

EXPAND

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15th Annual
Research & Creative
Achievement Week
April 5th–9th Student Center

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#RCAW2021



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RCAW 2021

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ACADEMIC COUNCIL

Grant Hayes, PhD, Interim Provost & Senior Vice Chancellor for Academic Affairs | hayesb15@ecu.edu

Mark A. Stacy, MD, Vice Chancellor for Health Sciences | stacyma17@ecu.edu

Michael R. Van Scott, PhD, Interim Vice Chancellor for Research, Economic Development, & Engagement | vanscottmi@ecu.edu
Greenville, NC 27858-4353 | www.ecu.edu

April 2021

We are pleased to invite you to participate in the East Carolina University Research and Creative Achievement Week (RCAW 2021), an all-virtual event this year. The week of April 5 – April 9 has been set aside to highlight the extraordinary accomplishments of our students in research and creative activities. While we remain in the midst of COVID-19-induced disruption, it is our core mission to support our students in this exciting opportunity for them. It is the hope of the organizing committee that you will attend, as much as your time allows, to see and hear what our students have achieved. Also, we hope that you will strongly encourage your students to attend. A partnership of these entities sponsors the event: Division of Academic Affairs, Division of Health Sciences, Brody Graduate Student Association, Graduate and Professional Student Senate, Office of Undergraduate Research, Office of Postdoctoral Affairs, Graduate School, and the Division of Research, Economic Development, and Engagement.

Research and Creative Achievement Week is a showcase of graduate and undergraduate student research and creative activities that are taking place here at ECU. There will be over 250 student virtual presentations, a large increase from last year's rapid conversion to an online event. Graduate student oral and poster presentations will take place on Monday, April 5. Undergraduate student oral and poster presentations will take place on Wednesday, April 7.

As part of our continuing emphasis on student and student-faculty collaborative work, the Provost's Challenge takes place on Friday, April 9, 1 – 2 PM, and the Innovation & Entrepreneurship at RCAW event also on Friday, April 9. The entire week is capped off with a virtual presentation event to recognize RCAW award winners, Graduate Faculty Mentor Award winners, Thesis and Dissertation Award winners, and other award winners on Monday, April 12.

Please consider encouraging your classes to attend specific discipline-related oral student presentations throughout the week.

Visit the RCAW blog at <http://blog.ecu.edu/sites/rcaw/> for a schedule of events (click on Schedule).

What an exciting week and a great experience for our students! We look forward to “seeing you” at this virtual event and participating in these events.

Grant Hayes

Mark A. Stacy

Michael R. Van Scott



2021 Provost Challenge

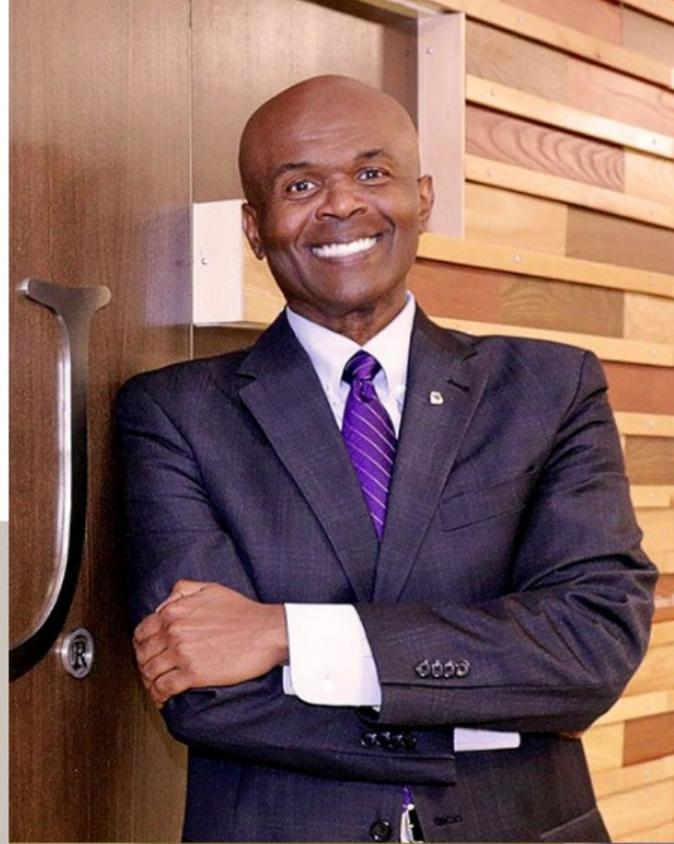
Student Well-Being and Mental Health

The Provost Challenge harnesses the intellectual strengths and research resources of ECU to improve the quality of life, health, education and employment for the people of eastern North Carolina.

The initiative is committed to engaging students through the use of innovative learning strategies to develop new tools and approaches that drive job creation, health innovation, and educational improvements in our communities.

JOIN US
FRIDAY, APRIL 9TH
1:00-2:00PM

symposium.foragerone.com/research-and-creative-achievement-week



Dr. Grant Hayes

Provost, East Carolina University

The goal of the annual challenge is to focus on the three pillars that make ECU unique; student success, public service and regional transformation.



Innovation & Entrepreneurship at RCAW Showcase Event

Outstanding projects demonstrating innovation and entrepreneurship by the ECU community will be showcased at this virtual event.

Projects demonstrate the following programs:

- RISE29
- I-Corps @ ECU
- Accelerate Rural NC
- Crisp Small Business Resource Center
- Miller School of Entrepreneurship
Innovation LLC

Join us Friday, April 9, 2021 at RCAW

Provosts' Challenge

Express Team: Seth Caddell, Devontae Grace, Pega Ogbemor, and Daylen Wheeler

On Campus 5K/ ECU 5K: Katrina Free, Charlotte Jones, Courtney Layton, Arjun Nagpal, Joyel Puthuparampil and Sierra Welsh

ECU Mental Health Connections: Jakyre Bryant, Honesty Garrett, Tanner Godwin, Katelynn Hudson, Samantha Lisk, and Joseline Mata

Your Mind Matters: Anarut Bustos, Kassidy Daniels, Meriem Mekaoui, Makaleigh Moore, Macy Stoneham, and Eder Torres-Tobon

Calendar Relief: Dana Crosson, Yuvraj Desai, Abdulla Hroub, Andrew McGriff, Anna Overton, Kayla Peace, and Glenwood Taylor

Innovation & Entrepreneurship Showcase

I-Corps:

Mobile App to Assess WBGT-Heat Stress Risk of Outdoor Workers: Jo Anne Balanay, Sinan Sousan

Pathways to Positive Health: Craig Becker

15-Deoxy, D12,14-Prostamide J2: A Selective Immunotherapeutic for Treating Melanoma; Colin Burns, Rukiyah Van Dross, Daniel Ladin

ADAPT: A Web-Based Intervention for Bereaved Parents: Nancy Dias

BioEphX: Advancing Delivery of Biomatrix-saturated EFNA1 to Mitigate the Complications of Myocardial Infarction: Robert Hughes, Jitka Virag, Bryan Allinson

Data Aggregator: Richard Lamb, Rebekah Lamb, Jonah Firestone

Go-Bo: A Modular Martial Arts Weapons Kit: Douglas Thomas, Heather Thomas

Shoreline Scour Mitigation using 3-D Printed High Strength Concrete Coral Reefs: Amin Akhnoukh, Tejan Ekhande

S-CHAT Smartphone Serious Game Simulated Conversations for Asynchronous and Passive Learning/Instruction: Joshua Peery, Kuan Chen

I-Corps @ ECU, The Business Model Canvas: Byron Aguilar

Rise 29:

The Hackney Distillery: Emily Cross, Dana Shefet

County Road Seafood Consulting Recommendations: Noah Dove, Julie Ann Vincent

BoozeJuice: Keaton Forbes, Carter Forbes, Cole Bivens, Danny Blakeman

Other Innovation & Entrepreneurship:

BHR Smart Homes: Brendan Cunningham, Hannah Holland, Randall Jennings

Alinement Dancewear: Madeline Douglas

Colorful Desires: Kenneth Roach, Ebonee Johnson, Kayla Jones, Tyrell Govan

Trax Golf: Nick Stukey, Dillon Forstber

Schedule of Events

Monday, 5 April

Graduate Student Presentations

9 am - 5 pm - **Posters** <http://blog.ecu.edu/sites/rcaw/files/2021/03/grad-poster.pdf>

9 am - 5:05 pm - **Oral** <http://blog.ecu.edu/sites/rcaw/files/2021/03/grad-oral-schedule.pdf>

Wednesday, 7 April

Undergraduate Student Presentations

9 am - 5 pm - **Posters** <http://blog.ecu.edu/sites/rcaw/files/2021/03/ugrad-poster.pdf>

9 am - 2:30 pm - **Oral** <http://blog.ecu.edu/sites/rcaw/files/2021/03/ugrad-oral-schedule.pdf>

Friday, 9 April

1 pm - Provost Challenge

2-4 pm - Innovation & Entrepreneurship Showcase

Monday, 12 April

12 pm - RCAW Recognition Ceremony

RCAW Awards

Thesis/Dissertation Awards

ECU Distinguished Faculty Mentor Awards

Provost's Challenge

Innovation & Entrepreneurship Awards

Planning Committee Members

Executive Committee

Mary Farwell

Assistant Vice Chancellor, Division of Research, Economic Development, and Engagement

Donna Kain

English, Thomas Harriot College of Arts and Sciences

Lynnsay Marsan

VC Fellow for Undergraduate Research, REDE

Tom McConnell

Associate Dean, The Graduate School

Jocelyn Bayles

Nutrition Science, Undergraduate Student

Marquerite Bond

The Graduate School

Kathleen Cox

Associate Dean, The Graduate School

Amy Curtis

Science Librarian

Taylor Dement

Biomedical Physics Student, Thomas Harriot College of Arts and Sciences

Planning Committee Members (cont.)

Christyn Dolbier

Psychology, Thomas Harriot College of Arts and Sciences

Nehad Elsawaf

Economics, Thomas Harriot College of Arts and Sciences

Rich Franklin

Microbiology & Immunology, Brody School of Medicine

Emma Goldberg

Department of Physiology, Brody School of Medicine

Pam Hopkins

School of Communication

Margaret Macready

Division of Research, Economic Development, and Engagement

Travis Moffitt

MA Music Student, College of Fine Arts & Communications

Plummer Nye

The Graduate School

Matt Smith

Communication Specialist, University Communications

Virginia Stage

Nutrition Science, College of Allied Health Sciences

Undergraduate Oral Presentation Schedules

All undergraduate presentations are on Wednesday, April 7th. All presentations are recorded. Each 5 minute live segment is for the Question – Answer part of the presentation

Dave, Parth	9:00 AM	Wilson, Nia	1:15 PM
Patterson, Kaylee	9:05 AM	Pigg, Hunter	1:20 PM
Moore, Kaila	9:10 AM	Southern, Kaitlin	1:25 PM
Long, Jessica	9:15 AM	Break	1:30 PM
Hall, Jonathan	9:20 AM	Mundt, Laura	1:45 PM
Akers, Sarah	9:25 AM	Klug, Jacob	1:50 PM
Jackson, Danielle	9:30 AM	Ruiz, Jessica	1:55 PM
Break	9:35 AM	Guiler, William	2:00 PM
Chan, Elizabeth	9:40 AM	Martin, Tara	2:05 PM
Russell, Rasheanah	9:45 AM	Arensberg, Ashley	2:10 PM
Lynch, Spencer	9:50 AM	Turner, Diana	2:15 PM
Gowdy, Alyssa	9:55 AM	Lennon, Chelsea	2:20 PM
Break	10:00 AM		
Booyesen, Grethe	10:05 AM		
Shefet, Dana	10:10 AM		
Ring, Hannah	10:15 AM		
Mitchell, Dasia	10:20 AM		
Davis, Rachel	10:25 AM		
Lewis, Amy	10:30 AM		
Break	10:35 AM		
Watkins, Rachel	10:45 AM		
White, Alita	10:50 AM		
Keeter, Caroline	10:55 AM		
Adgate, Joseph	11:00 AM		
Break	11:05 AM		
Rajan, Arvind	11:15 AM		
Stewart, Savannah	11:20 AM		
Roupe, Zachary	11:25 AM		
Chernauskas, Schuyler	11:30 AM		
Break	11:35 AM		
Cobb, Faith	1:00 PM		
Smith, Haley	1:05 PM		
Weddle, Kenneth	1:10 PM		

Undergraduate Poster Presentations

All undergraduate posters are on Wednesday, April 7th. All presentations are recorded. Student presenters must be available for the entire **live** 1.5 hour section for judges and audience members to ask questions.

Smith, Breanne	9:00-10:30 AM	Malachowski, Taylor	9:00-10:30 AM
Ejindu, Cindy	9:00-10:30 AM	Kleinert, Bradley	9:00-10:30 AM
Eisen, Harper	9:00-10:30 AM	Eakes, Remington	9:00-10:30 AM
Free, Katrina	9:00-10:30 AM	Wingard, Nicolas	9:00-10:30 AM
Battle, Darian	9:00-10:30 AM	Luke, Mikayla	9:00-10:30 AM
Wright, Michael	9:00-10:30 AM	Pentakota, Ananya	9:00-10:30 AM
Fuller, Cassidy	9:00-10:30 AM	Moore, Madison	9:00-10:30 AM
Patel, Puja	9:00-10:30 AM	Smith, Cameron	9:00-10:30 AM
Johnson, Elizabeth	9:00-10:30 AM	Seabrook, Jocelyn	9:00-10:30 AM
Dorn, Alexandra	9:00-10:30 AM	Nandigama, Nainika	9:00-10:30 AM
Martin, Hannah	9:00-10:30 AM	Pierce, Whitney	9:00-10:30 AM
Blumthal, Elizabeth	9:00-10:30 AM	Massey, Malinda	3:30-5:00 PM
Phinizy, Tyler	9:00-10:30 AM	Pellow-Summers, Amelia	3:30-5:00 PM
Osborn, Ramsey	9:00-10:30 AM	Cross, Emily	3:30-5:00 PM
Hewett, Sydney	1:00-2:30 PM	Bunten, Timothy	3:30-5:00 PM
Kenny, Summer	1:00-2:30 PM	Chakraborty, Kunal	3:30-5:00 PM
Davis, Rebecca	1:00-2:30 PM	Webster, Abigail	3:30-5:00 PM
McGinnis, Erin	1:00-2:30 PM	Bolick, Hannah	9:00-10:30 AM
Pridgen, Madalyn	1:00-2:30 PM	Sasser, Georgia	9:00-10:30 AM
Hutto, Hailey	1:00-2:30 PM	Redick, Lily	9:00-10:30 AM
Fricke, Cecilia	1:00-2:30 PM	Urban, Alex	9:00-10:30 AM
Powell, Harley	1:00-2:30 PM	McCallum, Lindsey	9:00-10:30 AM
Chamberlin, Jamie	1:00-2:30 PM	Johnston, MaKenna	1:00-2:30 PM
Alligood, Breanna	1:00-2:30 PM	Foster, Brianna	1:00-2:30 PM
Halvorsen, Kelsey	1:00-2:30 PM	Willard, Samantha	1:00-2:30 PM
Pilkington, Jason	1:00-2:30 PM	Florimonte, Mariella	1:00-2:30 PM
Baukema, Abby	1:00-2:30 PM	Nicoletti, Alexandra	1:00-2:30 PM
Gerber, Bronte'	9:00-10:30 AM	Alford, Claudia	1:00-2:30 PM
Bradley, Steven	9:00-10:30 AM	Feiler, Tatum	1:00-2:30 PM
Pallozzi, Megan	9:00-10:30 AM	Foster, Samantha	1:00-2:30 PM
DeVitto, Evan	9:00-10:30 AM	Warren, Leah	1:00-2:30 PM
Willis, William	9:00-10:30 AM	Meeks, Joshua	1:00-2:30 PM

Rogers, Allison	1:00-2:30 PM	Warfel, Olivia	1:00-2:30 PM
Walker, Carmen	1:00-2:30 PM	Priest, Allison	1:00-2:30 PM
Amaresh, Sneha	1:00-2:30 PM	Koirala, Ananya	1:00-2:30 PM
Swinson, Kathryn	3:30-5:00 PM	Wood, Ceilia	1:00-2:30 PM
Koster, Melissa	3:30-5:00 PM	Zia, Raazia	1:00-2:30 PM
Chan, Victoria	3:30-5:00 PM		
Hagans, Kinsley	3:30-5:00 PM		
Murphy, Savannah	3:30-5:00 PM		
Caras, Emily	3:30-5:00 PM		
Sharabi, Lihi	3:30-5:00 PM		
Buie, Elizabeth	3:30-5:00 PM		
Schroeder, Alexis	3:30-5:00 PM		
Congema, Marianne	3:30-5:00 PM		
Hoffman, Sarah	3:30-5:00 PM		
Ruffin, Tanner	3:30-5:00 PM		
Tallant, Maria	3:30-5:00 PM		
Waddell, Jillian	3:30-5:00 PM		
Phillips, Savannah	3:30-5:00 PM		
Blango, Dymon	3:30-5:00 PM		
Foster, Brittany	3:30-5:00 PM		
Bonin, Thomas	3:30-5:00 PM		
Butler, Adam	3:30-5:00 PM		
Lowe, Sydney	3:30-5:00 PM		
Levesque, Allison	3:30-5:00 PM		
Miller, Ashley	3:30-5:00 PM		
Barnett, Zachary	3:30-5:00 PM		
Middleton, Shea	3:30-5:00 PM		
Cole, Emma	3:30-5:00 PM		
Sessoms, Olivia	3:30-5:00 PM		
Wheeler, Mackenzie	3:30-5:00 PM		
Krell, Grace	3:30-5:00 PM		
Reed, Elisabeth	3:30-5:00 PM		
Eldreth, Dustin	3:30-5:00 PM		
Holloman, Billy	3:30-5:00 PM		
Viverette, Elizabeth	1:00-2:30 PM		
Gribble, Lindsay	1:00-2:30 PM		
Contreras, Melany	1:00-2:30 PM		
Agostini, Marco	1:00-2:30 PM		

Graduate Oral Presentation Schedules

All undergraduate presentations are on Monday, April 5th. All presentations are recorded. Each 5 minute live segment is for the Question – Answer part of the presentation

Lukas, Laura	9:00 AM	Khanjari Nezhad Jooneghani, Zeinab	11:45 AM
Schuler, Gwyneth	9:05 AM	Break	12:00 PM
Longest, Kaitlyn	9:10 AM	Bunner, Wyatt	12:30 PM
Wilson, Kelsi	9:15 AM	Shookster, Daniel	12:35 PM
Sall, Kayla	9:20 AM	Landry, Taylor	12:40 PM
Yerges, Anna	9:25 AM	Terwilliger, Zoe	12:45 PM
Tyndall, Krystal	9:30 AM	Black, Hannah	12:50 PM
Elder, Michael	9:35 AM	Woods, Sydney	12:55 PM
Futrell, Abbey	9:40 AM	Buckner, Thomas	1:00 PM
Briney, Paul	9:45 AM	Madipally, Divya Jyothi	1:05 PM
Tyler, Jamie	9:50 AM	Patel, Bhavin	1:10 PM
Break	9:55 AM	Break	1:15 PM
Thompson, Nicole	10:00 AM	Hutchinson, Katya	1:20 PM
Anderson, Sarah	10:05 AM	Graves, Karena	1:25 PM
Livingston, Patricia	10:10 AM	Beblo, Julianne	1:30 PM
Philips, Lane	10:15 AM	Bennett, Sina	1:35 PM
Wekam, Vanina	10:20 AM	Naimo, Anthony	1:40 PM
Evans, Shayla	10:25 AM	Bigham, James	1:45 PM
Novakowski, Tanya	10:30 AM	Bowers, Crystal	1:50 PM
Fugate, Sandra	10:35 AM	Rhodes-Pruitt, John	1:55 PM
Starnes, Amanda	10:40 AM	Prevette, Thaddeus	2:00 PM
Break	10:45 AM	Break	2:05 PM
Eubanks, Samantha	10:50 AM	Swan, Lindsay	2:10 PM
Richards, Connie	10:55 AM	Hesson, Nicholas	2:15 PM
Fischer, Jill	11:00 AM	Christensen, Timothy	2:20 PM
Johnston, Miguel	11:05 AM	Berman, Adam	2:25 PM
Mercurio, Myrna	11:10 AM	Johnson, Madison	2:30 PM
Reedy, Gerald	11:15 AM	Delbrocco, Lauren	2:35 PM
Break	11:20 AM	Break	2:40 PM
Break	11:25 AM	Maloney, Brian	2:45 PM
Davis, Storm	11:30 AM	Tahmasebifard, Neda	2:50 PM
Carroll, Matthew	11:35 AM	Grantham, Rachel	2:55 PM
Philips, James	11:40 AM	White, Timothy	3:00 PM

Purcell, Brittney	3:05 PM
Dunn, Monica	3:10 PM
Dayal, Sahil	3:15 PM
Break	3:20 PM
Yang, Hailong	3:25 PM
Mendenhall, Todd	3:30 PM
Goodnight, Sarah	3:35 PM
Lee, Timothy	3:40 PM
Pogue, Joel	3:45 PM
Bartlett, Brian	3:50 PM
Trackenberg, Stacy	3:55 PM
Break	4:00 PM
Wellman, Emory	4:05 PM
Streuber, Dillon	4:10 PM
Orr, Kristen	4:15 PM
Donnelly, Shannon	4:20 PM
Khatiwada, Muna	4:25 PM
Carver, Jonathan	4:30 PM
Kann, Peter	4:35 PM
Works, Anna	4:40 PM
Pahl, Matthew	4:45 PM
Depolt, Kelley	4:50 PM
Kernstine, Melissa	4:55 PM
Baker, Eleanor	5:00 PM
Jarrett, Christopher	5:05 PM

Graduate Poster Presentations

All undergraduate posters are on Monday, April 5th. All presentations are recorded. Student presenters must be available for the entire **live** 1.5 hour section for judges and audience members to ask questions.

