genetic resource. To address the sperm, the senior design
requires use of a new protocol.

Methods

Introduction: a new protocol for long-term storage and

Preservation: a new protocol for long-term storage and

Methods: a new protocol for long-term storage and

Results

Conclusions

Acknowledgments

We wish to thank the Department of Biological Engineering for funding our project. Additionally, Dr. Todd Monroe, Dr. Dori Bates, LSU Maritime

Instructor, and Denise Hall, LSU Maritime

Instructor, for their invaluable insights and assistance.
Introduction

Floodings are the overflow of various depths of water onto the land that is otherwise dry. Aside from wildfires, flooding is the most widespread and destructive natural disaster. The Federal Emergency Management Agency offers flood map services to informative flood risks. The residents in those flood zones need to be responsive, flood protection devices that can be set up quickly, require no, and are a small-scale prototype designed to withstand the hydrostatic force of three feet of water. A pump was used within the device to expel the water seeping into the device.

Objectives

- The main focus of the device is to construct a framework that will remain upright even with the high hydrostatic force caused by rising water without debris.
- The device will withstand lift of water without the braces breaking or the fabric collapsing.
- Two people will be able to have the device set up within 90 minutes.
- The device will handle a maximum seepage of 10 gpa.

Stake Design

According to the federal highway administration, the minimum factor of safety of 1.5 against sliding should be used for footings:

- $F_s = \frac{V}{V_{dr}}$
- $V = \frac{Q}{(1 + B)}$ (Equation 1)
- $V_{dr} = \frac{100\text{ lb}}{3.5}$ (Equation 2)

In order to have multiple stakes, they must be far enough apart to be out of the failure surface. A common recommendation for the thickness of oil is 30°.

Bracing Design

- Bracing was designed from two 4 in. ASTA 436 steel rectangular channels and one 4 in. ASTA 436 steel L-channel.
- The two rectangular channels are welded together to form a 90° angle.
- The L-channel is welded to the two rectangular channels so that it forms two 45° angles.
- Designed to a factor of safety of 2.5.

Calculations:

- $F_s = \frac{V}{V_{dr}}$
- $V = \frac{Q}{(1 + B)}$ (Equation 1)
- $V_{dr} = \frac{100\text{ lb}}{3.5}$ (Equation 2)
- $F_s = 2.5$ (Equation 3)

Design & Construction

- Pool noodles were duck taped to the vertical sides of the device to prevent the turf from rusting against the steel and tearing.
- The tape was connected to the braces by attaching promonts on the turf to carabiners on the braces.
- One layer of sand bags were placed on the turf. The turf was connected to the braces.
- One pump with an attached float switch was placed inside the device.
- It took 4 hours for two people to set up the device.

Testing

- Fabricated from ASTA 436 flat, steel, and rectangular bars.
- Welded onto the base of the horizontal rectangular channel.

Results & Observations

- Due to the high rate of seepage, the water level was set at 3.5 ft.
- The water reached a maximum height of 25.5 inches (Figure 12). At this height the braces did not move at all and none of the carabiners bent.
- However, the top ripped away from a few feet of the grass after being subjected to the force from the 25.5 inches of water for 3 hours.
- There was also a much higher rate of seepage than what was anticipated shown in Figure 13. The seepage came from under the turf and through the zipper.

Conclusion

- It was determined that the device can be set up by two people within an hour and a half.
- While testing the device inside out, cracks in the top had to be made in order to have the turf sit correctly on the ground. These cracks allowed water to flow under the turf at a higher rate than anticipated.
- The device was not able to be tested at 3 ft. of water. At maximum water height, the braces and stakes did not slide or bend under the pressure. The turf began to stretch at the perimeters and up and out of the ground.

Future Testing

- Additional irrigation and irrigation.
- Test the device with the correct side facing out.
- Hypothetical test results showing that seepage comes during the turf and through the zipper. Water to address this problem includes:
  - A zipper that is better protected from the water. This could be tested by using the same design as a breakaway dry-run paper.
  - Additional layer of sand bags around the base of the device.