Suarez, Collins	9:00-9:30 AM	Tucker, Emily	1:45-3:15 PM
Butler, Patricia	9:00-9:30 AM	Sanders, Margaret	1:45-3:15 PM
Navaei, Maryam	9:00-9:30 AM	Fileccia, Cassandra	1:45-3:15 PM
Chawla, Vinay	9:00-9:30 AM	Neville, Jessica	1:45-3:15 PM
Seals, Nathaniel	9:30-11:00 AM	Schult, Caitlin	1:45-3:15 PM
Popovic, Grega	9:30-11:00 AM	Moore, Kathryn	1:45-3:15 PM
Sabu, Stephiya	9:30-11:00 AM	Reyes, Michelle Anne	1:45-3:15 PM
Hopersberger, Dariel	9:30-11:00 AM	Broder, Natalie	1:45-3:15 PM
Ciuca, Angela	9:30-11:00 AM	Whaley, Taylor	1:45-3:15 PM
Satterwhite, Emily	9:30-11:00 AM	Sears, Camryn	3:30-5:00 PM
Dorgham, Mohammed	9:30-11:00 AM	French, Natalie	3:30-5:00 PM
Dugom, Patrick	9:30-11:00 AM	Hulsey, Tara	3:30-5:00 PM
Naser, Amna	9:30-11:00 AM	Pavell, Dakota	3:30-5:00 PM
Belcher, Heather	9:30-11:00 AM	Boyd, Rachel	3:30-5:00 PM
Biagioni, Ericka	9:30-11:00 AM	Young, Elizabeth	3:30-5:00 PM
Ubah, Chukwudi	9:30-11:00 AM	Mulkey, Mackenzie	3:30-5:00 PM
Libby, Nichole	9:30-11:00 AM	Bush, Dominic	3:30-5:00 PM
Tripson, Mark	9:30-11:00 AM	Saul, Amelia	3:30-5:00 PM
Nichols, Quentin	12:00-1:30 PM	Forys, Jessica	3:30-5:00 PM
Banaszynski, Matthew	12:00-1:30 PM	Wilder, Emily	3:30-5:00 PM
Donini Rivera, Ariana	12:00-1:30 PM	Middleton, Virginia	3:30-5:00 PM
Anderson, Alexis	12:00-1:30 PM		
Easterling, Elise	12:00-1:30 PM		
Osunkwor, Offormata	12:00-1:30 PM		
Mitchell, Justin	12:00-1:30 PM		
Ferris, Kathleen	12:00-1:30 PM		
Glover, Leasia	12:00-1:30 PM		
Garcia, Christopher	12:00-1:30 PM		
Fyle, Amanda	12:00-1:30 PM		
Maynard, Daniel	12:00-1:30 PM		
Garcia, Aied	12:00-1:30 PM		
White, Avian	1:45-3:15 PM		
Delgado, Kimberly	1:45-3:15 PM		
Krassovskaia, Polina	1:45-3:15 PM		

Mentor List

Abdel-Salam, Tarek M	Driscoll, Virginia Darnell	Hudson, Nathan E
Ables, Elizabeth Tweedie	Dubis, Gabriel	Hur, Mi-Sook
Alipour, Kent	DuBose, Katrina D	Hur, Misun
Annetta, Leonard	Eagan, Sheena Marie	Hvastkovs, Eli Gerald
Asagbra, Oghale Elijah	Edwards, Robert	Issa, Fadi Aziz
Asch, Rebecca G	Egan, Kathleen Louise	Jensen, Jakob F
Atherton, William Leigh	Eppler, Marion A	Johnson, Erika Katherine
Atkinson, Terry Stafford	Erickson, Timothy Paul	Jubran, Hanna
Aziz, Shahnaz	Etheridge, James Randall	Kang, Jin-Ae
Babatunde, Oyinlola Toyin	Ewen, Charles R	Kariko, Daniel Josip
Baker, Michael Drew	Farr, Deonna Emm	Kennerly, Susan
Banerjee, Sambuddha	Fazzone, Patricia Anne	Kindl, Heather
Bell, Natasha Lynn	Ferreira, Rosana Nieto	Knox, David H
Beltran-Huarac, Juan	Field, Erin Kirby	Kovar, Cheryl L
Black, Kristin Zenee	Fish, Matthew Taft	Kowalczyk, Christine Marie
Blakeslee, April Monica Houghton	Forbes, Thompson Hollingsworth	Kulas, Anthony
Blanchflower, Tiffany Machado	George, Stephanie	Lagomasino, David
Bolin, Linda Prior	Geraldeli, Saulo	Lamb, Alfred C
Bowler, Mark C	Geyer, Christopher	Larson, Kim L
Broskey, Nicholas Thomas	Gittman, Rachel Kelley	Lee, Jinkun
Chen, Yan-Hua	Gonzalez, Monica Lyn	Lee, Joseph G
Christensen, Timothy W	Goodwillie, Carol	Lee, Tammy D
Christian, John C	Graber, Theodore G	Lewis, Travis Earl
Clemens, Stefan	Gregory, Jenny Crowder	Limberis, Loren
Cofie, Leslie E	Guidry, Allen O	Lin, Ziwei
Collins, John	Habeeb, Christine	Littleton, Heather
Corbett, Robin	Haddock, Rosemary Kidd	Loudon, James Ernest
Daniel, Isaac Randolph	Hegde, Archana	Mansfield, Kyle David
Das, Bhibha Mayee	Hodge, Elizabeth Baker	Martin, Ryan John
DeWitt, Regina	Hodgson, Jennifer	Massarra, Carol
Dias, Nancy	Horn, Patrick Jacob	Matthews, Jennifer Cremeens
Dolbier, Christyn	Horsman, Eric	McCarlie, Van Wallace
Donica, Denise	Huang, Hu	McClung, Joseph Matthew

Mentor List (cont.)

McCoy, Michael W	Roop, Roy M
McKinnon, Jennifer Faith	Roper, Rachel L
McRae, Susan B	Rothermich, Kathrin
Meardon, Stacey Augusta	Ryan, Teresa Jean
Mitra, Siddhartha	Sastre, Lauren Rogers
Mizelle, Elizabeth	Shearman, Sachiyo M
Moss, Mark Eric	Sherman, Susan G
Muise, Heather Lynn	Shewchuk, Brian M
Murashov, Alexander K	Shinpaugh, Jefferson
Murenina, Elena Konstantinovna	Sitzman, Kathleen Laura
Murphy, Lynne	Skibins, Jeffrey C
Murray, Nicholas P	Soderstrom, Kenneth M
Nassehzadeh-Tabrizi, Moha	Sousan, Sinan
Neil, Janice A	Speicher, James Edward
Neufer, Peter D	Spuches, Anne M
Ngo, Thanh	Stage, Virginia Carraway
Olson Lounsbery, Marie	Surkar, Swati Manoharrao
Owens, Tosha Lynn	Szatmari, Erzsebet Maria
Oyen, Michelle Lynn	Thompson, Beth
Pardi, Vanessa	Thornton, Kendell C
Pawlak, Roman M	Tisnado, James R
Peery, Annette Ivey	Tran, Tuan D
Peralta, Ariane Legaspi	Tyndall, Deborah Eastwood
Perry, Jamie L	Vahdati, Ali
Perry, Megan A	Vail-Smith, Karen
Pokhrel, Lok R	Vance Chalcraft, Heather D
Polakowski, Nicholas	Wei, Holly Lee
Reardon, Robert Martin	Wells, Angela Franks
Rickenbach, Thomas M	Wilmes, Justin A
Rider, Patrick Michael	Yeh, Chia Jung
Roberson, Donna W	Zhu, Yong
Robidoux, Jacques	
Rocha, Edson R	

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Award Categories

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Graduate Oral Biomedical Sciences

Graduate Oral Human Health

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Graduate Poster Natural Sciences

Graduate Poster Social Sciences

Masters Oral Education

Masters Oral Engineering/Technology

Masters Oral Natural Sciences

Masters Oral Visual and Fine Arts

Masters Poster Engineering

Masters Poster Human Health

Post Doctoral

Undergraduate Oral Biomedical Sciences

Undergraduate Oral Business

Undergraduate Oral Engineering

Undergraduate Oral Human Health

Undergraduate Oral Humanities

Undergraduate Oral Natural Sciences

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Undergraduate Poster Biomedical Sciences

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Synthesis and Characterization of Nanobioglass for remineralizing purposes

Gabriel Abuna

General Dentistry

Mentor: Saulo Geraldeli

Dental caries and periodontal disease are responsible for the most frequent set of chronic diseases in humans, for which no perfectly regenerative solutions are available yet. As a result, materials combining an intrinsic antibacterial activity with tissue regeneration properties for minimally invasive dental therapies are in high demand. Here we report on the fabrication and characterization of a novel nanobioglass for such dental applications. The material is composed of narrowly dispersed $\text{Na}_2\text{O-CaO-P}_2\text{O}_5\text{-SiO}_2$ bioglass nanoparticles, 30-70 nm in diameter. The systems were characterized for their particle size, morphology, phase composition and glass/polymer interface with the use of transmission electron microscopy, and Fourier transform infrared spectroscopy. After annealing at 680° C, amorphous silica in bioglass coexisted with silicalite-1 and combeite, the average crystallite size of which was 20-40 nm. The negatively charged silanol groups of silica may extend to the interaction with dentin collagen fibrils decalcified due to caries, making the material of potential interest for adhesive fillers of cariogenic lesions in teeth.

Temporal Leadership

Joseph Adgate

Management, College of Business

Mentor: Kent Alipour

The topic of leadership is common in today's world, as the specific behaviors used to lead have been found to have an impact on a group's successes and failures. Because work tasks typically have deadlines, time is a situational factor that influences most workplaces. Despite this, research on the time-related aspects of leadership is surprisingly limited. However, recent work has proposed "temporal leadership" as a behavioral style that can be used to influence others to efficiently use time. Temporal Leadership is broken down into five dimensions; Temporal Direction, Temporal Modeling, Temporal Intervention, Temporal Monitoring, Temporal Encouragement. Each of these dimensions can play a key role in getting individuals to make better use of their time.

Using ICE-Sat2 to Determine Water Level and Wave Power

Marco Agostini

Coastal and Marine Studies

Mentor: David Lagomasino

In 2018, NASA launched a new satellite into space called Ice, Cloud and Elevation Satellite-2, or ICESat-2 for short. The primary purpose of this satellite was to measure the elevation of ice sheets, glaciers, and sea ice to monitor their change in the warming climate, which it does very well. However, after the satellite was launched, it was discovered that it appears to be able to detect other properties as well, such as sea floor topography, waves, and water level. We are interested in testing the accuracy of the satellite to measure these properties - particularly waves and water levels - in order to discover how coastal ecosystems, influence wave power and ocean topography of the coast of North Carolina and around the world. We are doing this by first comparing data from ICESat-2 to in situ data we have collected using offshore buoys and water level sensors in the Sound. This will confirm the accuracy of the satellite data and help develop new remote sensing models to predict wave height and water levels that can be used in other coastal environments. We have already subset portions of data by hand as an initial proof of concept, and now we plan to scale information retrieval through sophisticated computer codes (in Python) to analyze larger amounts of data in more specific regions in a much more efficient manner. I will further develop Python codes to subset global data within the cloud environment and automatically compare that data with water level information collected in the field by the requested sensors. We will then create computer models to predict wave height and water level that can be used to estimate these parameters around the world. After confirming the accuracy of the satellite, we will then use it to calculate the wave power and water levels around the globe, in places where offshore buoys are not present. Shorelines have been eroding at an increasingly rapid rate for many years, and with rising sea levels natural coastline defenses are becoming more and more essential. We will be building these efforts on top of several other ongoing projects funded by NASA and SECOORA. This project will enable us to make measurements of waves and water levels in some of the most remote places in the world. It will help us to estimate just how effective different coastal barriers are, as well as be able to monitor them remotely, without having to make excursions or deploy expensive equipment.

Why so Blue? An Investigation into the Genetic Underpinning of Blue Eggshells in the Eastern Bluebird

Sarah Akers

Biology

Mentor: Sarah McRae

Eastern Bluebirds *Sialia sialis* are among a variety of different species of birds that lay blue eggs. Blue eggshell coloration has been proposed to serve many functions including acting as a signal of maternal quality, playing a role in structural integrity of the shell, and providing the embryo protection from solar radiation. In a wild population of bluebirds nesting in purpose-built boxes at East Carolina University's West Research Campus, fewer than 5% of females lay white eggs. This rare shell color variant occurs in other populations and has a hereditary component. However, little is known about the genes that control eggshell color. I am using a two-pronged approach of pedigree analysis and genetic sequencing to identify the gene(s) responsible for blue eggshell coloration in the Eastern Bluebird. Pedigree analysis of families of bluebirds including females that lay eggs with the rare white egg trait suggest an inheritance pattern consistent with the trait being autosomal dominant or linked to the Z sex chromosome. I used DNA isolated from blood samples taken from white and blue egg-layers to compare sequence data. First, I amplified part of a gene known to be responsible for blue egg coloration in two strains of chicken, to determine if white and blue egg-laying bluebirds have sequence differences in the same gene. Second, I compared whole genome data from a selection of white and blue egg-laying females using genome wide association analysis to find regions of sequence dissimilarity. Localization of sequence divergence and comparison to an annotated songbird genome could lead to discovery of gene(s) controlling blue egg coloration in this and other bird species, and improve our understanding of how and why such pigmentation evolved.

Sociodemographic Influences on Spiritual Well-Being Among Latinx Leaders

Claudia Alford

Nursing

Mentor: Kim Larson

Background

Early integration of palliative care after cancer diagnosis has been shown to improve outcomes, yet people of Latinx heritage face serious health disparities in these areas. In the face of patient-provider incongruence in language and culture, Latinx leaders, trained in palliative care can serve as powerful agents in disseminating culturally responsive care to their community. Spirituality is thought to guide perspectives on end of life, yet there are few studies that examine how socio-demographic variables influence spirituality and end of life concerns among Latinx leaders. The purpose of this study was to explore whether and how education, age, and religion influences spiritual well-being among a sample of Latinx leaders.

Methodology

We conducted a mixed methods participatory action research study in rural eastern North Carolina with the overall goal of developing a community palliative care model for Latinx persons with cancer. The first aim of the overall study was to elicit sociocultural perspectives of Latinx community leaders on cancer and death. 15 Latinx leaders participated in one of three focus groups and subsequent training programs. One major theme from the focus group discussions was *Getting in the Good Book*, which referred to spirituality and a good death. Later these participants completed the Spanish/English Functional Assessment of Chronic Illness Therapy - Spiritual Well-Being Scale (FACIT-Sp). The overall FACIT-Sp score, ranging from 0-48, measures Spiritual Well-being and sub-domains of meaning, peace, and faith. FACIT-Sp results were cross-referenced with 3 demographic categories: religious preference (Catholic and non-Catholic), age (>40 and ≤ 40), and education (≤ high school and college).

Preliminary Findings

Spiritual wellbeing scores ranged from 32 to 48 among the 15 participants, with an average of 40.7. Higher education was the variable suggesting greater spiritual well-being in all three sub-domains of meaning, peace, and faith. Younger age compared to older age had a slightly higher spiritual well-being score. Religious preference revealed no difference.

Discussion

Spiritual well-being among this sample was slightly higher than other studies with Latinx populations. Educational level could be related to a deeper understanding of existential life and death issues resulting in a higher spiritual well-being score. Higher scores for younger age could be related to longer time to live and achieve purpose and meaning.

A National Study of HPV Infection and Vaccine Uptake Among US- and Foreign-Born Adults

Breanna Alligood

Public Health Studies

Mentor: Leslie Cofie

Background

Previous research has examined changes in human papilloma virus (HPV) infections and vaccine uptake before and after the introduction of HPV vaccines in the US in 2006. Whereas differences among race/ethnicities and by US regions have been reviewed, less is known about differences by nativity. This examines recent trends in HPV infections and vaccine uptake among US- and foreign-born adults in the US.

Method

The 2006-2018 National Health and Nutrition Examination Survey data on adults age 18-34 years (N=5080) were analyzed. Measures included HPV infections: any type, high risk types 16 and 18, and quadrivalent types (6, 11, 16, 18); and HPV vaccination uptake. Chi-square tests were used to examine difference by nativity status gender. Changes in infection and vaccinating rates across the 5 survey cycle years were also examined.

Results

HPV infection prevalence included any HPV infection (53%), high-risk types (6.68%) and quadrivalent types (8.48%). Also, 20.63% of participants had received HPV vaccination. HPV infection and vaccination were significantly associated, $p > .001$. There were significant differences between US and foreign-born individuals in the prevalence of HPV infection (44.06% vs. 37.31%) and vaccination (22.46% vs. 11.34%), $p > .0001$. US-born females had the highest HPV infection (47%) and vaccination prevalence (26.19%), whereas foreign-born males had the lowest (34%) and infection (4.79%).

Conclusion

Higher vaccine uptake among US-born than foreign-born adults suggest that the rate of infection decline among foreign-born individuals is lagging behind US-born adults. Continuous monitoring of HPV and vaccine uptake is critical for highlighting the need to develop intervention strategies to increase HPV vaccination among foreign-born individuals.

Formative Assessment for the Development of an Undergraduate Research Experience for College Students from Farmworker Families, North Carolina, 2020

Sneha Amaresh

Public Health

Mentor: Joseph Lee

BACKGROUND: College students from families with migrant and seasonal farm work and agricultural processing experience face many barriers to educational attainment in the United States: sporadic schooling experiences, cultural and communication barriers, low pay, discrimination, and health issues from farm work. Retaining students from families with agricultural experience in higher education and research is critical for addressing educational and health inequities. In an effort to develop experiences that could serve as a pipeline for undergraduate students from farmworker and agricultural backgrounds into research careers, we conducted interviews to inform program development by exploring the research experiences of university students and recent graduates.

METHODS: Ten college-age students or recent graduates from four North Carolina universities from families with migrant or seasonal farmworker experience or agricultural processing experience were interviewed by phone between March 25, 2020, and June 17, 2020. We used a qualitative approach with inductive and deductive thematic coding of interview transcripts.

RESULTS: Three themes were identified that should be taken into consideration in the development of programs to promote research experience. The themes were: (1) *Consideration of students' lived experiences*, which described the importance of a program recognizing the context of students' experiences often as first-generation students in primarily White Institutions; (2) *The importance of providing mentorship and resources*, which participants highlighted the value of networks of resources and experience in navigating college; and, (3) *Include strong marketing and outreach efforts*, which highlighted potential barriers to hearing about opportunities.

DISCUSSION: Our findings show that research programs for undergraduate students from MSFW families are of interest to students. Such programs should consider the context of students' experiences as (often) first-generation students in (often) primarily White institutions, include advice to successfully navigate college, and have strong marketing and outreach efforts to reach potential participants.

The Binding of Metal Ions to EF-Hand Peptides of Human Cardiac Troponin C: Thermodynamic Characterization of Ca(II) and Cd(II) binding to EF-Hands III and IV

Alexis Anderson

Chemistry

Mentor: Anne Spuches

Cadmium, one of the most toxic naturally occurring elements in our environment, exerts adverse health effects upon humans through divalent calcium, Ca^{2+} , dependent pathways. However, the molecular mechanisms by which this occurs are not well known. The goal of this study is to shed light on possible binding interactions that may occur between divalent cadmium, Cd^{2+} , and EF-hand peptides that are present in many Ca^{2+} binding proteins. We chose to focus on EF-hand peptides III and IV of cardiac troponin C, a calcium binding protein that is responsible for heart muscle contraction. Both EF-hand peptides contain a Ca^{2+} binding loop and it is our hypothesis that Cd^{2+} may bind to this loop region as well due to the similar size of the ions Ca^{2+} and Cd^{2+} ions (0.99 and 0.97 Å respectively). EF-Hands III and IV (each 33 amino acids in length) were produced using solid state peptide synthesis, purified by reverse phase High Performance Liquid Chromatography (HPLC), and characterized by Quadrupole Time-of-Flight (QTOF) mass spectrometry. Isothermal Titration Calorimetry was used to study the binding of Ca^{2+} and Cd^{2+} to an equimolar EF-hand III and IV sample. Using a sequential binding sites model, it was found that two Ca^{2+} ions bound to the equimolar peptide complex with affinities of $8.30 (\pm 0.2) \times 10^4$ and $2.30 (\pm 0.07) \times 10^3$. In a subsequent experiment, it was determined that Cd^{2+} ions bound with affinities of $8.15 (\pm 0.33) \times 10^3$ and $4.97 (\pm 0.15) \times 10^3$. These data reveal that like Ca^{2+} , two Cd^{2+} ions are capable of binding to these peptides with an order of magnitude lower affinity than Ca^{2+} for the first site. These data are important because they reveal that Cd^{2+} is capable of binding to EF-hand peptides and that EF-hand containing proteins may act as targets for Cd^{2+} toxicity. Further studies will include fluorescence spectroscopy to further probe structural changes that occur upon binding.