Acknowledgements

We would like to thank Dr. Jon Bilodeau, Mr. T. M. McClure, Dr. N. J. M. Smith, Dr. S. S. Schena, Dr. C. T. Thongbai, Dr. T. J. Bollong, and Mr. D. T. T. T. Ho for their help in this project.
Adhesive, Sensor-Based Hydrogel to Dynamically Monitor Joint Angle

Introduction
Physical therapy involves the application of a variety of movements through the use of mechanisms designed to improve function and mobility. Devices used in physical therapy to measure and track the progression of joint range of motion through the use of handheld and attached measuring devices. However, the maneuver for adhesive hand-free sensing devices is often uncomfortable and difficult to maintain for a prolonged period.

The adhesive, sensor-based hydrogel developed in this project can be attached to the joint to monitor a range of motion of the knee and hip. The sensor-based measure is transferred to the computer using the equation and a graph is drawn that shows the information in a manner that is meaningful.

Problem Statement
The current methods of joint range measurements are complicated and involve the integration of complex and expensive devices. This paper presents a new method of joint range measurements that are more accurate and can be used in a clinical setting.

Design Objectives
The objective of this research is to develop a sensor-based hydrogel that can be used to monitor joint range of motion. The sensor-based hydrogel will be integrated into a sensor-based device that can be used in a clinical setting.

Design Approach - Sensor
The sensor-based hydrogel is used to monitor joint range of motion. The sensor-based hydrogel is a soft material that is applied to the joint and can be used to measure joint range of motion. The sensor-based hydrogel is placed on the joint and is used to measure joint range of motion.

Design Approach - Combined
The sensor-based hydrogel is placed on the joint and is used to measure joint range of motion. The sensor-based hydrogel is placed on the joint and is used to measure joint range of motion. The sensor-based hydrogel is placed on the joint and is used to measure joint range of motion.

Lower Extremity Automated Power Evaluation Device (L.E.A.P.E.D.)

Background
This study aims to create a portable, inexpensive, and easily operated device that quantifies power output following the completion of a leg press and may be used in a variety of research and clinical settings. An accurate device quantifying power output for comparison over time is needed. This device will be utilized at LSU Health Science Center to research adolescents with cerebral palsy. In addition, this device can be implemented in PT clinics for analyzing patients' post-injury or surgery.

Methods
Position 1: Typical pre-test starting position.
Position 2: Mild press position.
Position 3: Final testing position.

The subject being tested will be instructed to press as hard as possible beginning from position 1 and ending in position 3. Data will be recorded during a single press with additional weight added depending on a patient's limitations.

Results
Sample Data Set

Conclusion
This device acquires two simple sets of data: force and distance over time, which can easily be transferred to an excel template with pre-set equations that calculates out an ample amount of data into tables and graphs to be interpreted by the physician or therapist. Analysis of the patients results can show if there has been improvement over multiple visits, left vs. right leg dominance, and maximum power produced.

Future Testing
The use of L.E.A.P.E.D. has been verified under six healthy individuals of differing sizes and physical capabilities. The next steps will be used in a clinical setting. The system will be used to monitor patient progress over the course of a physical therapist training regimen. Primarily, L.E.A.P.E.D. will be used in the research of improving the lives of adolescents with cerebral palsy.

Acknowledgements
We would like to thank Mr. Jeffrey Ortego for his guidance, supervision, and support over the last two semesters. We would also like to thank Dr. Moreau and Dr. Pontiff for the project proposal and counsel. Also, a special thank you to Dr. Monroe and Traction Elite Physical Therapy.
Designing a Tree-Coring Tool
Assessing Volatile Organic Compound’s (VOC) Contamination

Design Team: Amanda Donahue, James Hebert, Asia Johnson, Laura Martin, Marcus Simon
Advisory: Dr. Theodore H. Smith, Rutgers University, Dr. Dara Dobson
Department of Biological & Agricultural Engineering
Louisiana State University

Introduction
An increment borer is a specialized tool that removes a cylindrical section of wood tissue, starting from the bark to the softf of a living tree. This conventional method provides important information about tree-ring chronology. Handling a manual increment borer can be a tedious process. Therefore, our primary goal is to develop a more efficient procedure to cores trees.

Objectives
1. Create an 18-in bore bit
2. Design and manufacture the boring tool attachment
3. Significantly reduce the amount of physical strain on the user
4. Atlanta quality tree sample

VOC's
The Environmental LLC is interested in this project for the use of assessing the biomass of VOC’s

Design
A. Parts included in drill attachment:
   - Manufactured Borer Bit
   - Keyless Chuck
   - Gearbox with 10:1 gear ratio
   - Thermoplastic Extractor
   - Adapters
   - Support Handle

Test trials & Results Table

<table>
<thead>
<tr>
<th>Trial</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attained +1.5 inch sample after using the borer bit and drill</td>
</tr>
<tr>
<td>2</td>
<td>Made cuts to the borer bit and was first time testing with full assembly</td>
</tr>
<tr>
<td>3</td>
<td>Bit attained +1 inch in sample. Attachment malfunction</td>
</tr>
</tbody>
</table>

Conclusion
Though our design did not result in obtaining a complete high-quality sample, we were able to create a functioning drill attachment. With the data collected from testing, we are able to locate the points of failure and propose design modifications to further product development in the future.

Acknowledgements
Thanks to Mr. Scott Aberg at EnvirosDec. LLC, Dr. Theegals, Dr. Chris Allen, for the invaluable guidance and support. Thanks to the Biotechnology Facilities at LSU for all help and support.

Vacuum-Operated Modular Microscope (VOMMS)
Device for Analysis of Sperm (VOMMDAS)

Faculty Advisor: W. Todd Monroe, PhD
Department of Biological and Agricultural Engineering

Introduction
Sperm (Sperm) is a primary male organ in development biology due to the potential of their ability to influence the development of specific genes. The rationale for this study is to create a device that will allow individuals to analyze sperm samples for genetic information. The device itself is made of a combination of metal, thermoplastic, and a circular glass viewing window.

Methods

Conclusions

Acknowledgements

We would like to thank Dr. Dobson and Dr. Dobson for their support and Dr. Don Box, LSU, for his invaluable guidance and support.
BAE Advisory Council

MISSION:
The mission of the Advisory Council is to advise and counsel the chairperson and the faculty of the Department of Biological and Agricultural Engineering (BAE) on matters pertaining to academic quality and stature of the Department. The Council will provide counsel on how the Department and the College can improve relationships and meet the needs of students, industry, commerce, government, and the society through best utilization of available resources. This includes actively supporting the Department's Development efforts in securing additional resources through individuals and industry.

Chairperson—Nick Gerbo
Vice-Chairperson—Richard Nelson
Secretary—Scott Bergeron

Meetings occur three times a year—summer, fall, and spring.

GOALS STARTING IN SUMMER 2017

1-Year Goals
- 15 active members on Advisory Council
- 30 networks of alumni for internships
  o Partnership with the Olinde Career Center

2-Year Goals
- Industry partners with senior design projects
- Progressively advance funds

5-Year Goals
- Meaningful financial contribution to the department

The Community Playground Project Celebrates 20 Years

For the past 20 years, LSU Biological and Agricultural Engineering Professor Marybeth Lima has made it her mission to build safe, accessible playgrounds—and bright futures—for local public school students.

With the help of her BE students and volunteers, she has spearheaded more than 30 playground builds through the LSU Community Playground Project. To commemorate the CPP's 20th anniversary, Lima and her design students recently hosted a celebration at University Presbyterian Church, where there was plenty of food, laughs and stories shared among students, volunteers and community members who have worked together over the years.

Founded in 1998, the LSU CPP has first-year BE students work together with local schools and community partners to
co-design and build playgrounds in an effort to ensure all children have access to play. Elementary and college students collaborate to create a playground design, which is finalized by children’s votes and input from teachers, administrators, and community members. The team then works together to fundraise and write proposals to pay for the playground and its installation.

The playgrounds, which can be constructed in 2-3 days, are usually built by volunteers to promote learning and community spirit and to minimize construction costs. In all, the CPP teams have designed playgrounds that serve approximately 12,000 children every school day.

“I try to do as many as I can, as fast as I can,” Lima said. “Finding volunteers is easy because we’ve been doing it for a while and most people love to come out and build. It’s the money that’s hard.”

For this reason, the CPP team fundraises and writes grant proposals to obtain funding. If the funding goes through, the team then organizes volunteers and helps facilitate the build. Lima has a list of 550 volunteers to call on for help with projects, many of whom were at the celebration gathering.