Nature's Effects on Student Transition into High School

Sarah Anderson

Science Education MAED

Mentor: Tammy Lee

The purpose of this research project is to determine if students transitioning from middle school to high school found that visiting a natural environment had any effect on their mental health and stress. Freshmen at a local high school in Wilmington, North Carolina were given the opportunity to use a green space at the school for a restorative environment. In several studies, it has shown that nature, even scenes not just immersion, helps people regenerate focus, find mental clarity, and feel happier overall. The students were given a pre- and post- survey that asked them to rate their perceived stress levels. Interviews were conducted for students to describe stressors in their life, comfortability in nature, and the effects of nature. Students spent twice a week in nature without any distractions or tasks to create meditation and exploration in a restorative environment.

Low Income Housing in Eastern North Carolina

Ashley Arensberg

Design - Geology, Planning, and Environment

Mentor: Misun Hur

The problem with the quality of housing in low-income areas is critical. Most of this housing is old which puts homeowners at risk for health problems and safety. The purpose behind this research is to dive into how wages affect how affordable housing is. From literature review, I decided on two research questions: "What is the difference in affordability options between rural and urban North Carolina" and "How much of a role do minimum wage and income affect families on their housing choice?"

Policies were set in across all the types of government for help; Federal, State, and Local. On the Federal level, policies such as the *Moving to Opportunity* program, the *Neighborhood Stabilization Program*, and the *Cares Act* helped get low-income residents to move into better areas, but still able to afford housing they would need. On the State level, *Housing Choice Vouchers* and the *Rental Assistance Demonstration* do well for private and public housing developers since they are more tailored towards what that area needs. Local level policies will include the interviews I conduct that will give me a better insight into how these areas function and what is needed. The article that I derived most of the research from was *Housing for North Carolina's Future*, for its specific geographical areas and timespans.

My investigation includes two forms of research methods: the secondary data analysis and interviews. The geographical area focuses on eastern NC, both rural and urban. Focusing on the past 10-15 years to see how trends have changed, and then looking 10-15 years into the future to see where trends are heading. This analysis would come from the Census and the American Community Survey, which contains data, tables, and maps. Lastly, interviews will be conducted to get a take on professionals' (those in local governments, planning departments, and within the housing sector) knowledge for past, present, and future trends.

I am expecting to find the differences in the way that rural and urban cities are governed and by what means to tackle this problem. By comparing the two, we can see how their policies affect their communities and the residents. By looking at how income plays different roles, I will be able to conclude what will need to change in the present and what will be needed for the future so that families get good housing that is both cheap but safe.

Key reference: *Housing for North Carolina's Future* [PDF]. (2020, June). Washington, DC: The Urban Institute.

Are You Adapting? Evaluating a Predator-Induced Phenotype in a Mixed-Species Context using Local Pine Woods Treefrogs

Eleanor Baker

Biology

Mentor: Michael McCoy

Predator-induced phenotypic plasticity describes an individual's phenotypic response to predation cues in their environment. In scientific literature, predator-induced phenotypes are referred to as a form of adaptive plasticity, as these phenotypes often confer adaptive benefits upon induced individuals when predators are present. For example, some tadpole species develop muscular tails when exposed to dragonfly nymph predators, allowing for increased escape speed. Predator-induced tail morphologies enhance survival in subsequent predator encounters in induced tadpoles, relative to non-induced tadpoles of the same species. However, predator-induced phenotypes come at a cost when predators are absent: induced tadpoles exhibit slower development in predator-free environments compared to their non-induced counterparts. In nature, many frog species cooccur in ponds, yet species differ in their abilities to exhibit adaptive plasticity in response to shared predators. Current understanding of the costs and adaptive benefits of predator-induced phenotypes is based on intra-specific comparisons. Our study assesses this phenomenon in a mixed-species context. We conducted a two-part experiment to evaluate the adaptive value of a predator-induced phenotype in the Pine Woods treefrog tadpole in the presence and absence of a heterospecific, the Squirrel treefrog (exhibits no tail morphological response to predators). In Part 1 (Induction), single-species assemblages of each species were assigned to one of two predator exposure treatments (caged nonlethal dragonfly nymph or no predator). After four weeks, tadpoles of both species and predator exposure treatments were photographed for morphometric analyses to quantify phenotypic responses. Pine Woods tadpoles only are expected to exhibit enlarged, colorful tails in response to predators. In Phase II (Predation Trials), single (Pine Woods tadpoles only) and mixed-species assemblages (Pine Woods and Squirrel tadpoles) were exposed to one of two predation treatments (free-swimming predator (lethal) or no predator). Periodic survival estimates were collected from tadpoles of both assemblage types in the lethal treatments. Preliminary survival data indicates that the adaptive advantage of the predator-induced phenotype in Pine Woods tadpoles is retained in both single- and mixed-species assemblages. This study contributes new insights into the ecology and maintenance of adaptive plasticity in complex natural communities.

Fracture history, development, and material properties in folded Devonian shales and sandstones of West Virginia

Matthew Banaszynski

Geology

Mentor: Eric Horsman

Fractures in sedimentary strata are important for a variety of reasons, including resource exploration, bedrock engineering properties, and understanding deformation history. In the central Appalachian fold and thrust belt, Alleghanian-age folding resulted in complex populations of fractures developed in the late-middle Devonian siliciclastic strata of the Chemung Formation. To better understand factors influencing fracture development during progressive folding, we studied fractures in these folded strata at 12 locations and 27 sedimentary beds in northeastern West Virginia and westernmost Maryland. Outcrop data were collected on fracture orientations, density, compressive strength, bed thickness, and lithology. The outcrop scale (sub-map scale) patterns in fold character were also noted where they could be observed. Regional patterns in 3D joint orientation, density, and mineralogy can be used to better understand development of small-scale folds in complex siliciclastic sequences.

The density of fractures (primarily joints and veins) in the Chemung within the field area is dependent on lithologic factors (e.g. bed thickness and grain size) and structural factors (e.g. local bedding dip, local fold curvature, regional deformation styles). In general, higher fracture densities and stronger clustering of joint orientations are located to the southeast, towards the more-deformed core of the Appalachian fold province and away from the lower-deformation Cumberland Plateau region. Two bedding-perpendicular joint sets exist at most outcrops. Strike orientations generally contain one set parallel to the regional fold axis around 30° and another perpendicular set at 330° . Fracture density increases non-linearly with decreasing bed thickness, in accordance with existing models. No clear trend exists between compressive strength of a bed and the areal fracture density.

Evaluation of Software Packages for the Computational Modeling of PhyB & PIF3 Coated Bead Interactions

Zachary Barnett

Engineering

Mentor: Loren Limberis

Phytochrome B (PhyB) is a plant protein that is conformationally photosensitive and involved in plant growth and development. Upon being irradiated by red light (~660 nm), PhyB takes on its active form, Pfr. Once in the active form, Pfr is capable of binding to a separate protein, known as phytochrome-interacting factor (PIF3), yielding a Pfr-PIF3 complex. Upon irradiation with far-red light (~730 nm), Pfr reverts back to its inactive state, and unbinds from PIF3. This binary nature allows PhyB to function as a molecular switch by existing in either a bound or unbound state. To experimentally model this interaction, agarose-coated magnetic particles with a diameter between 10 and 40 microns were coated in either PhyB or PIF3. Placing these beads into a buffered suspension renders a colloid. This physical system is useful in studying bead aggregate formation, and higher-order properties such as aggregate shedding or collapse upon removal of the red light. Despite the perceived simplicity of the experiment, physical systems make large-scale replication, and variable exaggeration & minimization unfeasible. Creating an accurate computational model would address these issues and yield insight into the mechanism of the PhyB-PIF3 binding action. Unfortunately, the scale of the PhyB-PIF3 system is unique because it occupies the *meso*-scale of computational modeling. Therefore, the system is subject to forces found at both the *micro*- and *macro*- scales. Due to the convenience of disregarding certain forces at various scales, very few programs exist that can accurately model mesoscale systems. Presented here is an initial evaluation of five modeling packages for the creation of a PhyB-PIF3 system. They include Blender, SpringSaLaD, ReaDDY, Comsol, and LAMMPS. Each of these packages differs in programming language, open and closed-source, and scale. Based upon these factors, it was ultimately determined that the Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) possesses the greatest promise for building a computational model of the PhyB-PIF3 system. This evaluation will clarify why LAMMPS is the optimal program out of those evaluated, and therefore reduce time future projects will spend exploring new software.

Projected Changes of the Distribution of Nassau Grouper Spawning Habitat and Its Management Implications

Brian Bartlett

Coastal Resource Management

Mentor: Rebecca Asch

Nassau Grouper (*Epinephelus striatus*) is an endangered, iconic Caribbean reef fish whose spawning success may be threatened by climate change. Throughout most of their range, these fish spawn within aggregations on coral reefs from December to April. Climate change threatens to reduce spawning habitat via thermal stress and varying conditions. Previous research projects a reduction of up to 82% of spawning habitat utilizing one earth system model, but additional research is needed to assess the robustness of this projection and understand how fisheries management and conservation may be affected. This research aims to identify how climate change will impact Nassau Grouper by assessing changes in its spawning habitat under climate change utilizing multiple earth system models, as well as how these changes will impact current management strategies (MPAs and seasonal bans on fishing and sales). By utilizing a suite of climate models, climate conditions can be simulated over different time periods. These simulations can then be coupled with a non-parametric probabilistic ecological niche (NPPEN) model to assess changes in habitat suitability for spawning aggregations and how these changes will alter management effectiveness. Under future climate conditions, the probability of spawning at current-day aggregation sites showed average declines by as much as 22% by mid-century and nearly 66% by 2100. The effectiveness of management strategies shows similar declines over the same periods, as suitability in management areas decline. Nassau Grouper also seem to exhibit phenological shifts, with spawning suitability likely different months in the future, further reducing the effectiveness of management.

Characterizing the role of the Zn finger protein MucR as an H-NS-like gene silencer and essential virulence determinant in *Brucella abortus* 2308

Ian Barton

Microbiology and Immunology

Mentor: Roy Roop

The 16 kDa Zn finger protein MucR is a global transcriptional regulator found throughout members of α -proteobacteria, regulating a diverse set of functions including virulence, symbiosis, exopolysaccharide production, motility, and cell cycle progression. Studies suggest that MucR predominantly acts as a repressor or gene silencer, preventing the expression of genes when they are not beneficial. For instance, in *Agrobacterium tumefaciens* and *Sinorhizobium meliloti*, MucR homologs repress virulence and symbiosis loci, respectively, until extracellular signals lead to their expression through the transcriptional activators VirG and ExpR. Thus, expression of costly virulence or symbiosis functions are restricted to host interaction. MucR has been demonstrated to be an essential virulence determinant in *Brucella abortus* and *Brucella melitensis*, where a *mucR* mutant exhibits decreased survival in macrophages and is severely attenuated in mice. Despite MucR homologs being well-appreciated as important transcriptional regulators, surprisingly little is known about how they function at the molecular level or how their regulatory activity is coordinated with other transcriptional regulators. We have previously shown that MucR binds with low affinity to AT-rich regions in *Brucella* promoters in a fashion reminiscent of the prototypic gene silencer H-NS. *Brucella* and related α -proteobacteria lack functional H-NS homologs, so it is tempting to speculate that MucR is performing similar regulatory roles in these systems. Here, we show that MucR binds within the promoter regions of several *Brucella* genes that have been linked to virulence (e.g. *btaE*, *babR*, and *bpdB*) and silences the expression of these genes, and present strategies for dissecting the regulatory role of MucR in the coordination of virulence functions during host interaction and pathogenesis.

Health Survey Recruitment Research Using Social Media

Darian Battle

Public Health

Mentor: Deonna Farr

The COVID-19 pandemic makes the recruitment of participants for health research challenging. Understanding how to use social media for research recruitment can address these challenges. The purpose of this study was to use social media to recruit a diverse group of women 40 and older to learn more about their knowledge of breast density. To be eligible for the Qualtrics survey participants had to be female, 40 years or older, and never been diagnosed with cancer. Two rounds of recruitment were conducted over a two week period for this study. The first round of ads ran from June 24 to July 1, 2020, and consisted of 45 individual ads with different headlines and interest terms. In general, the different headlines focused around the eligibility criteria or what the survey was about. The types of general terms used for interest in the first round of ads were general and health-related. The second round of ads ran from July 9 to July 16, 2020, and consisted of 10 individual ads. These ads all used the headline and interest terms that were the most impactful from the first round of ads. Additionally, new interest terms and behavioral targeting were added that focused on enhancing the diversity of our sample. After each round of ads, Facebook metrics were used to analyze the data by the number of link clicks, cost per ad, and cost per link click through. We also reviewed the survey data to see accessed the survey. The ads that had more general interest terms recruited more participants in rounds one and two. The number of women that started the survey was 657; however, 582 were actually eligible to complete the survey. Additionally, we recruited less non-white participants. During rounds 1 and 2, 78% and 81% of the eligible recruits were white. In terms of age, the majority of women recruited were in the higher age ranges. In both rounds one and two, less than 9% of the women were in the lowest age range, 35-44. Social media recruitment lead to a sample that was mostly older white participants. While social media can support participant recruitment for health research, one of the challenges is recruiting a racially and ethnically diverse sample.

Kids Run The World- Future

Abby Baukema, Anna Vassallo, Jake Kelly, Elizabeth Martin, Merry Sauls, Linnea Meletiou

Management Accounting

Mentor: Timothy Christensen

Kids Run the World is a program at the Boys and Girls Club whose goal is to educate children on how to live a healthier lifestyle through physical activity. Childhood obesity and inactivity has been an increasing concern in America, especially in underserved populations. Kids Run the World utilizes student-athletes to study the increase in the children's engagement in physical activity. Sustainability is one of the many important parts of this project, as it determines the amount of success and overall impact that will be generated. In an effort to continue the success of this project, the Life Skills department at East Carolina University could allow athletes to use Kids Run the World as approved community service hours in order to increase the number of volunteers. There has been a continued partnership with the East Carolina Athletic Department, and in the future, the program plans to continue and grow connections with the department. As more Honors College students become participants in the mission of Kids Run the World, expansion to other locations will become more feasible.

An Exploration: Replication of Natural Marine Processes & Relationships in the Ceramic Studio

Julienne Beblo

Ceramics

Mentor: James Tisnado

The ocean is a three-dimensional and dynamic world in which organisms are involved in relationships that range from beneficial, to interdependent, to parasitic. Many of these organisms additionally exhibit life cycles that include diverse body forms and reproductive strategies that result in numerous young. The dispersion of these young and the movement of their adult counterparts take place in the many layers and habitats of the ocean. All of this occurs in the vast, three-dimensionality of the marine world and relies on the interaction between organisms and the environment. Ceramics lends itself to the creation of three-dimensional forms and objects. To further explore this connection, clay was used to replicate and represent these dynamic interactions, showing the constant interplay between organisms and marine ecosystems in a tangible installation.

The Validity of Current Turbidimetric Approaches in Determining Fibrin Diameter

Heather Belcher

Biomedical Physics

Mentor: Nathan Hudson

Objectives: The formation of fibrin fibers is a major component of blood coagulation. However, much is still unknown about fibrin's structural and mechanical properties. One problem is determining the diameter of fibrin fibers. Since electron microscopy requires that samples be dried out, it results in measurements of diameters that are not physiologically relevant. Therefore, another method for determining the diameter of fibrin fibers is with turbidimetry, which measures the intensity of transmitted light through the sample relative to the incident light at various wavelengths. With the assumption that fibrin fibers are randomly oriented, thin, cylindrical rods, the diameter and mass-length ratio of the fibers can be estimated from this measurement. However, there are several different approaches to determining these parameters from the data. This work investigates the validity of three of the commonly utilized approaches.

Methods: A theoretical dataset of turbidity values was created based on light scattering theory for rod-like structures using a numerical integration in Mathematica for fixed values of fiber length, diameter, and mass-length ratio. A plot of these turbidity values was then fit with model functions from the three different approaches and the y-intercept and slopes from these fits were then used to extract out the diameter and mass-length ratio in order to compare the output given by the approaches to the values used to create the dataset.

A plot was also made of the turbidity values obtained from the light scattering theory for various lengths along with turbidity values made using the three approaches for the same values of diameter and mass-length ratio for comparison. Plots were then made of the percent error in the y values for the approaches as compared to the light scattering theory values at the various lengths.

Results: All three approaches used require that the fibers be sufficiently long with respect to the wavelength; however, this is often not the case. The smaller the fiber length, the more error there is in all three approximations used. Furthermore, for fibers of small lengths, there is a non-linearity in the plot at higher wavelengths, leading to a poorer fit of the linear approximations in these wavelength ranges.

Conclusions: The results suggests that all three approaches investigated are unreliable for fibers of realistic lengths, and especially when using high wavelength values for those fibers.

Serpents; Symbolism and Mythology

Sina Bennett

Ceramics

Mentor: James Tisnado

Recently, I have started using serpents in my artwork to symbolize my anxieties and thoughts. Upon further investigation, I realized serpents/snakes have an extensive history of symbolism and mythology. For millennia serpent imagery has been used throughout the world to symbolize a variety of beliefs, ideations, and mythologies. In my research, there have been several elements that serpent symbolism has throughout history and different cultures. I want to examine the symbolism and mythologies serpents take on in different cultures and historical contexts.

Knowing the historical ideas behind the imagery of serpents will help me find context in my work. Since serpents/snakes have such an extensive history, it is vital to know the background and understand the way the viewer might perceive the work. I plan on using this imagery as a way to visually link the work I make together.

Augmented Reality AR: An instrument of contemporary printmaking.

Adam Berman

Printmaking

Mentor: Heather Muise

The present state of the world holds many challenges as a consequence of the continuing pandemic. The difficulties of maintaining social distance and other public health measures have found their way into all facets of everyday life. Contemporary printmaking is not exempt from these modern obstacles. The most significant of these struggles has been the inability to hold exhibitions of new bodies of work. To combat these new complex situations, requires elaborate solutions. The quickly progressing technology of augmented reality could be the solution. This technology has the ability to host a fully curated show for the viewer to observe on their smart phone safely wherever they are. Furthermore, this technology can aid the artist in delivering their message, by adding animated and augmented information with which a patron can interact.

The impact of maternal exercise on programming mitochondrial efficiency in offspring umbilical cord-derived mesenchymal stem cells

Ericka Biagioni

Bioenergetics and Exercise Science

Mentor: Nicholas Broskey

The Developmental Origins of Health and Disease Hypothesis postulates that the intrauterine environment plays a role in programming long-term health outcomes in offspring. In particular, a subpar intrauterine environment, such as those found in metabolic diseases, has been shown to program mitochondrial dysfunction in offspring, which may lead to the metabolic disease susceptibility later in life. Additionally, studies in rodents have found that dysfunctional maternal mitochondria can be passed down through multiple generations, thus continuing this vicious pattern of metabolic diseases. It is well established that aerobic exercise can enhance mitochondrial efficiency in adult skeletal muscle, yet little is known about the impact of maternal exercise on the programming of offspring mitochondria. The purpose of this study was to investigate the impact of maternal exercise on offspring *in vitro* mitochondrial function in a human cohort. We isolated mitochondria from fetal umbilical cord derived mesenchymal stem cells (MSCs) of women who were either regularly exercising or sedentary during pregnancy. The MSCs were differentiated down a myogenic phenotype to be used as a model of offspring skeletal muscle. The ATP:O ratio and membrane potential were measured as markers of mitochondrial efficiency. We hypothesize that the MSCs from women who were exercising during pregnancy will exhibit a more efficient mitochondrial phenotype compared to the MSCs from sedentary women.

Military Suicide Epidemic: A Veteran's Perspective Throuh Art

James Bigham

Art MFA

Mentor: Heather Muise

As a medically retired United States Army veteran my creative research deals with the current military suicide epidemic. As someone that has experienced the loss of far too many friends, and dealt with feelings of hopelessness and depression I attempt to give an understanding into the mind of those veterans that society has forgotten or ignored.

My creative work and its process is not easy, pretty or peaceful in the way we usually expect art to be, it is uncomfortable for both me and the viewer. I hope to provide hope, but the truth is, that is not the reality for far too many. If we are to work towards reducing the numbers that are losing this very personal battle, we must first understand why this crisis this is happening.

THREE DIMENSIONAL MOTION CAPTURE ANALYSIS FOR SQUAT WEIGHTLIFTING EXERCISE DURING HIGH INTENSITY WEIGHTLIFTING WORKOUT

Hannah Black

Biomechanics and Motor Control

Mentor: Patrick Rider

Background: High Intensity weightlifting is style of exercise that utilizes the 2 Olympic weightlifting movements, the snatch and the clean & jerk. The majority of HIW workouts are scored by time so the goal is to do the required repetitions as fast as possible leaving very little time for rest. The sense of urgency to go as fast as possible often results in technique change throughout the workout. Little research exists on biomechanical technique alterations that may lead to injury during HIW movements. If researchers can quantify mechanical alterations after multiple lifting attempts, then they may be able to aid athletes during HIW workouts and help minimize technique alterations. Minimizing technique alterations may improve performance and reduce the risk of injury in HIW activities.

Purpose: The purpose of this study is to quantify the 3D biomechanical alterations in snatch movement after repeated repetitions.

Methods: 20 weightlifters will be recruited. A 3D motion capture system will be used to collect kinematic data. Each participant will complete 30 repetitions of the snatch for time. The weight used for collection is based off 60% of the participant's estimated one rep max snatch and will be held constant for all 30 repetitions. Participants will be allowed to take as much rest between repetitions as they desire but have a goal of completing the 30 repetitions as fast as possible.

Marker data will be integrated and processed using Qualisys Software. A biomechanical model will be created in Visual 3D Software using the markers placed on the participant during data collection. Kinematic data will be derived from the model movements based on the 3D trajectory of the reflective markers. The 3 phases of interest for each lift are the start, bar at the knee level, and the catch. All 30 lifts will be analyzed for each condition in each participant. The kinematic variables of interest are 3D body segment angle positions at the key phases and joint angular velocity between the key phases. The barbell variables of interest are peak height, peak velocity, and maximum barbell displacement. The 1st repetition for each participant will be used as a baseline and differences from baseline for each variable will be calculated. Mean and standard deviations will also be calculated.

Preliminary Results: A 2D pilot study found that all participants exhibited considerable amounts of technique alterations, most notably towards the last reps of the workout.

Reducing Effects of Sensory Disorders with Innovative Technologies

Dymon Blango

Biology

Mentor: Timothy Christensen

Sensory Processing Disorders affect 5-16% of school aged children. In addition, 40% of children with ADHD also share the Sensory Processing Disorder. Furthermore, sensory deficits are prominent in the learning environment and hinders many students from realizing their full potential.

SENSE-ational began as an Honors 2000 team at East Carolina University with the goal of helping reduce distractions in the classroom for students with sensory processing issues. Our original idea was to design, create, and manufacture kits that were to be distributed into those very classrooms. Due to COVID-19, and the lack of children in the classroom, we were unable to implement these kits. We needed to pivot in our attempt to help children who were struggling with online learning. We produced "DIY" YouTube videos of how to make sensory items. We now have a handful of quality, engaging, and useful videos on our YouTube channel, as well as our very own logo and a plan to move forward with our brand. We are utilizing the 3D printer in the Innovation and Design Lab at ECU to create and test our prototypes. In the future we are strengthening our brand recognition through the development of marketing materials and outreach to teachers.

In the coming months, SENSE-ational hopes to move into our business model canvas and jumpstart our very own SENSE-ational business. We have plans to partner with schools to gain a sample of student beta testers to gather data and feedback. For our sales, we've discussed not only using an online commerce platform, but also partnering with education companies such as Scholastic. We plan to use all our new videography and branding skills that we have gained this past semester to brand and market our new product. In addition, SENSE-ational plans to create more content on YouTube, increase our social media presence, and increase the number of productive partnerships within the county and beyond.

Nutrition Education in BSN Nursing Education: An Historical and Narrative Review

Elizabeth Blumthal

Nursing

Mentor: Annette Peery

Nutrition is an essential component of health promotion, disease prevention, and disease treatment. Nurses need nutrition knowledge and skills and be able to apply these in the clinical setting. Nutrition education in BSN nursing programs is inconsistent across programs and there appears to be a gap in nutrition education within nursing education.

The purpose of this review is to examine nutrition education within BSN programs through an historical review of Nightingale's focus on nutrition in nursing care, nutrition content on the RN licensure exam, and a narrative review of the literature on nutrition education in BSN nursing programs. Ten BSN programs in the southeastern US were reviewed to determine if a nutrition prerequisite, or nursing course was required.

Nightingale emphasized the relationship between nutrition and patient outcomes, noting that nurses spent the most time with patients and were best positioned to provide patient education and proper nutrition for healing. NCLEX-RN test plans from 1980-2019, showed a gradual increase in nutrition content from none in 1980 to an increasing amount by 2004. The content now focuses on enteral and parenteral nutrition, but also includes nutrition assessment, food-medication interactions, dietary restrictions, cultural considerations, and impact of disease on nutritional status.

Initial literature searches were completed in PubMed, Scopus, and ProQuest Search. No date limits were used. Keywords included "nursing students," "nursing curriculum," "nutrition classes," and "nutrition education." The search produced 2,050 articles after duplicates were removed. Two independent reviewers will screen the initial records and complete a full-text review of articles selected. A third reviewer will make the final judgement for unresolved articles. Full search strategies and results will be included in the final presentation.

Nutrition content in nursing curriculum appears to be more focused on treatment of disease rather than health promotion and disease prevention. Included more holistic nutrition content in pre-licensure coursework could better position nurses to provide accurate nutrition information. Further research is needed to determine the extent of the impact of limited nutrition education in BSN nursing education programs and the impact this gap in nutrition knowledge has on clinical practice and patient outcomes.

The Process of Promotion: One group's journey to elevating local artists

Hannah Bolick, April McLean, Joyel Puthuparampil, Christopher Embree, Hali Christensen

Communication

Mentor: Timothy Christensen

For much of history, the plight of small time local artists has been a dire one. They create, but struggle to find substantial enough audiences to support their passions. We set out to change that. Through the use of the Lean Launchpad Method we navigated through many iterations of organizations and entities that could help us reach our end goal. We started by trying to create a yearly talent event in which artists could get their work in front of audiences. Then we pivoted to trying to become an art promoting organization for the local Greenville market, trying to primarily to co-mingle the art cultures of the Greenville community and the University. We wanted to provide promotion and publicity events as well as marketing help to musical artists, visual artists, and every artist in between. This goal was a lofty one. We pivoted yet again when a unique opportunity fell into our lap. We are now working with an app start-up called Showboost. Their product is designed to be a platform on which local musicians can book gigs and sell merchandise, local venues can book musicians and sell tickets and fans can purchase tickets and merchandise from both entities in the same place. It is a product that embodies our mission statement with impeccable precision. It is made to bring audiences, venues, and artists into the same space, encouraging more free-flowing interaction between these groups, a phenomenon which rarely occurred before.

Student and Teacher Perceptions of Outdoor Educational Experiences

Thomas Bonin

History Education

Mentor: Allen Guidry

This study examines the perceptions of high school history teachers and students on outdoor experiences in education, with a focus on student engagement. Included is a review of relevant literature surrounding the use of outdoor educational experiences and studies on the effects of outdoor experiences in education. It uses a small group conference interview format to ascertain teachers' perceptions on the benefit students would have from outdoor educational experiences and their perceptions on the practicality of outdoor experiences. Students are questioned in small group interviews on their perceptions of what the benefits of outdoor educational experiences could be to them. Both sets of questions are designed to address perceived benefits, challenges, and effects on student engagement.

Do the Knee Osteoarthritis Outcomes Scores Correlate with Strength and Function in ACL reconstructed and Healthy Individuals?

Grethe Booyesen

Athletic Training

Mentor: Anthony Kulas

Anterior cruciate ligament (ACL) injury in the knee is a common, debilitating injury in athletes and the general population. Most individuals undergo ACL reconstruction (ACLR) to repair the ligament and restore functional capabilities and then return-to-play criteria are applied to determine readiness to return to play. One tool to determine readiness to return to play is the Knee injury and Osteoarthritis Outcome (KOOS) score which is a patient oriented outcomes tool that assesses patient symptoms, pain, activities of daily living, sports and recreation, and quality of life sub-scores. There are also functional tests that may be used, however the relationship between these patient oriented outcomes and functional criteria is not clear. The purpose of this project was to determine if strength (quadriceps strength symmetry) or functional hop test measurements correlated with KOOS sport/recreation activities and quality of life sub-scores.

10 ACLR subjects and 10 healthy control subjects participated in this University IRB approved study. The subjects completed the KOOS, had quadriceps strength tested by a dynamometer along with other biomechanical variables, and completed functional tests. Independent samples t-tests revealed that the ACLR group had significantly poorer KOOS sub-scores in 4 categories than the healthy group. The sub-scores for the ACLR vs Healthy groups respectively were as follows: Symptoms 79.29 ± 16.04 vs 98.21 ± 2.52 ($p=.002$), Pain 85.56 ± 14.80 vs 98.89 ± 1.94 ($p=.011$), Activities of daily living 94.85 ± 7.91 vs 99.85 ± 0.47 ($p=.061$), Sport 77.50 ± 20.85 vs 100 ± 0.00 ($p=.003$), Quality of life 71.25 ± 21.08 vs 98.13 ± 3.02 ($p=.001$). Quadriceps strength was not correlated with either the sport and recreation sub-score (ACLR: $r=-.524$, $p=.120$; Healthy could not be computed because these sub-scores were all 100%) or quality of life sub-score (ACLR $r=-.236$, $p=.512$; Healthy $r=-.519$, $p=.124$) for either group. In addition, none of the hop test measurements were significantly correlated with the KOOS sub-scores ($p>0.05$). A limitation of the current study was that a small sample size was used and potentially statistically underpowered. Alternatively, if these results are true, the KOOS sub-scores may be telling us something that the functional hop tests and quadriceps strength cannot. Further research on the subject would require a larger sample size as well as further investigation to determine the utility of the KOOS as a part of return to play criteria.

Controlling the Masses with Political Propaganda Art

Crystal Bowers

Printmaking

Mentor: Heather Muise

Propaganda art is commonly used to promote an agenda and to gain power by using psychological techniques to sway the opinion of the general public. The current political climate in the United States is such that the people are pitted against each other, making it more difficult for them to understand another groups' viewpoints. Propaganda art is used to persuade and control to benefit a political objective rather than coming together to find the middle ground that will benefit the people as a whole. My goal is to explore political propaganda art and its role in polarizing the United States. I hope to use my art to create political dialog and stimulate thought and introspection regarding the use of propaganda art used by each party in the political arena.

Archaeologists Don't Dig For Dinosaurs! The Design of an Archaeological Exhibit in a Paleontology Museum at the Aurora Fossil Museum in Eastern North Carolina

Rachel Boyd

Anthropology

Mentor: Isaac Daniel

The Aurora Fossil Museum in Aurora, North Carolina is a small paleontology museum whose primary focus is the display of marine fossils recovered from the local phosphate mine. Besides the fossils, the museum also has an exhibit on the Native American artifacts that were donated by local residents. Currently, the museum is renovating the space to expand the presentation of the archaeological and cultural history of the region. This exhibit will also feature the cultural history of the town and area. The proposed display will focus on archaeology as a discipline contrasting it to the discipline of paleontology. The purpose of my internship is to assist in redesigning the archaeology exhibit. The completion of the redesign will benefit the museum and the surrounding community.

Evolutionary conserved microRNA-10 (miR-10) in Behavioral Alterations Associated with the Western-Diet-Induced Obese Phenotype

Steven Bradley

Multidisciplinary Studies

Mentor: Alexander Murashov

INTRODUCTION:

Our recent observations have shown that an obese phenotype induced by a western diet (WD) in *Drosophila Melanogaster* displays behavioral changes such as sleep disturbance and increased preference for food high in fat, sugar, and sodium. qPCR of WD fly brains revealed an increase in miR-10, suggesting a potential link between this miRNA and the observed behaviors. This study seeks to determine the role of miR-10 in these behavioral changes by comparing transgenic flies given a control diet (CD) with upregulation or downregulation in miR-10 in several neural pathways to flies with a WD-induced obese phenotype.

METHODS:

In order to observe the effects of miR-10 loss or gain, transgenic flies that express GAL4 in dopaminergic and serotonergic neurons were crossed with flies that have either a loss or gain of miR-10 under GAL4-induced upstream activation sequence (UAS). Mutant fly stocks were tested against controls and flies given WD. These tests include a passive avoidance learning and memory test, food preference test, feeding frequency test, and a locomotor/mortality test.

RESULTS:

Flies on WD showed an increase in nighttime activity, increased mortality, increased preference for WD over CD, decreased learning and memory, and hyperphagia during observed eating habits.

CONCLUSION:

Preliminary data has been analyzed to reveal the likely involvement of miR-10 in the altered behaviors. Because experiments on mutant flies are currently in progress, it is too early to conclude if this involvement truly takes place.

THE EFFECTS OF IMPLEMENTING RESEARCH-BASED INTERVENTIONS TO FIDELITY WITHIN THE MTSS FRAMEWORK ON K-2 LITERACY

Paul Briney

Educational Leadership

Mentor: Travis Lewis

Concerns continue to exist in public schools nationwide regarding students who are reading below grade level. The purpose of this mixed methods study was to focus on the components of the MTSS Framework as well as the creation, implementation, and monitoring of researched-based, tiered interventions. This study evaluates a comprehensive process, known as the Multi-Tiered System of Support, to remediate students reading below grade level in grades K-2 at Creekside Elementary. Creekside Elementary School, a low-performing school as determined by the State of North Carolina, has received a State Report Card grade of a "D" for the 2015-2016, 2016-2017, and 2017-2018 school year. As part of this study, the scholarly practitioner employed a tiered system of interventions as recommended throughout the MTSS Framework, along with a uniformed process to collect student data. Throughout the study problem-solving meetings took place, student data was traced using progress monitoring, and interventions were implemented reading interventions were implemented by all K-2 classroom teachers. The findings of this study show that students in the primary grades who are working below grade level have the capability to make academic gains if specific routines and expectations are put in place by school administrators and classroom teachers. These components consist of quality tier I instruction, a sound understanding of the MTSS framework, schoolwide schedules, collaboration and communication, and an effective data collection process.

Impact of COVID-19 on Dental Care Access in Bertie County

Natalie Broder

Public Health

Mentor: Vanessa Pardi

Objectives: To identify and assess the effects of the COVID-19 pandemic on dental care access in Bertie County, North Carolina.

Methods: An in-person survey is being applied to participants of a School-Based Oral Health Program who have provided their consent and parental consent for their children to participate in this research. Questions on the survey consider the effect of COVID-19 on dental care access and factors contributing to receiving care. Questions on the survey pertain to employment, change of income, and receiving dental treatment during the pandemic. In addition, concerns with COVID-19 in regard to leaving the house and receiving care, and other issues or barriers that effect the ability to receive dental care during the pandemic are also explored.

Expected Results: The information gathered from the questionnaire can be used to measure the effect of COVID-19 on access to oral care and identifying future trends in oral health epidemiology in rural populations in eastern North Carolina.

Cell Proliferation and Differentiation in Poroelastic Hydrogels for Bone Tissue Engineering

Thomas Bruckner

Biomedical Engineering

Mentor: Michelle Oyen

Bones are a vital organ system that help provide structure, motion, and protect the body but can be prone to breaking. While bone can naturally heal, older individuals and those with bone-weakening diseases such as osteoporosis may require bone grafts to facilitate proper healing. However, bone grafts are limited in supply and artificial sources have been sought out to meet demand with one such source being hydrogels. While promising hydrogels still need more research to understand all their properties, such as the effect of poroelasticity in double-network hydrogels on cell viability and differentiation. To study this relationship a bioactive double-network hydrogel of gelatin methacrylate and poly(ethylene glycol) diacrylate are used and characterized by indentation testing. Encapsulation of the cells is achieved via photopolymerization of the polymer solutions to form a 3D matrix for the cells. Effects of this hydrogel on cells is tested using MC3T3-E1 pre-osteoblasts for evaluating cell viability and differentiation into osteoblasts and compared against seeding on tissue culture plastic and functionalized polyacrylamide hydrogels. By incorporating more complex properties like poroelasticity into hydrogels, the effect of hydrogels on cell health can be better understood.

Self-Compassion Intervention for Women with Overweight/Obesity and Internalized Weight Bias

Elizabeth Buie

Psychology

Mentor: Christyn Dolbier

Internalization of weight bias occurs when one believes negative weight-related stereotypes to be true of themselves (i.e., believing that one is deserving of disrespect or unworthy of partnership on the basis of their weight). Higher levels of internalized weight bias (IWB) are strongly associated with a range of negative consequences, such as lower health-related quality of life, maladaptive eating patterns, lower self-esteem, body image concerns, and greater psychopathology (i.e., stress, anxiety, and depressive symptoms). Although the importance of reducing IWB has been well documented for improving the well-being of overweight individuals, effective interventions for reducing IWB and associated consequences are limited.

The present study seeks to address the potential of self-compassion decreasing levels of IWB by evaluating the efficacy of a brief and completely virtual, 3-week self-compassion intervention for women with overweight/obesity and IWB. This study will be an extension of the original pilot study, which was a single group, pre-post design, in which researchers examined the efficacy and acceptability of a general self-compassion program for this population of women, and will build on information already gathered. Although there were improvements in eating behavior and self-compassion following the intervention, there were no reductions in IWB—the primary variable of interest. Therefore, the current study seeks to build on the pilot study in the following ways: take a more direct approach to target IWB in the self-compassion intervention, and include a randomized waitlist control design to strengthen study methods. We will examine whether participants in the intervention condition experience greater improvements in self-compassion, IWB, body image (i.e., body shame and body appreciation), mood (positive and negative affect), and maladaptive eating behaviors (i.e., binge, emotional, and intuitive eating) compared to the waitlist control group. We plan to present on study progress at Research and Creative Achievement Week with regard to intervention implementation, such as recruitment, retention, and completion data. Preliminary findings may also be discussed.

Understanding the role of Rab10 in neuronal resilience

Wyatt Bunner

Rehabilitation Sciences

Mentor: Erzsebet Szatmari

Objectives: Advanced age and presence of ApoE epsilon allele are major risk factors for Alzheimer's disease (AD). However, a small percentage of elderly and carriers of ApoE epsilon, do not develop AD ("AD resilient" individuals). The molecular basis of resilience to AD is not fully understood. Recently, a loss of function mutation in Rab10 gene was shown to confer a 40% reduction in AD risk, even in patients homozygous for ApoE epsilon allele. Here we describe our results on cellular, molecular, and behavioral characterization of Rab10^{+/-} mice, that we created to study the cellular and molecular mechanisms of Rab10-dependent neuronal resilience in a mouse model of AD on Rab10^{+/-} background.

Methods:

Behavioral studies: Open field (OF), Object in place (OIP), Morris water maze (MWM), novel object recognition (NOR) and trace Eye Blink Conditioning (EBC) tests.

Biochemistry: Western blotting to evaluate the level of Rab10 reduction in the brain of Rab10^{+/-} mice.

Immunofluorescence staining: Coronal brain sections stained with anti-NeuN antibody to evaluate the effect of Rab 10^{+/-} on brain morphology.

Transcriptome profiling: Gene expression analysis using the nCounter neuropathology panel.

Results: The level of Rab10 in the brain of Rab10^{+/-} mice was reduced by approx. 50% compared to their Rab10^{+/+} litter mates. Rab10^{+/-} mice displayed no obvious abnormality in feeding, fertility and brain gross anatomy during a 12-month observation period. Interestingly, we noticed significant difference in body weight between genotypes, that was sex-dependent: female Rab10^{+/-} mice had significantly higher body weight, than their Rab10^{+/+} littermates. Next, we performed a battery of behavioral testing. Our results show that Rab10^{+/-} mice perform significantly better in OIP task that tests hippocampus-dependent spatial memory. To elucidate the possible molecular basis of enhanced memory formation, nCounter profiling of the cerebral cortex was performed. Rab10^{+/-} mice had a significant change in the expression of multiple genes associated with neuronal survival (Synaptotagmin-4 and Syntaxin 2).

Conclusion: Rab10 functions as a negative regulator of hippocampal learning and memory formation. Understanding the molecular mechanisms of neuronal resilience to disease may hold important clues for the design of novel neuroprotective strategies.

Analysis of Profitability of 50-Day Moving Average and 200-Day Moving Average in Different Market Conditions, Among Differently Sized Market Caps, and Between Industries

Timothy Bunten

Finance

Mentor: Thanh Ngo

I have not written out a formal abstract yet, as I am still wrapping up the research phase of my project. As my title states, I am analyzing the profitability of the 50 and 200 day moving average technical indicators. I am using SAS to analyze every stock in the S&P 5000 over the time period 2005-2010 (a period containing the financial crisis, where there was obviously a bull and a bear market). I conducted the simple t-test and Wilcoxon non-parametric test to evaluate the statistical significance of the difference in profitability between the different conditions. My study builds on past studies in the field, expanding the current literature.

Investigating the WWII Battle of Attu Using a KOCOAs analysis and Kriging model

Dominic Bush

Coastal Resource Management

Mentor: Jennifer McKinnon

Often referred to as "forgotton", the World War II Battle of Attu, which took place May 1943 in the Aleutian Islands (Alaska), was the war's only land battle to be waged on North American soil. The conflict was a result of the U.S. military's campaign to recapture the Aleutian Island of Attu, which had been occupied by Japanese forces since June 1942. Representing one of the U.S. Army's first amphibious assaults, the battle is noted for the role that terrain and weather played, especially as it relates to U.S. troops' lack of preparedness for subarctic combat. Although they outnumbered their Japanese counterparts 6 to 1, it took the U.S. force almost three weeks to dispatch their adversaries, who had played Attu's topography and climate for every advantage possible. However, the battle remains on the peripherals of society, despite the nearly 3000 who died during it. This is likely due, in part, to the relatively small influence that Attu had on the overall outcome of WWII. The island's remote locale is also a primary contributor to the battle's relatively high level of anonymity. The difficulty in accessing Attu has severely limited, thus far, efforts to archaeologically document the battle. This is compounded by a lack of definitive cartographic information on the battle, as well as, the dispersed nature of the battle's documentation and numerous ambiguities within that historical record.