“Everyone you see here works for me or is an alum who graduated and came back for the party,” Lima said.

“She’s great,” says Beatriz Garcia, a BE senior from Brusly, La., who has been a part of Lima’s CPP team since her freshman year. “I still plan on helping with playground builds after I graduate.”

After the students presented her with a tiara and trophy to show their appreciation, Lima smiled and quickly shifted everyone’s attention back to the celebration. After all, this is a woman whose motto is “Service is the rent you pay for living on this earth.”

To learn more about LSU CPP, visit

BESO

BESO Activities

• Currently American Society of Agricultural and Biological Engineers members

• The annual BESO Crawfish Boil was a great success!

BESO 2017-2018 Blurbs

From Anthony Nguyen:

“I think, because of BESO, as well as the faculty and staff, we are able to grow a form of community compared to the other engineering departments at LSU. The fact that we have a BESO lounge makes it a good place to chat with other colleagues about interests and struggles, and it’s a great way to relax without having to worry as much. The crawfish boil and sweet potato/rice sale are great ways of engaging with colleagues of different years or of the same year as you. I’ve noticed that freshmen tend to avoid the BESO lounge because of how ‘intimidating’ the higher-year undergraduates might seem to be. So, if there’s a way to fix that problem, then perhaps members of the BE department can form a stronger relationship with each other.”

From Aimee Turner:

“BESO is a great organization! Everyone is super friendly, and the events are really fun. By joining BESO, I have really been able to connect with many students and faculty in the BE department. In addition to the great people, the monthly meetings are very informative and many of the guest speakers have really helped me get a better idea of what I want to do when I graduate from LSU.”

From Christian Lemoine:

“I enjoyed BESO so much because it gave me a chance to interact with other students in the major outside of the classroom, and it allowed me to make friends within the department. More importantly, as a student who didn’t always know what he wanted to do after graduation, BESO exposed me to a lot of options and helped me form a good idea of what choices I had following graduation. It is a good place to get the information you need from friendly and helpful faculty and students in the department.”

BESO 2018–2019 Officers:

President
Thaksin Kongchum; Fun Fact—played violin

Vice President
Brandon Tramontana; Fun Fact—robotics minor

Secretary
Angelle Leger; Fun Fact—plays in Tigerband

Treasurer
Kaitlin Dinh

Fundraising Chairs
Athena Lindsay; Fun Fact—kept her baby teeth even after learning the truth about the tooth fairy
Daniel Augustin; Fun Fact—business minor, part-time ninja

Fundraising Sub-chairs
Jackie Begue; Fun Fact—double-jointed
Chris Bolonga

Social Chair
Christina Dang; Fun Fact—Met singing group Fifth Harmony

BESO Outreach Representative
Gabrielle Kerkow
Master of Ceremonies
Dr. Marybeth Lima, professor

Awards & Recognitions

Harold T. Barr Memorial Scholarship
Presenter: Dr. Cristina Sabliov
Recipient: Jordan Remont

Richard L. Bengtson Endowed Scholarship
Presenters: Dr. Richard Bengtson and Mrs. Rhonda Bengtson Courville
Recipients: Alison Carrier
Jonathan Cuccia
Christina Dang
Jeanne Steyer

William H. and Barbara A. Brown Scholarship
Presenters: Dr. & Mrs. Bill Brown
Recipients: Dominique Angibeau
Thaksin Kongchum

Albert P. Halluin Memorial Scholarship
Presenter: Mr. Tracy Jones
Recipients: Jacob Bursavich
Nicholas Moss
McKenzie Windham

Mansel M. Mayeux Honorary Scholarship
Presenters: Mr. Mike Mayeux and Mr. Steven Mayeux
Recipients: Logan Daigle

Wiley D. Poole Memorial Scholarship
Presenter: Mr. Nick Totaro
Recipients: Amber Jarrell
Drake Melancon
Emily Patterson
Introduction of the Outstanding Alumni

Award recipient Dr. Alex Thomasson

Presenter: Dr. Richard Bengtson

Distinguished Alumni:
Dr. Alex Thomasson, MSAE 1989

Biography:
Professor

Undergraduate Education:
B.S., Texas Tech University, Agricultural Engineering, 1987