This project seeks to rectify this situation by conducting an archival study of this conflict, which centers on a synthesis of all available sources into a terrain analysis known by the military acronym KOCOAs. By doing so, the story of Attu is refocused on the geographical realities of the island and how they influenced the flow of battle. The information ascertained is combined with data on force size (number of troops) and the battle's chronology as inputs for a Kriging interpolation model designed to predict which areas were subjected to the highest levels of fighting. This not only creates a spatial summary of the battle as a graphic to be used for public outreach purposes, but also serves as a blueprint for future archaeological investigations of the island.

The Child-Parent Reading Experience in Pediatric Medical Office Waiting Areas

Adam Butler

Public Health

Mentor: Terry Atkinson

The practice of shared reading between parent(s) and children (especially those ages 0-5 years old) contributes significantly to children's literacy development and readiness for school learning. Parents often report that finding the time for daily shared reading is a challenge. Thus, the waiting times prior to pediatric medical visits offer a unique opportunity for them to engage in shared reading with their children. READ ENC, a local literacy coalition in Pitt County, has partnered with several pediatric offices in the surrounding community to place READ ENC Book Nooks filled with children's picture books in their waiting spaces. This research study focused on whether the presence of these Book Nooks engaged parent(s) and children in shared reading while waiting. Interviews comprised of a pre-determined set of eleven open-ended questions were conducted with five pediatric practice managers. Additionally, seven two-hour long observations were conducted in three separate pediatric office waiting rooms in order to observe and document the interactions of parent(s) and children while waiting and whether or not the presence of the Book Nooks resulted in any shared reading. The qualitative data collected from these interviews and observations were analyzed through open, axial, and selective coding. This process highlighted a common finding that children typically initiated the reading that occurred while waiting, sometimes resulting in attempts to engage their parents in shared reading. Moreover, the data identified engaging with technology (cellphones, television, and arcade games) and well-child forms as significant distractions for both parties, which often took place rather than shared reading. While it is clear that the presence of books available in waiting areas has the potential to provide families with additional reading time, simply supplying books in waiting areas does not guarantee shared reading as an outcome. Study findings point to the potential of increasing office and pediatric promotion of shared reading while waiting and limiting technology and well-child form completion in order to prioritize increased reading engagement in the waiting space.

Cost-Benefit Analysis of 3D FE Modeling of the Tibia Throughout the Stance Phase

Patricia Butler

Biomedical Engineering

Mentor: Stephanie George

Running is associated with mental and physical benefits; however, running generates repetitive forces that can result in a bone stress injury (BSI) [1]. The tibia is the most common injury site, accounting for 40-60% of BSIs [2]. While 3D computational models are considered the gold standard for estimating tibial stresses and strains [3], they are computationally expensive, time intensive, and not easily integrated into clinical practice. The use of 2D cross-sectional (CS) models, such as VA-BATTS requires less user involvement and faster processing time [3]. This project aims to 1) compare the finite element analysis (FEA) results between tibial 3D models and 2D CS models at the distal third, and 2) determine if the differences are clinically and statistically significant throughout the stance phase. Previously collected kinetic/kinematic data and MR images of eight subjects' right tibias were used to create the FEA models. These subjects were aged 18-35, healthy, uninjured, and often ran more than 16 kms a week. To date, only the 3D models have been produced and analyzed. To make the 3D models, MR images were imported into MIMICS (Materialise, Belgium) where semiautomatic segmentation was performed. Next, the models were imported into 3-Matic (Materialise, Belgium), adjusted for proper orientation, and trimmed to remove the upper/lower 15% of the tibia. Finally, the models were imported into ANSYS (ANSYS, Canonsburg PA) where FEA was performed using personalized force values throughout the entire stance phase. The maximum values for the von Mises stress and strain occurred at either 50 or 60% of the stance phase, near the posterior middle of the tibia, and had average maximum values of 149.6 ± 39.6 MPa and 7616 ± 2032 $\mu\epsilon$ throughout the model. Next steps include analyzing 2D CS data collected from VA-BATTS and performing paired t-tests for all subjects at each 10% increment of the stance phase. It is expected that this study will find the differences in FEA results between 3D and 2D CS models, identify if these differences are clinically significant, and determine the limitations of each method. The identification and understanding of maximum tibial stresses and strains could lead to clinical interventions for runners at risk for BSIs.

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InclusivECU: Promoting Inclusivity, Understanding, and Education for ECU's LGBTQ+ Population

Emily Caras, Jordan Kirk

Dance

Mentor: Timothy Christensen

InclusivECU is a student-led group that has a goal to increase understanding, diversity, and inclusivity for all students that are pursuing a higher education. This problem was identified, and a solution developed through the Honors 2000/3000 curriculum. After extensive research, it was determined that while the atmosphere around college campuses, including East Carolina University, has become more welcoming for the LGBTQ+ population, yet there are still areas where the system fell short. Through first-hand accounts and interviews with the ECU students, it was found that the housing situation prevented many students from having a safe and welcoming living space. This may have had numerous factors including individual students being intolerant or even the UNC System itself, namely UNC System Policy 700.8.1 that states all UNC System students must be housed according to their assigned sex. It was determined that a majority of LGBTQ+ students were uncomfortable in their housing arrangement or even faced harassment due to their identity while on campus. When examined further, statistical evidence was found that indicated suicide and depression rates of LGBT+ college students skyrocket when they are not provided gender-inclusive housing and bathrooms (Sutton, 2016). Another issue that was discovered was the lack of education on LGBTQ+ topics at ECU. To combat these issues, InclusivECU was proposed as ECU's first LGBT+ and Ally Living Learning Community. This provides LGBT+ and gender-nonconforming students with a safe space to stay on campus. This also allows participating individuals access to LGBT+ educational events, classes, and a chance to advocate for social justice both on and off-campus. The group was given the opportunity to form a themed living community through the 2020-2021 academic year to prototype the idea while coming up with a set curriculum and plan for the Living Learning Community. InclusivECU is now tied with and supported by not only the Honors College, but the Department of Sociology, the Department of Human Development and Family Sciences, and the Dr. Jesse R. Peel at the LGBTQ center.

Simulation of Transient Traffic Flow Resulting from Mixed Conventional and Autonomous Vehicles

Matthew Carol

Software Engineering

Mentor: Jinkun Lee

Major vehicle manufacturers are shifting towards autonomous electrical vehicles from current Advanced Driver-Assistance Systems (ADAS). The replacement of conventional vehicles by autonomous vehicles is predicted to result in changes to the traffic network system. This transition will be made gradually by the increased availability of affordable autonomous vehicles on the market. Therefore, we are interested in developing agent based traffic network models with different traffic mix ratios where conventional and autonomous vehicles are interacting with each other. We use SimMobility, a traffic simulation platform that can incorporate millions of agents, to investigate various traffic network models. In doing so, we aim to analyze the efficacy of our proposed mixed traffic scenarios. We propose several autonomous vehicle models and provide numerical examples of the transient simulation. After validation, we will be able to predict how the replacement of conventional vehicles will transform the traffic network over time. The insight learned will be useful for better decision making in traffic network control.

Adamts9 in primordial germ cell migration and gonadal development in zebrafish

Jonathan Carver

Molecular Biology and Biotech

Mentor: Yong Zhu

Metalloproteases are involved in various pathological and normal physiological processes including organogenesis via enzymatic modification of membrane located signaling molecules and the extracellular matrix (ECM). Adamts9 (a disintegrin and metalloproteinase with a thrombospondin type 1 motif, member 9) is a secreted metalloprotease that is widely expressed during development and its sequence and structure are highly conserved from *C. elegans* to humans. Knocking out orthologs of Adamts9 caused unmigrated and mis-migrated primordial germ cells (PGCs) in the invertebrates *C. elegans* and *Drosophila*, respectively. However, the roles of Adamts9 in germ cell migration and gonad development in vertebrates is still unknown partly due to the embryonic lethality of Adamts9 knockout (Adamts9 KO) mice. Zebrafish Adamts9 KO can survive to adulthood and therefore provide an opportunity for studying Adamts9's role in gonadal development. Our previous study found heavily male biased sex ratios in adult fish, only a few infertile female Adamts9 KO zebrafish could be found at 7 months post fertilization (mpf), and 1 year of age or older. In the present study, we try to identify early defects in the gonad development caused by Adamts9 KO that lead to observed late phenotypes observed in adult fish. We found the expression of *adamts9* begins around germ ring stage (~ 7.5hpf) and reached peak levels at 2-3 days post fertilization. Typically, all PGCs completed their migrations and clustered tightly together in the gonadal ridge at 24hpf in wildtype embryos; however, the migration was delayed at both 15hpf and 24hpf in Adamts9 KO zebrafish embryos. Intriguingly, all PGCs were able to reach the gonadal ridge at 48hpf in Adamts9 KO. At 2 weeks post fertilization (wpf), significantly less germ cells were found in Adamts9 KO. By 3wpf, Adamts9 KO had significantly less developed stage I oocytes. Gonads were significantly smaller in Adamts9 KO at 4 and 5wpf. Our results suggest aberrant Adamts9 function causes dysfunctions in PGC migration, gonadal growth and development, and likely leads to biased sex ratio and female fertility issues in adult Adamts9 KO zebrafish.

Activity Based Costing for Management Decision Making in Quality Assurance Laboratories

Kunal Chakraborty

Accounting

Mentor: John Christian

Activity Based Costing (ABC) is a costing that allocates overhead costs based on the activities that create the cost, providing a much more accurate cost of the service or product. "ABC was pioneered by Copper, Kaplan and Johnson & Johnson. They developed a costing methodology used to allocate overhead costs directly to costs objects and help managers make the right decisions regarding product mix and competitive strategies" (Ray 2012). ABC helps allocate costs more effectively so products can be better evaluated and identify weather a product line is worth keeping or not. Organizations and companies can identify activities required to produce a product, of the given activities' costs can be assigned on various grounds such as labor, equipment and consumable costs. On the contrary traditional costing systems use all costs including overhead costs to determine a cost per unit. Traditional costing systems add average overhead rates to the cost driver such as labor. Traditional costing systems easier to implement, significantly cheaper, and easy to understand from a third party compared to ABC systems. This costing skews data because the overhead costs are split between all the products making it difficult to identify key cost drivers, this may result in different management decisions. This does not give an accurate representation of the performance if a company produces multiple products. ABC systems are expensive and take time to implement but they specifically demonstrate where money is being allocated. This results in upper management being able to make efficient portfolio management decisions, ultimately removing products which starve resources from more profitable items. ABC has helped companies in all industries from pharmaceuticals to auto manufacturers, allowing them to create competitive strategies to propel towards its visions and goals.

Early Life Lead Exposure and its impact on Child Oral Health Outcomes

Jamie Chamberlin

Biochemistry

Mentor: Mark Moss

In North Carolina, \$16.7 million per year is spent in the Medicaid program for dental services performed under general anesthesia¹. This dental care is frequently allocated to children and has been preliminarily linked to early life lead (Pb) exposure at levels below those that require an environmental investigation by public health officials². As a screening, North Carolina tests over 100,000 children ages 1 and 2 years old for lead levels and reports the data to the state's Childhood Lead Poisoning Prevention Program. It is a hope of this study that using the existing environmental surveillance system will enhance prevention of dental decay in young children and reduce the future need of dental services that require general anesthesia.

In North Carolina, physicians actively participate in child oral health by applying fluoride varnish up to six times for children between the ages 12 to 42 months. This study aims to use the existing blood Pb levels collected at age 12 months and 24 months by ECU Pediatrics to determine the association between Pb exposure and dental caries at age 6-8 years. The study also aims to evaluate the relationship between salivary gland function at ages 6-8 years and blood lead levels from age 12 months and 24 months. All saliva samples and a cheek swab will be stored for future research that can take advantage of the Center for Human Health and Environment (CHHE) resources.

Effect of Metformin on the Lifespan of *Drosophila*

Elizabeth Chan

Biology

Mentor: Peter Neuffer

There are multiple effects that aging has on the body from graying hair and wrinkles to chronic diseases. Metformin, a drug commonly used to treat diabetes, has been shown to protect against several aging-related diseases in diabetic patients including cancer, neurodegenerative disease, and cardiovascular disease. Metformin's ability to mildly decrease the efficiency of mitochondrial energy transformation has led to speculation that metformin may also promote healthy aging and extend longevity in non-diabetic, otherwise healthy individuals. The effect that metformin has on aging has not been fully evaluated with mitochondrial efficiency combinations such as a high-fat diet, low-fat diet, fasting, exercise, and sedentary activity. We hypothesized that metformin, by decreasing mitochondrial and whole body bioenergetic efficiency, will increase health span and/or lifespan in flies on a high-fat diet, but either decrease or have no effect in flies on a standard low-fat diet. Mitochondria efficiency was determined with multiple high-resolution oxygen consumption measurements performed using the Oroboros Oxygraph-2K (Oroboros Instruments). The behavior of the *Drosophila* was also observed by using the LAM25H locomotor activity monitors (TriKinetics Inc, Waltham, MA) to measure the total flight activity of the flies. Survival curves were also generated to determine the average lifespan of the *Drosophila* for each of the experimental groups. Pending the results, we will continue to study the effect different diet/mitochondrial efficiency combinations on the lifespan of *Drosophila* and may apply these combinations to *Drosophila* offspring to determine if transgenerational inheritance is present.

Influence of trait mindfulness on COVID-19 anxiety in college students

Victoria Chan

Psychology

Mentor: Kendall Thornton

Among the battery of physical symptoms and signs that COVID-19 imposes, the pandemic has also sparked an increase in anxiety across the globe. The emotional responses that this death reminder has triggered can be understood through terror management theory (TMT). TMT postulates that anxiety of death drives much of human behavior. Combined with the additional stressors that college students experience, this mortality reminder has the potential to affect students' mental health considerably. Mindfulness-based therapies have shown significant promise in treating physical and psychological symptoms in multiple studies. Studies also consistently suggest that mindfulness, either as trait or practice, may be inversely related to anxiety through emotion regulation. These studies suggest that trait mindfulness offers a therapeutic benefit towards handling existential anxiety. This investigation explores the influence of trait mindfulness on anxiety caused by COVID-19 among college students.

Over the past 30 years, TMT research has repeatedly used a mortality salience (MS) induction in which participants describe what they think would happen to them as they die and after they are dead, including any emotions aroused by the thought of their own death. There is no potential risk to the participants; in the more than 300 published studies that have used MS manipulation, significant deleterious effects for participants have not been found. In this study, participants are asked to "Briefly describe the emotions that the thought of [your own death due to COVID-19 (i.e., MS condition)/watching TV (i.e., control condition)] arouses in you" and to "Jot down, as specifically as you can, what you think will happen to you physically as you [die due to COVID-19 (i.e., MS)/watch TV (i.e., control)] and once you [are physically dead due to COVID-19 (i.e., MS)/have watched TV (i.e., control)]." Participants then complete the Mindful Attention Awareness Scale, followed by a delay task, which consists of the Positive and Negative Affective Schedule. Participants will then complete the Coronavirus Anxiety Scale (CAS), Brief Mood Introspection Scale, and Rosenberg Self-Esteem Scale. We predict that participants with higher levels of trait mindfulness will report lower scores on CAS as a result of mortality salience. We plan to present preliminary findings at RCAW.

An Automated Hurricane Image Classification Model for Pavement Distress Using Unmanned Aerial Vehicle-Aerial Images

Vinay Chawla

Construction Management

Mentor: Carol Massarra

Assessing pavement condition is extremely essential in any effort to reduce future economic losses and improve the structural reliability and resilience. Data resulting from pavement condition assessment are used as a record of infrastructure performance and as a major component to assess their functionality and reliability. However, rapid pavement condition assessment is challenging because of cost associated with assessment, safety issues, and the accessibility restrictions, especially after natural hazards. This research aims to develop an automated pavement aerial image classification model to rapidly classify pavement distresses. High resolution aerial images representing alligator and longitudinal cracks are collected for pavements using Unmanned Aerial Vehicle (UAV) around East Carolina University campus. The image classification model is developed using a Convolutional Neural Network (CNN), a deep learning approach. The results indicate an accuracy of 97% in classifying the two categories of distresses. The methodology behind the developed model will help to reduce the resource requirements and increase the safety, enable transportation engineers in rapidly assessing the pavement damage, aid in making quick decisions for road rehabilitation and recovery, may assist emergency response managers in deciding the safest route to take after hurricane events, and devise a restoration or repair plan.

A Gender Analysis of the Historiographies of Catherine the Great

Schuyler Chernauskas

Russian Studies

Mentor: Justin Wilmes

Through history we are able to learn many things such as warning signs, tactics, and pinpoint where things went wrong. Looking back on history from a modern perspective can help us recognize where prejudice has negatively impacted our learning capabilities through history.

Catherine the Great is arguably the second greatest leader in Russian history. However, she faces unjust criticism that her male counterparts did not face, and often her accomplishments are diminished. For example, Catherine the Great is the only leader that was able to conquer Crimea, however she is criticized by some, such as historian Alan Fisher, as not doing all she could in this realm

When analyzing the sometimes harsh criticisms of Catherine the Great, a trend of patriarchal views and gender prejudice emerge. Many criticisms are attributed to her womanhood, and often those critiques contradict one another. For example, a Frenchman in the court of St. Petersburg, criticized Catherine for being dominated by Potemkin, while J.H. Castera, philosopher and contemporary of Catherine, argued that Catherine skillfully manipulated Grigory Orlov as a check on Potemkin. In this instance, Catherine was criticized for passivity and weakness in the first instance, and aggressive and manipulation in the second.

Gender bias in analyzing Catherine the Great began to appear to me as I researched her accomplishments. This can be explained through gender theorists and philosophers such as Simone de Beauvoir and Catherine McKinnon who discuss how gender roles have substantiated the objectification of women. In de Beauvoir's academic experience, along with other female historians, cases are evident where women's accomplishments are downplayed and considered "amateur" in comparison to their male counterparts. French philosophers Louis Althusser and Jacques Derrida explore in depth the mechanisms and hierarchies of power which also help to explain this gate-keeping against women.

In analyzing Catherine the Great's history it is important to understand how gender has affected her reputation to learn as much as we can about her impact, as well as to develop an awareness of patriarchal lenses of historiography. Not all factors were gender-based. Her successors played a role in her reputation as well. Understanding all aspects of her legacy will allow us to get closer to the truth about Catherine without emotion and bias affecting the facts.

Specimens of isolation & old chemistry

Timothy Christensen

Photography

Mentor: Daniel Kariko

A pandemic is a strange time full of unexpected possibilities. The time spent staring at 4 walls and the stuff collected over a lifetime has led to different interpretations of my practice. I've collected insects since a young age. I've revisited these collections through a collision of digital and old photographic techniques. Using digital methods, I capture micro panoramas of these tiny creatures. This digital work then becomes the subject of the less precise chemistry of wet plate collodion photography. The images are a fusion of the Victorian obsession of cataloging and collecting specimens from nature and the modern scientific obsession with detail and resolution.

Perioperative urinary TIMP-2*IGFBP7 and Acute Kidney Injury: A Systematic Review

Angela Ciuca

Nursing

Mentor: Linda Bolin

Acute kidney injury (AKI) is an insult to the kidney that leads to a decline in glomerular filtration rate within hours to days. It is estimated that 30% to 40% of all hospital acquired AKI cases develop during the perioperative period (McKinlay, Tyson, & Forni, 2018). Many studies strive to improve the timeliness of identifying a surgical-associated AKI using novel renal biomarkers. These are inflammatory markers compared to the current standard use of functional markers. The current standard is to measure serum creatinine, which may not rise for 24 hours to 7 days after the injury indicating functional loss. The purpose of this systematic review is to identify, evaluate and summarize the current literature for use of the novel renal biomarker urinary tissue inhibitor of metalloproteinase-2 * insulin-like growth factor binding protein 7 (uTIMP-2*IGFBP7) for early identification of AKI during the perioperative period for adult patients having major surgery. Databases searched include CINAHL, ProQuest, Scopus, and PubMed. One additional article was found through reference review. The literature search followed the PRISMA guideline. Twelve articles were reviewed and synthesized regarding the usefulness of uTIMP-2*IGFBP7 in early identification of AKI during the perioperative period. The majority of studies reviewed report high sensitivity of uTIMP-2*IGFBP7 to identify surgical-associated AKI (AUROC >0.8); however, there is no consensus regarding the ideal time point for measurement or the cut-off values. This novel renal biomarker shows promise of early identification of AKI in the adult surgical patient compared to current standard models. Future studies are warranted. The findings of this review will be applied in designing a quantitative study for the evaluation of using uTIMP-2*IGFBP7 to identify AKI in surgical patients in the southeastern United States.

Characterization of a Prototype Omnidirectional Source for Surface Impedance Measurements

Faith Cobb

Engineering

Mentor: Teresa Ryan

Surface impedance describes how sound is reflected or absorbed by a surface. The American National Standards Institute and the Acoustical Society of America have published a standard method (S1.18) for measuring outdoor surface impedance. This work represents part of the effort implement that standard: to characterize the omnidirectional source used in the standard's measurements. The ability to make such standard surface impedance measurements supports a larger ongoing effort to develop a numerical model of long-range (~3 km) atmospheric acoustic propagation in littoral or riverine environments. These standard measurements in the field inform the question of how surface impedance affects transmission loss. These surface impedance measurements are conducted with an omnidirectional sound source and two receiver microphones. The ideal omnidirectional source would consist of an infinitely small pulsating sphere suspended in space. The ideal is approximated by using a small speaker with a 3D-printed cone that has a larger radius at the speaker and narrows to a hole with a smaller radius. This conical attachment funnels the sound wave in order to produce a spherical sound wave that is emitted from the end of the cone and expands in all directions. In order to evaluate if the cone produces an omnidirectional sound wave, the prototype must be characterized with a directionality test. This test is performed by emitting a single frequency tone from the source and measuring the sound pressure level at intervals 360° around the source. In order to be considered omnidirectional, the prototype source should have a uniform sound pressure level in all directions. This work will present the preliminary experimental results from the directionality tests.