Graduate Education:
M.S., Louisiana State University, Agricultural Engineering, 1989
Ph.D., University of Kentucky, Agricultural Engineering, 1997

Research Interests
Cotton engineering, precision agriculture, remote sensing, sensor development, bioenergy, identity preservation
Rising Star Award

Lacey Simon, BSBE 2012, MSBAE 2014

My career began in 2008, when I walked in the doors of EB Doran. The colleagues and professors I encountered were shaping my future more than I expected. In 2011, LSU BE alumna Emily Hodges came to Dr. Sabilov’s Process Design class to present her work as a process engineer at Procter & Gamble. That was my first exposure to P&G, and I remember thinking I’d never measure up to get a job at a place like that.

Seven years later, I am promoted to a Band Two Manager at P&G with a role as Site Environmental Manager at the Sacramento Chemicals Plant. My resume/CV highlights some notable achievements during my tenure at P&G, but I will showcase my progression following my graduation from LSU in 2014, with an MS in BAE.

**Process Engineer at P&G Alexandria Fabric Care (2014)**

This was my first assignment at P&G, and until this point, my most difficult. I was placed in the most volatile operation in the company (Tide PODs), which had a reliability of less than 50 percent. I was responsible for eliminating equipment losses on the most critical piece of equipment in the operation (the machine that actually makes the pods). With collaboration from individuals in operations, I was able to bring the equipment from more than 10 stops per day to less than two stops per day over the first year.

During this role, I became a global expert and resource for cost savings and forecasting, serving as team leader of a group of engineers from Louisiana, Ohio, France, and Japan.

**Site Equipment Owner (2016)**

This was my second assignment at P&G. I was responsible for more than 30 technicians’ training, results, and career progression. I was also responsible for all equipment changes and upgrades on the equipment I owned. Some of the big projects I oversaw included child safety improvements to make the pods less soluble when ingested, and equipment throughput increase of more than 30 percent.

**Start-up Leader (2017)**

This was my third assignment at P&G. I oversaw the launch (start-up and validations) of a bundle of new products, leading a project team of all functions.

**Site Environmental Manager (2018)**

This was my fourth and current role at P&G, that I was promoted to on March 1, 2018. I will be managing the Site Environmental Program at the P&G Chemicals site in Sacramento, where the main products are glycerin, methyl esters, fatty acids, alcohols, and fatty acids. I will be fully on-boarded to work within the site operation to ensure we have the proper programs—including new projects—to meet government imposed criteria, which is elevated in California.
LSU Discover Day

Jacob Bursavich
Biological Engineering major Jacob Bursavich was named a 2018 LSU Discover Scholar awardee. These awards are given to the top 10 undergraduate researchers at LSU each year. They were celebrated at a ceremony on March 6, 2018, with their faculty mentors, family, and friends. Each awardee received a $1,500 travel stipend and will be highlighted at the annual LSU undergraduate research symposium LSU Discover Day.

https://www.youtube.com/watch?v=xP7NDhUWnAs&feature=youtu.be

Grace Rozanski—May 2018 Graduate
Grace Rozanski has worked on the culture and gene expression of aged and young human adipose derived stem cells over the past year. She presented her work, titled “The Extracellular Matrix: A Target for Rejuvenating Aged Human Adipose-derived Stem Cells,” at LSU Discover Day. Her project focused on age-dependent changes in the extracellular matrix and their role in the decline in hASC regenerative capacity.

Caroline Copeland—May 2018 Graduate

“Cancer Cell Secretome Alters Adipose Derived Stem Cells through ECM Secretions to Increase Cell Proliferation and Adipogenesis”