Design and Configuration of DoD-Compliant UAS Sensor Platform

Emma Cole

Engineering

Mentor: Teresa Ryan

In late 2017, the United States Department of Defense (DoD) issued a ban on the use of commercial off the shelf drones due to security concerns about technology manufactured in countries like China. The East Carolina University Acoustics and Vibrations Lab has historically used DJI brand drones for mapping of atmospheric conditions and GPS position. With the current DoD guidance, the lab does not have UAV technology that can be launched from or fly over U.S. military installations. A Pixhawk flight controller, mounted on top of a 3D Robotics X8 frame, is manufactured in America and is compliant with DoD regulations. This project will assemble, configure, and program a DoD-compliant drone system for use in planned studies at the U.S. Army Corps of Engineers Field Research Facility in Duck, NC. This work will be using open-sourced Windows based flight control software and a Pixhawk flight controller to enable waypoint-controlled flights. The design process, flight test results, and preliminary atmospheric data will be presented.

Culturally Responsive Community Palliative Care

Marianne Congema, Sarah Hoffman

Nursing

Mentor: Kim Larson

Early integration of palliative care after a diagnosis of cancer improves outcomes, yet such care for Latinx populations is lacking in rural regions of the country. We used a participatory action research design with Latinx community leaders from emerging immigrant communities in North Carolina to explore sociocultural perspectives on cancer and death. Thematic analysis was conceptualized as *Four Kinds of Hard* represented by four themes: Receiving an Eviction Notice, Getting in the Good Book, Talking is (Sometimes) Taboo, and Seeing Their Pain Makes Us Suffer. These themes captured fears of deportation, coping with cancer through faithfulness, ambivalence about advance care planning, and a desire to spare families from suffering. Findings suggest strategies to improve conversations about end-of-life wishes when facing advanced illness and death. This study demonstrates the importance of training Latinx community leaders to improve palliative care and bridge service gaps for Latinx families living in emerging rural communities.

MD Simulation Study of Cd and Pb Bound to Human Cardiac Troponin C

Melany Contreras

Chemistry

Mentor: Anne Spuches

Toxic metals such as Cd and Pb present a threat to public health, as they can cause cognitive disorders, various cancers, and heart disease through molecular ion mimicry. Divalent Cd and Pb ions can bind to human cardiac troponin C (hcTnC), a Ca(II) binding protein responsible for heart muscle contraction, to cause Cd and Pb toxicity. The mechanism and the thermodynamics in which they bind to hcTnC, however, remain unclear. Molecular Dynamics (MD) simulations were performed for hcTnC wild-type bound to Ca(II), Cd(II), and Pb(II) using AMBER 18 in order to obtain binding energies. This study suggests that Cd(II) and Pb(II) binding to the native Ca(II) binding sites in hcTnC wild-type may be enthalpically driven. Furthermore, Cys residues located in positions 35 and 84 do not appear to participate in Cd(II) coordination as they are either 4.9 or 20 angstroms away from Cd(II) ions. Obtaining thermodynamic information on divalent Cd and Pb metal binding to hcTnC may provide insight into the basis of Cd and Pb metal toxicity.

Impulse Buying: How Digital Marketing is Influencing the Millennial Generation's Impulsive Spending

Emily Cross

Marketing

Mentor: Christine Kowalczyk

Impulse buying, in its most simplest form, is the process of making a purchase one had not intended to make (Cruze, 2020). Impulse buys can be small, they can also include larger items such as cars and computers. Millennials, currently aged between 26 and 41 and a population of 72.1 million, make up the largest segment of the American workforce (Pastore, 2020). Not only does this population make up a majority of the American workforce, they are also the highest spending generation and the generation that the media is most easily able to influence (Mullen, 2020). Among millennials, 82 percent buy a product they like the first time they see it, 70 percent admitted to often regretting purchases they made, and 64 percent reported they often make impulse buys (Mullen, 2020).

The purpose of this research is to analyze what forms of digital marketing are able to influence the millennial population the most. This research will also attempt to examine what demographics influence consumers to purchase an expensive or luxury product that they had not intended to buy. The demographics that will be included are age, race, gender, general income, and household type.

Information will be contributed to this research through surveys submitted anonymously from participants aged 25 to 40 years old. By analyzing the results from the surveys, there will be more insight on what forms of digital marketing are most successful in achieving an impulse purchase by millennials.

Investigation of conserved cysteines on a δ 12-fatty acid desaturase function in *Arabidopsis thaliana*

Parth Dave

Biology

Mentor: Patrick Horn

Lipids are required for all organisms to grow, reproduce, and survive. Despite the incredible diversity within the plant kingdom (374,000 species discovered to this day) certain enzymes are ubiquitously present to carry out important functions. The goal of this research project is to investigate the effect of select amino acid mutations on the functionality of a key enzyme FAD2, a δ 12 fatty acid desaturase located in the endoplasmic reticulum of *Arabidopsis thaliana*. The FAD2 enzyme plays a critical role in plant lipid synthesis in both reproductive tissue (seeds) and vegetative tissue (leaves) by converting oleic acid (18:1 δ 9) into alpha-linoleic acid (18:2 δ 9,12). Considering the essential role of FAD2 in lipid synthesis, our investigation aims to introduce seven independent cysteine (Cys) to alanine (Ala) mutations within the protein sequence to test their effects on enzyme structure-function, and ultimately the effect on seed oil production. Cysteine residues were chosen for targeted mutation due to their critical role in protein stability, catalysis, and/or role as a redox switch. Based on global sequence alignments performed for FAD2 homologs from more than a hundred different plant genomes, we predict that the more well conserved a cysteine residue is, the higher likelihood a mutation will negatively impact its function. Thus, the greater the conservation rate exhibited by a specific cysteine residue within the sequence, the greater the likelihood of the mutation to cause significant changes in FAD2 functionality. Thus far, we have successfully designed and introduced each of the seven mutants into the pESC-His yeast expression vector and are currently in the process of testing protein expression and analyzing lipid composition. We are carrying out parallel experiments in *Arabidopsis*. These findings will enhance our understanding how the role of Cys residues as well as providing information for genetic engineering of nutritional and industrial importance.

UNC System Smoke-Free Campus Initiative

Rachel Davis

Political Science

Mentor: Timothy Christensen

The state of North Carolina is one of the leading producers of tobacco in the United States. As such, the tobacco industry has played a significant role in North Carolina politics for decades. The relationship between big tobacco companies and the state legislature has resulted in a restrictive policy for University of North Carolina System schools. General Statute 143, Article 64, Sections 595-601 establish that UNC System schools cannot restrict tobacco use on their campuses to farther than 100 feet from buildings, with the exception of health science campuses. Originating in Honors 2000, our group has been conducting collaborative research for over a year. Now, with support from the Student Government Association at East Carolina University, the ECU Faculty Senate, and the statewide Association of Student Governments, we are well-positioned to amend the current legislation. Our proposed bill amendment has also gained approval from Representative Kandie Smith and Representative Donna White, who, moving forward, will act as sponsors to advance our bill further into the North Carolina General Assembly.

Speech Recognition in Noise Abilities between Musicians and Non-Musicians

Rebeca Davis

Speech and Hearing Sciences

Mentor: Virginia Driscoll

Understanding speech is critical to hearing and the quality of life. Not only have those with diagnosed hearing loss complained of difficulty understanding speech in the presence of background noise, but people with normal hearing have also reported difficulty understanding speech in noisy environments (Middelweerd, Festen, Plomp, 1989). Previous studies have shown that musical training improves speech recognition in noise (SRN) (Parbery-Clark et al., 2009; Brown et al., 2017). The purpose of this study was to investigate the effect between musical training and SRN abilities. It was hypothesized that musicians would outperform non-musicians in SRN tasks. Musician and non-musician participants completed an online protocol that included the AzBio sentence lists paired with five types of maskers including: multi-talker babble (MTB), speech-shaped noise (SSN), "Lounge Lizard" (LL), "Four Voices" (FV), and "Power Theme" (PT); the final three maskers represented different musical styles (Spahr, et al., 2012; Escobar et al., 2019). Stimuli were presented so that maskers were within comfortable listening levels, and the target speech was clearly audible. All participants used earbuds, headphones, or speakers. Sentences were scored as percent correct. With the exception of one listening condition, no significant differences in SRN abilities were detected between musicians and non-musicians. For the MTB, musicians who listened with computer speakers instead of earbuds or headphones significantly outperformed musicians who used earbuds or headphones and non-musicians, collectively. Data collection is ongoing to determine if this is indeed the case.

Customer Review Analysis using Machine Learning

Storm Davis

Software Engineering

Mentor: Moha Nassehzadeh-Tabrizi

Due to the continuous growth of E-Commerce platforms, more and more data is becoming widely available. Almost every online transaction, from buying products on Amazon to renting vacation houses on Airbnb, allows for users to leave feedback in the form of customer reviews. This work will explore the use of machine learning tools in combination with natural language processing techniques to determine the possibility of accurately predicting product features using customer annotated reviews.

Thoracoscopic Lobectomy after Neoadjuvant is Safe and Effective Compared to Traditional Open Surgery

Sahil Dayal

Medicine

Mentor: James Speicher

Non-small cell lung cancer remains the most lethal cancer in the United States. Late stage non-small cell lung cancers (NSCLC) are often treated with chemotherapy and radiation therapy (CRT) prior to surgery. Preoperative CRT increases the complexity of surgery due to development of dense inflammatory tissue, edema, and scarring adhesions. The increased difficulty in post CRT patients has resulted in slow adoption of minimally invasive techniques for post CRT resection. In the past, surgical resection for NSCLC has been proven to be efficacious after CRT, but the available data focuses mostly on open-chest procedures. The aim of our study was to demonstrate that there was no difference in surgical outcomes when performing minimally invasive thoracoscopic lobectomy after neoadjuvant CRT.

An IRB-approved, retrospective analysis of an institutional RedCap database was conducted of 275 patients who underwent lobectomy between the years 2014 and 2019 at a single institution. Baseline variables and data were collected. Statistical analysis of continuous and categorical data was conducted to compare outcomes of patients undergoing thoracoscopic lobectomy with history of neoadjuvant CRT, chemotherapy only, and radiation only to those with no CRT. Statistics were performed using a standard ANOVA for the continuous data and Fischer's Exact chi square test for the categorical data in SPSS.

There were no differences between the neoadjuvant CRT, chemotherapy only, and radiation only groups versus no CRT groups with respect to age, gender, BMI, presence of pulmonary disease, presence of cardiovascular disease, preoperative FEV1, estimated blood loss, length of hospital stay, ICU stay, days on ventilator, chest tube duration, presence of air leak, presence of post-op general complications, nor 30 day and 60 day mortalities. There were significant differences between the groups for the demographic categories of preoperative DCLO, smoking history, current smoking status, and also with lower rates of post-op pulmonary complications in the radiation only group.

There were no significant differences in outcomes between groups except for a lower rate of pulmonary complications seen in radiation only patients, which may be attributable to selection bias, sample size, or the lower rate of current smokers in the radiation only group. The data indicates that thoracoscopic lobectomy after neoadjuvant CRT is a safe option for patients with advanced regional NSCLC.

It's Dinner Time!

Lauren Delbrocco

Metal Design

Mentor: Mi-Sook Hur

In this presentation, I will focus on the evolution of dining objects and how they reflect one's family. Dining objects began as simple tools to consume substances. During the 16th century, hosts provided additional dining tools as health concerns increased and dining etiquette became formalized. Currently, dining tools have been stripped down into multipurpose and disposable objects. Regardless of the settings' elegance, gathering around a table to enjoy a meal with dining mates rises through the centuries. All these dining objects, even today, are a reflection of a family's mealtime style and their interests. The dining table is the center of attention in a home, a place for not just eating but for communicating, discussing, and entertaining. My concept reclaims the old-time tradition of specialized tools and dining equipment. My art works capture my family's interests, personality, style, and rituals with an intended purpose to build connections, tell stories, and commemorate together.

An Integrative Review of the Role of Long-term Care Nursing Staff in UTI Identification

Kimberly Delgado

Nursing

Mentor: Donna Roberson

Background: Inappropriate antibiotic use has resulted in a systemic healthcare crisis across long-term care (LTC) settings. Nursing staff in LTC are responsible for recognizing urinary tract infections' (UTIs) signs and symptoms in LTC residents.

Purpose: To examine the current literature related to nursing staff's role in identifying residents' UTIs and the subsequent nursing care.

Methods: This is an integrative literature review using Whittemore and Knaf's recommendations for problem identification and literature review. The quality of the articles was evaluated using Johns Hopkin's evidence-based practice guidelines. The team created a search strategy that was representative of the concepts under review: nurse, role, nursing home and urinary tract infection. Databases searched included PubMed, Scopus, CINAHL, Sociological Abstracts, SocIndex, PsychInfo, and ProQuest.

Results: The review included 22 articles published 2005-2020 and we identified three themes: antibiotic stewardship practices and nursing, nursing's impact on prescriptive decision-making, and the role of the nursing staff. Nursing staff were highly influential in the UTI identification and treatment process. Nurses were accountable for communicating residents' condition changes to healthcare providers. During the communication process, nurses shared their observations and recommendations with the providers.

Conclusion: The literature indicated that it was unclear what the roles that licensed practical nurses (LPNs) and certified nursing assistants (CNAs) play in the decision-making process. Further research is needed to understand the strategies used by nursing staff in identifying UTIs in LTC residents, the motivating factors that influence nursing staff's decision-making process, and nursing staff's perceived value to timely report residents' UTIs.

Compound Coastal Water Event Risk within Eastern North Carolina

Kelley Depolt

Geography

Mentor: Rosanna Ferreira

The combination of multiple climatic drivers across spatial and temporal scales is referred to as a compound event. Flood events result from the coincidence of drivers that are typically climatic in nature. Three distinct flood drivers: pluvial (precipitation-based), fluvial (river-based), and coastal (tidal-based) have the potential for causing damages on their own, but if these drivers occur concurrently or in close succession, this is called a Compound Coastal Water Event (CCWE) and the adverse consequences of the hazards can be exacerbated leading to substantial impacts. Within Eastern North Carolina, Hurricanes Florence and Matthew are examples of CCWE, where floods occurred outside the predicted flood zone boundaries. When considering flood risk, current studies and applications for risk assessment have used univariate or bivariate approaches, typically leaving out the influence of the pluvial driver, leading to an underestimation of risk during these events. The use of multivariate statistical analysis of the three drivers included in CCWE has not yet been explored. In this project, a copula-based approach is introduced that can be used to obtain multivariate probabilistic assessments of CCWE drivers and their corresponding return periods. It has been hypothesized that the joint distributions will yield a greater hazard risk and smaller return period for each variable compared to their univariate distributions. Analyzing all drivers will provide a better understanding of CCWE and how to respond to these events.

Biomechanical Differences In Lifters With Pre-Existing Injuries During The Snatch Exercise

Evan DeVitto

Exercise Physiology

Mentor: Patrick Rider

Introduction: High-intensity training (HIT) workouts such as CrossFit, are rapidly growing in popularity throughout the fitness industry. HIT workouts often include complex movements such as the snatch. The snatch requires the participant to lift a bar from the ground to an overhead position in one fluid movement. Participation in HIT workouts has been viewed as a higher injury-risk practice compared to other exercise programs. HIT workouts typically include high repetition counts. Research has suggested that high repetitions can result in a breakdown in the biomechanical technique used by the lifters leading to potential increase musculoskeletal injury risks. Research also suggests that athletes with pre-existing injuries have a significantly higher chance of reinjury than previously healthy athletes. The relationship between injury history and HIT mechanical changes is unclear, therefore the purpose of this study is to quantify the biomechanical differences between lifters with pre-existing injuries and those without.

Methods: At least 20 participants (18-45 years old) will be recruited to participate in this study. Each participant will complete a questionnaire assessing preexisting health conditions, injury history, and demographic information. Participants will complete a snatch workout which consists of 30 repetitions for time. Utilizing a twelve-camera 3D motion capture system, kinematic data will be recorded. Reflective markers will be placed onto the participant. A static trial will be performed to create a model of each lifter. The weight for the workout will be based on 60% of the participants one rep max for the snatch. The kinematic variables of interest are 3D body segment positions and joint angles. The first repetition for each participant will be used as a baseline, and differences from the baseline will be calculated to determine the biomechanical alterations and used to determine injury risk.

Significance of Results: These results will be significant to both healthcare professional and HIT participants. If our data supports that re-injury is common in HIT, releasing a patient too early could lead to a severe injury with a longer recovery time. Practitioners can design rehab or prevention programs that address these adaptations by strengthening auxiliary muscles to strengthen the injury site. Participants in HIW can better understand their injury risk and allow them to focus on their performance mechanics.

Quantifying Lignin in Suspended Particulate Matter in the Albemarle- Pamlico Estuarine System During the 2018 Hurricane Season.

Ariana Donini-Rivera

Geology

Siddhartha Mitra

Extreme, climate driven precipitation may alter the carbon cycle in coastal environments. Heavy rainfall often leads to flooding, and soil eroded during flood events is enriched in terrigenous organic matter (Rudolph *et al.*, 2020) and nutrients (Paerl *et al.*, 2019). In September 2018, Hurricane Florence caused more than 900 mm of precipitation to fall over a four-day span across coastal North Carolina (Kunkel & Champion, 2019). This storm event may have pulsed suspended sediments from coastal soils into the Albemarle-Pamlico Estuarine System (APES) and then out into the Atlantic Ocean via the Ocracoke, Oregon, and Hatteras inlets. Excessive nutrient input may lead to eutrophication, fish kills and an overall decline in water quality and condition of the estuary. Other studies have examined the impacts of hurricanes on the APES (Paerl *et al.*, 2001), but as climate change continues to accelerate (Cox *et al.*, 2000) it is crucial to acquire new data to allow us to better understand how the changing climate will impact the environment. My research quantifies carbon, nitrogen, and lignin in suspended sediments isolated from the estuary as well as through Oregon Inlet into the coastal ocean immediately after Hurricane Florence (storm conditions) and several months afterwards (non-storm conditions). This data will allow for me to determine if there was a change in water quality between the storm and non-storm periods, as well as the sources of water pollution and organic matter.

Characterization of Oxidative Stress Impacts on Lipid Metabolism to Enhance Plant Resilience

Shannon Donnelly

Molecular Biology and Biotech

Mentor: Patrick Horn

Understanding how climate change impacts crop quality is critical for engineering plants with enhanced resilience. Plants transform light energy into chemical energy through a series of reduction/oxidation (redox) reactions. This flow of electrons within the chloroplast cells fuel the production of high-energy molecules that are essential for an operating photosynthetic apparatus. When the flow of electrons becomes unbalanced due to abiotic stressors, an increased level of reactive oxygen species (ROS) accumulate, a process known as oxidative stress. The damaging effect of ROS accumulation is well accepted, but there remains a large knowledge gap in how chloroplast membranes are affected under these stress conditions. Therefore, this project contributes to enhanced plant resilience through a targeted study of oxidative stress impacts on lipid metabolism in the model system *Arabidopsis thaliana*. We are analyzing mutants in both redox and lipid metabolism pathways by conducting lipid stress-repair assays. In these assays, plants are subjected to a period of light stress then returned to normal, stress-free conditions to monitor the molecular events associated with this repair period. As part of optimizing these assays, we tested wildtype (WT) and the *ntrc* mutant (NADPH- dependent thioredoxin c, important in light response and early chloroplast development).; Preliminary results indicate a decrease in the 16:1d3t lipid species (a biomarker for chloroplast membrane integrity) in both WT and *ntrc* in presence of light stress. Upon returning these plants to normal light conditions, a repair phase initiated as evidence by the return of 16:1d3t to normal levels relative to untreated plants. Other lipid species showed distinct patterns between stress and repair. These results suggest under stress the chloroplast membrane loses integrity but the loss of NTRC is not required for membrane lipids to initiate the repair process. Future experiments will work on analyzing double mutants and their repair response to stress.