ABSTRACT
In 2018, it is estimated that 226,100 new cases of invasive breast cancer will be diagnosed in women in the U.S. Remodeling of the extracellular matrix (ECM) plays a key role in invasion. This remodeling changes integrin binding pathways, leading to upregulated AKT and MAPK pathways that increase cell proliferation and survival. Matrix remodeling also affects matrix stiffness based on collagen concentration, causing increased cancer progression and poor patient outcome. Current 2D models for drug studies are not ideal due to the heterogeneity of breast cancer and contributing stromal cell populations, including adipose derived stem cells (ASCs). To better identify how the tumor ECM is remodeled and how these changes contribute to drug resistance, we aim to develop and characterize tumor-stimulated ECM in ASCs. Here, we demonstrated that breast cancer secretome (conditioned media) stimulated ASCs. Changes in matrix-associated gene expression were evaluated with qRT-PCR for each cell type. In addition, total collagen stains were performed with Pico Serious Red Stain Kit. Conditioned media from both ER+ (MCF-7) and triple negative (MDA-MB-231 and BT549) cell lines induced increases in collagen deposition by ASCs. In the future, we plan to target these matrix-associated genes to test drug response in a more realistic microenvironment by making a better 3D tumor model that is sub-type specific. This model will allow a better understanding of how cancer cells function and, potentially, make prognosis and patient-precision therapy more effective in increasing patient survivability through targeting of the ECM.
**Gracie Miller—Junior**

“Evaluation of Extracellular Matrix Gene Expression as Predictive Markers of Breast Cancer Survival”

**ABSTRACT**

The ability to identify the subtypes of breast cancer is important in predicting therapy used to treat patients. Estrogen-receptor positive (ER+) and estrogen-receptor negative (ER-) can both develop drug resistance. Despite the current understanding of the different subtypes, there is still a lack in knowledge governing cell survival and proliferation, indicating a need for better prognostic indicators. The extracellular matrix (ECM) creates a unique microenvironment that supports cellular function and plays a key role in cancer progression. Due to their ability to induce cellular survival and mediate response to therapy, ECM related components may provide novel insight to patient response to therapy and outcome. This research aims to correlate tumor ECM composition to prognosis by identifying key matrix genes associated with patient survival for ER+ and ER- breast cancer tumor samples. Based on the expression of genes, Kaplan Meier plots estimate the survivability of cancer patients. With data from thousands of cancer patients over monthly follow-ups, graphs are made to measure the probability of survival over time based on whether a certain gene has high or low expression. Seventy-one different ECM genes including collagen, integrin, laminin, and elastin were looked at in ER+ and ER- cells. If there was significance in the Kaplan Meier plots, then the gene was important to survival, and is thus important to the ECM and ECM specific therapies. This correlation has the potential of bringing physicians one step closer to customizable patient precision medicine by providing additional prognostic markers.

**Layah Kahlif—Senior**

“Identification of Breast Cancer Subtype Specific Response to Extracellular Matrix”

**ABSTRACT**

Ninety percent of all cancer-related deaths are attributed to tumor burden at sites of metastatic lesions. Metastatic cancer cells, often correlating to stage IV (four) cancer, are characterized by their (1) rapid and uncontrolled growth, (2) ability to invade surrounding tissues, and (3) ability to spread to distant sites (metastasis). There is currently no satisfactory treatment for metastatic cancer. Prior research connects specialized intracellular structures, invadopodia, to cancer invasion and metastasis. These small finger-like projections, found selectively in invasive cancer cells, extend from the cell into the extracellular matrix via integrins. These integrins facilitate cell-to-extracellular matrix adhesion and attachment and the activation of these integrin binding pathways result in an increase in cell survival and proliferation, promoting tumor formation. The purpose of this research is to quantify the morphological differences of metastatic cancer cells on differing extracellular matrices in order to analyze how morphology correlates to adhesion and proliferation. Cell lines representing different breast cancer cell types are grown on various extracellular matrix substrates (fibronectin, collagen, and laminin) and visualized after undergoing fluorescent staining (Phalloidin, DAPI and Ki67 stains colorize actin ECM filaments, nucleic acid and nuclear proliferative protein respectively). This research aims to identify how characteristic matrix components induce a more aggressive phenotype for each breast cancer subtype to better understand how tumor environment differentially affects cancer proliferation. This research is currently in the preliminary stages of imaging and will evolve into quantitative differentiation through analysis of parameters such as cell length, diameter, height, projection area and volume.

**Akbar Zamin—Junior**

In my Discovery Day presentation, I shared my work on the synthesis and characterization of new collagen-lignin composites. These novel biomaterials exhibit robust mechanical properties, minimal cytotoxicity and immunogenicity, three desirable qualities for regenerative medicine applications.