The Effects m6A RNA Modification on Breast Cancer Progression and EMT

Mohammed Dorgham

Biochemistry and Molecular Biology

Mentor: Kyle Mansfield

Metastatic breast cancer is the number two killer cancer in women in the United States. The 5-year survival rate drops drastically as the cancer progresses and late diagnosis require drastic and less efficient treatments. Despite these facts, little is known on the regulation that causes this metastatic cancer to become so aggressive as well as invasive. In recent years, it has become clear that posttranscriptional regulation plays a key role in the aberrant gene expression underlying malignancy and metastasis. The mRNA posttranscriptional modification N6-methyladenosine (m6A) is involved in many post-transcriptional regulation processes including mRNA stability and translational efficiency. It has been reported to be involved in many different cancer types, including breast cancer, as well as Epithelial to Mesenchymal Transition (EMT) as a mode of progression of these cancer types. Currently there is data to suggest that m6A is both a tumor suppressor and facilitator for progression and migration in several cancer types including breast cancer. The most studied complex for carrying out the m6A modification is METTL-3-METTL-14-WTAP complex with the METTL-3 being the protein responsible for catalytic activity. We have used Crispr-Cas9 to knock down METTL-3 in three breast cancer cell lines representing different stages of progression (MCF10A, MCF10AT1 and MCF10CA1H). Interestingly, knockout of METTL-3 in the non-malignant MCF10A caused them to increase proliferation while decreasing migration capacity. Decreased METTL-3 in the HRas G12V-transformed MCF10AT1 had little to no effect on proliferation and increased migration capacity. In the highly malignant MCF10CA1H line, knockout of METTL-3 actually decreased malignancy as indicated by decreased migration, and proliferation. Studies are now underway to determine the impact of METTL-3 knockout on the EMT pathway and identify pathway members that may be regulated by m6A. We believe that by understanding how changes in m6A lead to phenotypic changes in cancer cells we may potentially be able to manipulate this mRNA modification as a novel breast cancer treatment.

The effects of burnout on student's self-concept and its relationship to engagement levels: a literature review

Alexandra Dorn, Hailey Hutto

Nursing

Mentor: Holly Wei

Background: Stress in nursing students is a significant concern due to the demanding nature of nursing school courses. Students are not only expected to succeed academically but also must learn to deal with the challenges of patient care and developing clinical skills. There is a need to understand the effects of burnout on student performance and provide recommendations for nursing programs.

Purpose: To examine research methods, critiques different approaches, and provide recommendations for universities and future research.

Methods: This is a systematic literature review guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Databases searched include MEDLINE via PubMed, CINAHL, PsycINFO, and Scopus. The literature reviewed was data-based studies on students' burnout published in peer-reviewed journals 2015-2020.

Results: Seventeen articles met the inclusion criteria and were reviewed. The studies' quality was assessed using the 2018 version of the Mixed Methods Appraisal Tool (MMAT). Two major themes were identified: the inverse relationship between burnout and self-concept and the relationship between levels of burnout and student engagement. Nursing faculties play a significant role in the development of student self-efficacy and positive self-concept.

Conclusion: The findings recommend that universities can improve students' psychological health by implementing mindfulness techniques and acceptance and commitment training. More research is needed to identify factors that combat negative self-concept and increase engagement.

Keywords: *Academic achievement, burnout, nursing students, student self-concept, student engagement*

Endobronchial Valves Are Successful In The Management Of Bronchopleural Fistula In Patients With Chronic Lung Disease

Patrick Dugom

Medicine

Mentor: James Speicher

Disclosures: None

Objectives. Bronchopleural fistula with prolonged air leak is a challenging problem in patients with chronic lung disease who are poor surgical candidates. Conventional management consists of long-term chest tube placement, however in some cases patients are unable to leave the hospital due to the need for continuous negative pressure applied to the tube. We report our investigational application of endobronchial valves in the management of patients with air leak arising from chronic lung disease in whom surgical intervention was contraindicated.

Methods: With Institutional Review Board approval of off-label use, endobronchial valves were placed in patients with persistent air leaks arising from non-operative causes. Successful outcomes were defined as complete resolution of air leak and removal of chest tube.

Results: Fourteen patients with persistent air leak requiring negative pressure suction were treated with 1 to 6 valves per patient. Persistent air leak was secondary to bullous emphysema, sarcoidosis, lung cancer, spontaneous and trauma-induced pneumothorax, or necrotizing infection. Overall successful outcome rate was 78.6%. There was a statistically significant reduction in length of stay following valve placement in the success group compared to the non-success group (10.9 days versus 61.7 days; $p=0.03$). Only one adverse event was recorded, of an endobronchial valve migration, with no adverse outcome.

Conclusions: Endobronchial valves are a valid option for high-risk patients who are not surgical candidates and have failed conventional management of persistent air leak arising from non-operative causes. This experimental use of endobronchial valves leads to high success rates and shorter length of stay when successful in these complex cases.

The Impact of Race on Body Image Dissatisfaction in College Age Females.

Monica Dunn

Kinesiology

Mentor: Bihbha Das

Nearly 40% of women (age 25-45) have engaged in a disordered eating behavior. Disordered eating is a critical public health issue with a variety of physical and psychological health consequences. One of the most prominent risk factors associated with disordered eating is body dissatisfaction.

Most of the research conducted on body dissatisfaction (BD) and its association with disordered eating has primarily studied white Caucasian females. However, this research is limited and less generalizable because it lacks representation of diverse ethnic populations in the US. Of the limited research performed on ethnic populations, the sample sizes are small and with confounding results. Understanding how ethnicity impacts BD, will allow better care for body image disturbances across multiple ethnicities. Thus, it is important to understand the role of race and ethnicity on one's body dissatisfaction. The primary purpose of this study is to assess how race and ethnic identity impact a person's body dissatisfaction. A secondary purpose is to assess how internalization of thinness and pressures (family, peers, significant others and media) to achieve the thin ideal, impact a person's body dissatisfaction. Race, ethnicity, pressures and internalization, and body dissatisfaction will be collected via online survey along with qualitative data. We hypothesize that Non-European American ethnicities will have a lower level of BD compared to European American females.

Descriptive statistics will be used to analyze demographic data. A linear regression model will be used to assess how race and ethnic identity impact body dissatisfaction. Qualitative questions will be analyzed through a content analysis to assess overall themes.

We anticipate body dissatisfaction along with the thin and fit ideal internalization, will have a high prevalence regardless of a person's ethnic identity. Potential findings can be used to towards positive body image education and disordered eating prevention across the United States. Understanding the psychosocial and cultural risk factors will help address eating disorders with a more personalized and appropriate approach toward ethnic and minority populations suffering from body dissatisfaction and disordered eating. Addressing body dissatisfaction and disordered eating in all ethnicities will empower a healthier generation.

The Trojan Horse Approach to Combating Antibiotic Resistance

Remington Eakes

Chemistry

Mentor: Sambuddha Banejee

Antibiotics cross bacterial membrane using porins, which are protein channels that can transport small molecules non-selectively. However, the overuse and misuse of these drugs has created antibiotic resistance in human pathogens, by the expression of dedicated drug-efflux pumps. On the other hand, bacteria express high-affinity uptake systems for hijacking iron, an essential micronutrient for host and pathogen alike. Of the various types of bacterial Fe^{3+} uptake systems, the Fe^{3+} -siderophore (siderophores are small organic Fe^{3+} chelator molecules produced by the bacteria) transporters are ubiquitous and often required for the survival of the pathogen. There are hundreds of characterized siderophores till date, many from antibiotic resistant pathogens, and these utilize specific outer membrane transporters (OMT) to translocate these Fe^{3+} -siderophores. Taking the specificity of the Fe^{3+} -siderophores towards their cognate transporters and their importance in bacterial survival, in this project I synthesized a siderophore-drug conjugate which can be taken up by its cognate receptor. Specifically, I used a redox active anti-malarial drug molecule, artesunate, and chemically conjugated it to a natural siderophore, 2,3-Dihydroxybenzoic acid (DHBA), using a diamine linker. Several drug-resistant pathogens use DHBA as their natural siderophore. The synthesized molecule has been characterized using proton $^1\text{H-NMR}$ and ESI mass spectroscopy. Currently, I am synthesizing and characterizing another siderophore from the bioterrorism agent, *Brucella abortus* which contains two DHBA molecules. To our knowledge, there is no reported method for synthesis of this siderophore. Once this siderophore is successfully synthesized, it will be conjugated with artesunate and this and the DHBA-artesunate conjugates will be tested on pathogenic species under conditions for their effectiveness.

Examining the contribution of mesopelagic fishes to the biological pump in the North Pacific Sub-tropical Gyre

Elise Easterling

Biology

Mentor: Rebecca Asch

When carbon dioxide is mixed into surface seawater, photosynthetic phytoplankton convert the carbon dioxide into oxygen and organic matter. Carbon in organic matter is transferred through the food web beginning with organisms feeding on phytoplankton and subsequently moving up each trophic level. Carbon is also transferred into deeper water through fecal matter and sinking dead organisms in the form of particulate organic carbon. Due to their vertical migratory nature of feeding, mesopelagic fishes are believed to be a major mechanism for transporting organic matter below the euphotic zone. After feeding at the surface, the fishes retreat to depths below 200 meters where carbon is released through fish respiration and defecation. The objective of my research is to develop and test a method of tissue analysis that quantifies the amount of carbon that is potentially sequestered in the ocean column and seafloor by measuring the carbon that is ingested as food and expelled as waste by mesopelagic fishes. I will utilize data collected on a research vessel in the summer of 2019 from Station ALOHA, which is located in North Pacific Sub-tropical Gyre (NPSG). The NPSG plays a large role in nutrient cycling, carbon fixation, and contains a high diversity of fish species, which makes an ideal location to sample for mesopelagic fish.

The mesopelagic fishes captured during the cruise are very small, many less than 30 mm. As a result, size limitations may require removing only the whole stomach for the Hawaiian fish samples. In that case, we will estimate the amount of carbon in their stomach by determining the allometric relationship between fish size/weight and the carbon biomass in the stomach lining and stomach contents using a variety of fish species sampled in Beaufort, NC. If generalizable across species, the allometric relationship from Beaufort samples will be used to derive a formula for estimating carbon content in the stomach lining of Hawaiian fishes, so that I can quantitatively estimate of the amount of remaining carbon in gut contents. We hope to discover a linear relationship between fish size/weight and carbon content of the stomach lining. Stable isotope analysis will be performed on both the Hawaiian and Beaufort fishes to determine carbon content of both stomach tissue and contents. Due to their large biomass, we anticipate mesopelagic fishes play a substantial role in providing a pathway to sequestering carbon deep into the ocean.

Contraception Use Barriers for Low Income Women

Harper Eisen

Public Health

Mentor: Kristin Black

There are many contraceptive options for women, and all have different costs, schedules, and effectiveness. In the United States, there are patterns in contraceptive use among religious denominations, socioeconomic status, race, ethnicity, and many other factors. For example, the birth control pill is a popular method for white, college graduates while, sterilization is common among women of color and those below 150% of the federal poverty level. These trends in contraceptive use are due to hundreds of years of discrimination, forced sterilization, and structural racism. Contraceptive access is influenced by social determinants of health, specifically education level, health insurance coverage, and socioeconomic status.

The objective of this study is to compare the prevalence of contraceptive use between low-income women and their high-income women counterparts. We also investigated factors that influence women's birth control use/access, including geographical location (urbanicity/rurality), median household income, and primary payer of hospital visit and determined how these social determinants of health influence the relation between income level and contraceptive use.

This study used data from the Healthcare Cost and Utilization Project (HCUP), which is a nationally representative sample of all the U.S. hospital inpatient stays. We utilized the 2012-2016 Nationwide Inpatient Sample (NIS) data from HCUP. The unweighted subset of the 2012-2016 NIS data that was used includes over 3.4 million delivery-related hospital inpatient stays by patients classified as female.

We conducted univariate analyses (using proportions and chi-square tests) to assess differences between low- and high-income women by the following variables: race/ethnicity, age at time of hospital visit, geographical location (urbanicity/rurality), median household income, or primary payer of hospital visit. To assess the relation between income level and contraceptive use, we performed a doubly robust g-estimator of a structural nested mean model and calculated the counterfactual disparity measure (CDM) and 95% confidence intervals. In the analysis of the income level-contraceptive use relation, expected primary payer of hospital visit, median household income, and urbanicity/rurality were examined as the potential mediators. These data are currently being analyzed and predicted results are forthcoming.

Depression and anxiety among undergraduate students in the time of COVID-19: the role of subjective social status and hopelessness.

Cindy Ejindu

Public Health

Mentor: Leslie Cofie

Objective: Previous research on anxiety and depression among undergraduate college students have been examined in relation to various sociodemographic determinants. However, little is known about the impact of subjective social status and hopelessness on this relationship. This study examined whether subjective social status and hopelessness are associated with depression and anxiety symptoms among students.

Methods: Data were obtained from a survey of undergraduate students (N=1602) in the eastern part of North Carolina. Independent measures include subjective social status (MacArthur Scale of Subjective Social Status, score: 1-10) and hopelessness (Brief-H-Neg Scale, score: 2-10), with a higher score indicating greater perception of subjective social status and hopelessness. Outcome measures include depression (Patient Health Questionnaire-9, score: 0-27) and anxiety (General Anxiety Disorder-7, score: 0-15), with a higher score indicating greater perceived depression and anxiety. Pearson's correlation and chi-square tests were used to examine the association between the independent and outcome measures.

Results: On average students reported severe depression (15.50 ± 6.10) and significant anxiety (12.96 ± 5.86). All students had some form of depression: mild (17.86%), moderate (34.7%), and severe (47.44%). Also, most students (62.88%) reported anxiety symptoms. The association between race/ethnicity, gender, income, and perceived anxiety and the depression categories were significantly different, $p > 0.01$. Students had a low mean score of hopelessness (3.90 ± 2.10) and a mean social status score of 5.04 ± 2.42 . There was a positive association of higher perceived hopelessness ($r=0.61$, $p > .001$) and a negative association of higher perceived social status ($r=-0.29$, $p > .001$) with higher perceived anxiety. Similarly, higher perceived hopelessness ($r=0.53$, $p > .001$) was positively associated, and higher perceived social status ($r=-0.29$, $p > .001$) was negatively associated, with depression.

Conclusion: Hopelessness was positively associated with depression and anxiety symptoms, and subjective social status was negatively associated with depression and anxiety symptoms. Further research should investigate the mediating role of hopelessness in the relationship between subjective social status and symptoms of depression and anxiety in undergraduate students.

LEVELING THE PLAYING FIELD: ACHIEVING PROPORTIONAL GIFTED REPRESENTATION THROUGH OPPORTUNITIES TO LEARN AND NONVERBAL ASSESSMENTS

Michael Elder

Educational Leadership

Mentor: Robert Reardon

Administrators in school systems strive to ensure that the identification of giftedness in elementary students results in proportional demographic representation. Overly stringent or biased gifted identification results in deserving students receiving fewer opportunities to learn and exacerbates the excellence gap. My aim in this action research for transformation project is to utilize three complementary perspectives on the continuum of giftedness to generate a more representative pool of students who will be further screened and potentially offered the opportunity to participate in the gifted education programming in East Coast County Schools (a pseudonym). One perspective will be provided by a non-verbal identification instrument, another perspective will be provided by the non-verbal form or a well-established test of academic ability, and the third perspective will be provided by a science-oriented, classroom-based instructional program. Teachers of Grade Three and Grade Four and their students at a rural, low socio-economic, and diverse elementary school will participate in this three-month, school-based intervention to achieve proportional representation of Black and Hispanic students among those accepted into the gifted education program.

Fluorescence Sensing to Track Wastewater Inputs in Nearby Waterbodies

Dustin Eldreth

Engineering

Mentor: Natasha Bell

Wastewater inputs into waterbodies is something that we should be concerned about because of the pathogens that are put into the system. When people are exposed to these pathogens, they are at increased risk of developing certain illness. The objective of this study is to quantify potential wastewater inputs by monitoring and relating fluorescence of organic matter and fecal coliform bacteria concentrations. Tryptophan fluorescence will be monitored in-situ using a field fluorometer (Albillia, FL30) and compared with fecal coliform concentration (Idexx, Colilert). Turbidity and fluorescent organic matter (fDOM) will also be monitored in-situ (YSI, EXO2) for potential use in correcting tryptophan fluorescence to account for inner filter effects and high background fluorescence, respectively. Baseline data will be compared to data collected after rain events. Concentrations of E. coli, turbidity, and fluorescence are expected to be higher after rain events due to runoff into waterbodies and rising groundwater levels.

Research-based criteria for engineering and sustainability curriculum at science and nature centers.

Samantha Eubanks

Science Education MAED

Mentor: Tammy Lee

Informal education bolsters science learning in the classroom by offering experiences that connect students to the subject and create a framework for future learning. The importance of science education has come to the attention of many researchers and policy makers due to an increased need for science careers in the United States (Maltese, Melki & Wiebke, 2014). This combined with an influx of science illiteracy and science denial among the U.S. population has created an increased demand for specialized science education programming and training.

Informal learning opportunities, such as visits to museums, science centers, are needed to support classroom educators in the science field, particularly as it relates to Pre-K-12 engineering resources (Bagati, Yoon, Evangelou, Magana & Kaloustian, 2015). Exploratory research of the literature and survey responses relating to the needs of science educators may inform criteria for curriculum that can better support students' learning in the classroom and interest in the science fields.

Collaborative Genetics Case Studies Methods

Shayla Evans

Science Education MAED

Mentor: Tammy Lee

Case study teaching is a method where students study a case, typically a real world scenario, and have to use problem solving and critical thinking skills to solve the case or formulate a conclusion to satisfy the case. The case study teaching method is becoming a commonly used technique in science education (Bonney, 2015). This study will investigate how students use case studies to analyze karyotypes, demonstrate conceptual understanding of genetic disorders, and create real-world connections to the abstract topic of genetics. This study will be investigated through a mixed-method design. Students will be provided surveys about their demographics and their interest in genetic disorders. Students will also be given a pre and post assessment, created by the teacher, that cover questions regarding genetic disorders to scaffold their knowledge about genetic disorders. Students will also be given a questionnaire to better understand student's opinions and perceptions on genetic disorders. From this study, the proposed outcomes are that students are able to gain an understanding of genetic disorders, gain an appreciation of how genetic disorders can impact citizens in society, and have in depth discussions about genetic disorder. Hopefully, students will also be able to address any preconceived notions or misconceptions they have surrounding genetic disorders as well.

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Posttraumatic Stress Disorder Specific to the Coronavirus Pandemic: Risk and Protective Factors Among College Students

Tatum Feiler

Psychology

Mentor: Christyn Dolbier

There is minimal research examining the effects of infectious disease outbreaks on college student mental health, so it remains unclear if there are risk and protective factors unique to this group that relate to the development of post-traumatic stress disorder (PTSD). The objectives of this study are to: 1) determine the rate of positive screens for PTSD specific to the coronavirus pandemic in an undergraduate and graduate student sample; 2) determine which risk factors identified in previous research (e.g., higher actual or perceived risk of exposure) are associated with an increased rate of PTSD; and 3) determine which protective factors identified in previous research (e.g., social support) are associated with a decreased rate of PTSD. Participants are undergraduate and graduate students at a large southeastern public university. A sample of 2000 students was randomly selected and invited to participate. In order to achieve our target sample size of 400 students, additional participants were recruited from the university psychology department participant pool and emails to student organizations, advisors, program directors, and faculty. PTSD will be assessed with the 20-item PTSD Checklist for the DSM-5. Risk and protective factors will be assessed using the Stressful Life Events Screening Questionnaire, Brief COPE, PHQ-8, GAD-7, MOS Social Support Survey, UCLA Loneliness Scale, Lubben Social Network Scale, Brief Assessment of Family Functioning Scale, and items our team developed and sampled from other infectious disease outbreak studies. Psychology participant pool participants will earn research credit for participating and students enrolled in other courses will be entered into a gift card raffle. Data are being collected during the 2020 fall semester and will be analyzed during the 2021 spring semester. We anticipate that prior trauma experiences, greater actual and perceived risk, and longer duration of quarantine will pose a risk for developing PTSD during the COVID-19 pandemic.

The Quantification of Low Concentrations of Dissolved Lignin Derived Phenols in Estuarine and Coastal Water Samples

Kathleen Ferris

Chemistry

Mentor: Siddhartha Mitra

Lignin compounds are phenolic polymers which are found in vascular plants, as well as in soil and sedimentary organic matter and can be used as biochemical tracers when studying erosion and its deposit into estuary and oceanic waters. Lignin is known to be a substantial contributor to oxygen and carbon dioxide in the atmosphere, two greenhouse gases that contribute to climate change. Lignin can be deposited into these water sources through erosion and disturbance caused by strong storms, such as hurricanes. Previous methods for quantifying lignin in low concentrated water samples have used cupric oxide for the oxidation of the samples to extract the lignin for liquid-chromatography mass-spectrometry (LC-MS) analysis, but what about for gas-chromatography mass-spectrometry (GC-MS) analysis? Both methods thermally oxidize the lignin polymer to produce lignin derived phenolic monomers, yet a method has not been developed previously that yields an accurate quantification of lignin phenols through GC-MS. Through various method development phases, a method will yield an accurate and concise way of using cupric sulfate to oxidize low concentration water samples for GC-MS analysis. This new method would be revolutionary for not only the geochemical realm but also bring forth a method for other regions to quantify their samples for further investigation to greenhouse gas contribution to the change in climate on our planet, following natural disturbances.

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Analysis of Jogging Gait and Sprinting Gait in Marine Aviation Members

Cassonadra Fileccia

Biomechanics and Motor Control

Mentor: Patrick Rider

All marines are required to pass two physical fitness tests per year, which include various running requirements throughout. However, ground marines and aviation marines' daily tasks and levels of work place physical activity differ greatly. While ground marine units can perform regular running exercises, aviation marines are more often left responsible for their own fitness levels. People who run regularly as their form of exercise are prone to overuse injuries, and high ground reaction forces and joint loads can increase this injury risk (Kozinc, 2017; Knapik, 2015). Therefore, the purpose of this study was to analyze the running form of marine aviation members who are not required to run at work, but are still required to pass running portions of physical fitness testing for injury risk.

The participants for this study included 5 marine aviation mechanics who were relatively healthy with no current injuries. Each participant ran 30 yards for two trials in both a jogging condition and a sprinting condition. They were recorded using a tripod camera and video analysis was done using Kinovea. Measurements included foot inclination angle at initial contact, tibia angle at loading response, trunk lean during stance, peak knee flexion during stance, and hip extension during late stance. Results found all subjects had normal measurements and were classified as low injury risk recreational runners. There was one exception of a participant who had increased knee flexion (62°) and trunk flexion (32°), which reduces load on knees, but can lead to IT band syndrome (Souza, 2016; Novacheck, 1998; Aderem, 2015). Future research should compare ground marines and aviation marines to see how running more consistently at work affects gait injury risk.

Science as A Solo Act: The Advantages to Departmental Expertise

Jill Fischer

Science Education MAED

Mentor: Tammy Lee

Upper elementary science instruction in Wake County, North Carolina and Durham County, North Carolina does not provide the same types of classroom experiences in its schools; some schools offer departmentalized science instruction in all or some upper elementary classrooms, while others are self-contained with only one teacher for all subject. The purpose of this study is to determine the perspectives of both teachers and students regarding departmentalized science instruction in upper elementary grades. The study will take place as an online survey given to approximately 9 third, fourth, and fifth grade science teachers and approximately 270 fifth grade students in North Carolina. The decision to offer the survey to fifth grade students only is because by fifth grade many students have had some experience with departmentalized science instruction and will be able to make the comparisons between departmentalized science instruction and self-contained science instruction.

It is expected that students and teachers will understand the benefit to departmentalized science instruction to enhanced student achievement on the North Carolina End of Grade Test for 5th Grade Science.

"Be There," "Chill Out," & "Trust Me": Suggestions from Undergraduates to their Parents: A Qualitative Analysis

Mariella Florimonte

Public Health

Mentor: David Knox

Two-hundred and forty undergraduates at a mid-size southeastern university responded to a survey which included the open ended question: "If I could go back and change one thing that my mother/father did wrong in rearing me, I would want them to _____." Overwhelmingly, survey participants identified poor communication from both their mother and father as a problem they wish they could have changed growing up. Negative conflict management and unhealthy or inadequate communication resulting in some participants feeling unheard and overly criticized. They longed for having "better dialogue with parents instead of them just getting angry and only wanting me to agree." Structural-functionalism and symbolic interactionism were used as a theoretical frameworks to understand the qualitative data.

Perceptions of Vocational Rehabilitation Professionals on Order of Selection, Caseload Size and Closure, and Desired Policy Changes

Jessica Forys, Margaret Sanders

Rehabilitation and Career Counseling

Mentor: Susan Sherman

A national survey of state vocational rehabilitation (VR) agency personnel was conducted regarding order of selection (OOS), caseload size, their impact on caseload closure, and desired policy changes to aid caseload closure in the future. Results indicated that VR professionals did not view OOS as having a significant impact on VR outcomes or caseload closures. Smaller caseload sizes were viewed as more beneficial to providing effective VR services and meeting the administrative demands of VR agencies. Caseload closure was further perceived as linked to the quality of consumer-provided services. The desired policy changes presented by the VR professionals surveyed were focused on the management of caseload size and closure, consumer eligibility, administrative duties, and funding. Considerations for future VR research are described.

Keywords: caseload closure, caseload size, order of selection, vocational rehabilitation

Reaching Latino Farmworkers with On-site Screening for Diabetes and Hypertension

Brianna Foster

Nursing

Mentor: Elizabeth Mizelle

Background: In the United States, 29% of Latinos aged 20 or older are diagnosed with hypertension and 12.1% aged 18 or older have diabetes. American Latinos are also at higher risk of kidney failure caused by diabetes. These conditions increase their risk for other acute and chronic diseases, but their limited healthcare access can leave these issues undiagnosed and unmanaged. Considering global health threats, like the COVID-19 pandemic and global warming, safety standards and healthcare access for this population must be prioritized. The purpose of this study was to provide on-site screening to Latino farmworkers for diabetes mellitus and hypertension and determine whether a relationship exists between pre- and post-shift levels of glucosuria and proteinuria with environmental heat stress.

Methods: This study was part of a larger sequential exploratory mixed method, community-informed research design. In collaboration with staff at a federally qualified health center in eastern NC we recruited farmworkers from a six-county area and included a final convenience sample of 31 male, migrant, Latino farmworkers. Using COVID-19 safety precautions, pre-shift and post-shift clean catch urine specimens were collected on-site and glucosuria and proteinuria were measured using reagent strips. Environmental heat stress was measured using a heat stress monitor in the fields where these farmworkers labored. Non-parametric analyses were done using SPSS v 27.

Results: Sixteen percent of the farmworkers screened had trace or 1+ protein in their pre-shift specimen and 70% had trace, 1+, or 2+ protein in their post-shift specimen. There was a significant ($p > .01$) change in the proportion of proteinuria over a worked shift; however, there was no significant difference in the environmental heat stress measures of those with or without proteinuria. One participant had glucosuria; pre- and post-shift measurement readings were 4+, requiring immediate referral to the health center for assessment of possible disease.

Discussion: The incidence of post-shift proteinuria suggests concerns related to unhealthy workplace conditions, such as poor hydration and extreme environmental heat stress. As primary sources of health information, nurses serving this population could disseminate accurate Spanish/English literature on the importance of hydration, rest, and shade during extreme weather conditions to both farmworkers and employers to mitigate acute and chronic kidney disease.

Effectiveness of Technology Tools in the Classroom

Brittany Foster

Middle Grades Education

Mentor: Leonard Annetta

As technology becomes more advanced and less expensive, the rate at which it is being introduced to K-12 education is increasing with each passing year. Older materials, such as chalkboards, projectors, VCRs, and slide projectors are quickly being replaced by newer technology, including computers, software applications, the Internet, audio and visual conferencing, and even virtual reality and artificial intelligence. Technology is becoming a big business, with public schools in the U.S. spending over \$3 billion on digital content alone. With more and more new technology being piled on year after year, questions are being raised about how much this technology is helping both students and teachers. Instructors and pupils alike must be taught how to properly use each new tool that is presented to them, and teachers must find ways each year to alter their lessons and fit the technology in. Studies have shown that teachers are slow to adopt new technology due to barriers such as lack of curriculum to support the technology and the worn-down infrastructure of K-12 schools. When considering all of these challenges, one must wonder how much technology is actually making it easier for educators to teach and students to master the material. It is an indisputable fact that technology enhances student engagement, but does it actually help students learn? The purpose of this study is to first conduct a literature review to gather information about the effectiveness of technology in classrooms. Next, this study will analyze the opinions of both middle school teachers and students on the effectiveness of technology in their personal experiences. At the end of the study, the teacher and student opinions will be compared to the literature, and conclusions will be drawn about the effectiveness of different types of technology in education.

A systematic review of environmental circumstances for opioid use among youth and young adults: Setting a research agenda to inform opioid overdose prevention

Samantha Foster, Sophia Villani

Public Health

Mentor: Kathleen Egan

Nonmedical prescription opioid use is the highest among youth and young adults, and earlier initiation of prescription opioid use has been linked to subsequent heroin, another type of opioid, use. The social and physical environment in which opioid use occurs may impact the severity of consequences experienced by youth and young adults. The objective of our study was to identify contexts where opioid use among adolescents and young adults occurs by conducting a systematic review of published studies. Following PRISMA protocol, a search strategy was iteratively developed for use in the databases: PubMed (searched via legacy pubmed.gov using the advanced search), Embase, ProQuest Search, PsycINFO (searched via the EBSCOhost interface), and the Cochrane Central Register of Controlled Trials (searched via the Ovid interface). The studies singled out by the search string included environmental and situational variables (e.g., social events, parental monitoring, easy access, context) and dependent opioid use (fentanyl, painkillers, opioid analgesic). Studies were restricted to human subjects who were adolescents or young adults under 25 years of age. Four reviewers (KLE, SEF, SMV, MJC), who were blinded to the others' decisions, screened the titles and abstracts, and then conducted a full-text review using Covidence software. There were 11,775 records recovered and 2,936 duplicates were removed. A total of 8,839 articles were identified for title and abstract screening and 294 were retained for full-text review. Two studies were included in the qualitative analysis. Both articles discussed the social context of nonmedical opioid use and one of the studies examined the location. High school seniors were more likely to report nonmedical prescription opioid use by themselves, whereas, most college students reported use with their peers. Additionally, high school seniors were more likely to engage in this behavior at home compared to other locations. The findings from this systematic review illustrate the need for additional research on the social and physical environment in which opioid use occurs among youth and young adults to inform prevention and harm reduction initiatives aimed to reduce opioid use and related consequences. A more effective, place-based approach to the opioid epidemic will result in better health outcomes for people of all ages, chiefly youth health outcomes.

Acute High and Moderate Intensity Treadmill Exercise Increases Appetite and NPY/AgRP Neuron Activity in Untrained Female Mice

Katrina Free

Exercise Physiology

Mentor: Hu Huang

Background: Exercise is commonly prescribed as a means for weight loss, however, exercise programs frequently have mixed success rates. Recent studies have shown exercise intensities differentially modulate appetite and appetite-regulating neurons in the hypothalamus. Furthermore, these studies have primarily focused on the effects in male mice, and the effects in female mice are unknown. As a result, this study examines the effects of different acute treadmill exercise intensities on appetite regulation in female mice.

Methods: 11 8-week old untrained female mice participated in a randomized-crossover trial of sedentary (sitting on top of running treadmill), low (10 m/min), moderate (14 m/min), and high (18 m/min) intensity acute treadmill exercise. The mice were fasted for 10 hours prior to each trial with 7 days between trials. Food intakes were measured at 1, 2, 3, 6, 12, 24, and 48 hours after exercise. An additional cohort of mice were perfused with PBS and formalin 3 hours post-exercise, and brains were extracted. Immunohistochemical detection for cFOS was performed to determine changes in NPY/AgRP, POMC, TH, and SIM1 neuron activity in response to exercise.

Results: Compared to sedentary trials, cumulative 24-hour food intake was greater following moderate and high intensity exercise, predominantly due to increased food intake 6-12 hours post-exercise. These increases in food intake were associated with increases in activity of the orexigenic NPY/AgRP neuron population in the arcuate nucleus of the hypothalamus. Interestingly, no effects on appetite were observed in response to low intensity exercise.

Conclusion: These results indicate that higher exercise intensities increase 24 hour food intake post-exercise in female mice, possibly explaining the low success rates of exercise-focused weight loss programs. Low intensity exercise may be a useful exercise regimen due to the absence of compensatory increases in appetite.

Paid time off (PTO): Work stress as a potential moderator between workaholism and PTO usage

Natalie French

Industrial/Organizational Psychology

Mentor: Shahnaz Aziz

The aim of the current study was to examine the relationships between individual paid time off (PTO) usage and worker characteristics including, workaholism, work stress, and work engagement. Workaholism, the compulsive need to work excessively hard, is related to negative work and life outcomes such as burnout and work stress. In 2018, roughly 27% of all PTO in the US went unused. Hence, we sought to determine why employees forfeit PTO benefits, which may lead to more personalized benefit plans. Thus, self-report measures were used to ascertain whether work stress strengthened the relationship between workaholism and PTO usage. Participants were recruited through Amazon's MTurk, with the sample consisting of full-time US-based employees. The results supported previous research in that workaholism was positively related to work stress. The results also supported conflicting research stating that workaholism is positively related to work engagement. While no significant relationship was found between work stress, workaholism, and PTO usage, there was a positive correlation between work engagement and PTO usage. Organizational implications are discussed, as well as study limitations and avenues for future research.

Understanding the Impact of Non-Health System Supports on High-Need-High-Cost Patient Outcomes

Cecilia Frickle

Nursing

Mentor: Thompson Forbes

The cost of health care services provided to high need high cost (HNHC) patients is one-fifth of all health care spending even though they only account for 1 percent of patients (Hayes et al., 2016). To improve efficiency and outcomes for this population, Care Management Programs and Accountable Care Organizations (ACO) coordinate care for these patients. While CMPs have resulted in reduced spending for HNHC patients, there may be other factors outside the healthcare systems formal structures that influence the health of this population of patients. The purpose of this study is to understand the impact of non-health system programs and services on HNHC patients who are also participating in ACO care management programs.

The study is a descriptive qualitative design using semi-structured interviews to gather data. Participants in this study were selected using a purposive sampling strategy using Vidant Health risk scoring criteria to identify HNHC patients. To be included in this study, patients must have had a risk score of 5 or greater. They also must have participated in at least 2 care management services. They had to be 18 years of age or older and be English speaking. Patients with a cognitive diagnosis were excluded. Qualitative content analysis was used to analyze the data during the spring 2021 semester.

My analysis includes 4 participants. Preliminary findings suggest that patients recognize the health care and non-healthcare system supports that influence their health. Non-healthcare supports are described by two themes: Family Support and Finding a Distraction. Care management health system supports are supported by the themes: Relieving a Burden and Expressing Care. This suggests that having social support would benefit patient's health. Outside of the care management program family support was indicated as helpful to participant's illness. Implications for practice may include encouraging patients to find support systems that motivate them by showing they care about their health. Also, including family in care would be beneficial. It is anticipated that these findings and interventions would improve outcomes and decrease spending for HNHC patients.

What impact will utilizing mastery pathways have on the ability to differentiate instruction in a ninth grade physical science classroom?

Sandra Fugate

Science Education MAED

Mentor: Tammy Lee

This study looks at the impact mastery pathways, a new tool within Canvas, has on differentiating instruction for the unit on chemical bonding in a ninth grade physical science course. During this unit, students followed different pathways based upon their level of understanding of the types of chemical bonds and the nomenclature associated with each type. They worked through activities where they achieved 80% or higher proficiency before moving to the next activity. Students followed a unique pathway completing it at their own pace. *The study found that students who use mastery pathways receive instruction that is more differentiated over a traditional classroom setting. Mastery pathway provides students the opportunity to work at their own pace, to receive individualized instruction, and to work towards mastery on each topic. Students experienced a great deal of success and felt an overall sense of achievement. Using mastery pathways to differentiate instruction makes the classroom more student centered, improves student achievement, and improves student's attitudes towards learning.*

The Effectiveness of Family Caregiver Experiences with Validation Theory versus Reality Orientation (RO)

Cassidy Fuller

Nursing

Mentor: Donna Roberson

Introduction: Due to the increasing prevalence of dementia worldwide, it is imperative that all caregivers understand how to effectively communicate and care for people living with dementia. Most care provided to people living with dementia is provided without pay by family or friends. There is little in the literature about the experiences of family caregivers using reality orientation versus Validation Theory, that is, responding to the person living with dementia as if their perceptions were reality. With a better understanding of caregiver experiences, education can be developed to support more effective communication. Training caregivers to communicate in a way that is therapeutic and beneficial to the person with dementia (PWD) is essential to delivering adequate care.

Purpose: The purpose of this study was to use qualitative inquiry to explore family caregiver experiences who use reality reorientation in an attempt to diffuse a situation versus using validation techniques.

Methodology: Following IRB approval, a qualitative inquiry was conducted. The sample was comprised of family caregivers of a PWD in attendance at a virtual community caregiver training event. The participant must have spoken English, been currently caring for a person living with dementia and must have been able to provide informed consent.

Data Analysis: Both the researcher and faculty mentor read the transcripts literally and in entirety, first to get an idea of the conversations and then re-read to mark comments thought to be related to pertinent family caregiver experiences. After individual review, the team met to arrive at consensus on the themes noted throughout each interview.

Results: The analysis of the transcripts found that frustration with reality orientation could escalate conflict between family caregiver and their person living with dementia. Participants who accepted the person in the time and place they thought they were in had more peaceful interactions and decreased stress in communication.

Conclusion: This research project supplied a unique look into two different communication strategies and encouraged participants to discuss the effectiveness of each one side-by-side. It highlighted the communication dilemmas faced by many caregivers. Many would agree that good communication is at the heart of providing effective care. The present work offers insight into effective communication techniques, as experienced by caregivers of people living with dementia.

FROM PROFESSIONAL DEVELOPMENT TO PROFESSIONAL LEARNING: A PERSONALIZED APPROACH TO PROFESSIONAL LEARNING FOR TEACHERS IN RURAL NORTHEASTERN NORTH CAROLINA

Abbey Futrell

Educational Leadership

Mentor: Travis Lewis

Improvement of teacher quality has been identified as a strong factor for improving student learning and increasing student achievement. Developing teacher knowledge and pedagogy is traditionally cultivated in schools through professional development. Though professional learning is common in all schools as a core practice, the design, quality, and results of the learning are unequal and inconsistent. Common practices such as lectured presentations, "sit and get" sessions, and brief "one-size-fits-all" workshops continue to be the most prevalent professional development methods used in schools. These common professional development methods facilitate neither a change in teacher behavior nor an improvement in student performance.

As a best practice, teachers require ongoing, personalized professional development that is designed and aligned with the tenets of effective andragogy, in order for learning to be retained and transferred to the classroom. However, there exists a disconnect between professional development practices and the effective transfer of assumed learning to the classroom to improve teaching practices. Only subsequent to this transference will changes in teaching and learning occur.

In this study, a qualitative research design was used to determine whether personalizing professional development results in a positive change in teacher perception of professional learning. Using a model for personalized learning, this study found that implementation of such a model resulted in positive changes in teacher instructional practices and attitudes towards professional learning.

Toxic Metal Interactions with EF-hand Proteins: Thermodynamic and Thiol Characterization of Ca(II) and Cd(II) Binding to the N-domain of Human Cardiac Troponin C

Amanda Fyle

Chemistry

Mentor: Anne Spuches

Calcium binding proteins contribute to all aspects of cellular function. Human Cardiac Troponin C (hcTnC) is part of the EF-hand family of calcium binding proteins that plays a crucial role in regulating heart muscle contraction and relaxation. The binding of Ca(II) to the N-domain of the protein induces a conformational change that allows for subsequent protein interactions that trigger heart muscle contraction. Interestingly, it has been shown in the literature that other heavy divalent metals such as Cadmium, Cd(II), and lead, Pb(II) can mimic calcium binding to hcTnC, in turn causing metal toxicity. The overall goal of the Spuches lab is to fully characterize Cd(II) and Pb(II) binding to hcTnC and learn how these metals impact subsequent protein interactions. While recent data obtained in the Spuches lab reveal that 3 Cd(II) ions bind to hcTnC and that one of these ions is bound to the N-domain as is the case with Ca(II), the exact location and identity of ligands is not known. Because Cd(II) has an affinity for thiol containing ligands, we would like to probe the possibility of Cd(II) binding to one or both cysteine residues present in positions 35 and 84 in the protein. We have shown by native gel that our protein does not form dimers due to the potential formation of disulfide bridges between proteins, and DTNB analysis of our apo-protein reveals that these cysteine residues are reduced and available for binding. DTNB analysis of protein bound to Ca(II) should also reveal the presence of reduced thiols as Ca(II) is known not to bind to these Cysteine residues, however it remains to be seen if Cd(II) will produce similar results. Data obtained from these studies will provide us with a deeper understanding of Cd(II) binding to EF-hand proteins. We hope to extend these studies to Pb(II) in the future.

Chronic nutrient enrichment alters the functional role of the soil microbiome in a coastal plain wetland

Aied Garcia

Biology

Mentor: Ariane Peralta

The introduction of nonpoint sources of fertilization can change the functional roles of microbes. These changes could alter nutrient cycling as well as beneficial relationships between microbes and plants. The microbes in bulk soils play important roles in nutrient cycles and can affect how an ecosystem functions. The soil microbiome acts as a microbial seedbank from which plants can recruit mutualistic microbes. For example, some plant root-associated microbes are known to improve plant uptake of critical nutrients (e.g., nitrogen, phosphorus). In this study, we ask the question: how does chronic nutrient enrichment of a historically low nutrient wetland alter the culturable soil microbiome? We hypothesize that there has been a loss of functional traits in fertilized soils compared to unfertilized soils that will result in more competitive plant-microbe interactions. In order to test this hypothesis, we collected bulk soil samples from a coastal plain wetland located at East Carolina University's West Research Campus. This ecological experiment was established in 2003 to examine how nutrient additions (N-K-P fertilizers) and human disturbances (mowing) affect the structure and function of plant and microbial communities. For this study, we cultured soil bacterial isolates (in mowed plots from different nutrient enrichment histories) on minimal growth media and measured phylogenetic relationships within and between bacteria from fertilized compared to unfertilized conditions. The increased availability of nutrients would allow once nutrient deprived microbes to become present. Studying the phylogenetic history of these taxa could show changes in traits (i.e. colony size) that would be indicative of a more competitive environment. For example, if comparing related bacterial taxa, a small sized cell will grow faster and might outcompete a larger cell. Results reveal differences in biochemical tests related to nutrient and carbon metabolism for a subset of bacterial isolates from fertilized compared to unfertilized soils. In addition, the colony size of the isolates in fertilized soils were relatively smaller than those in unfertilized soils. This ongoing work indicates that the addition of nutrients at this wetland site is modifying microbial traits (related to growth) of the cultured soil bacteria.

X-Ray Source Characterization for Optically Stimulated Luminescence

Christopher Garcia

Biomedical Physics

Mentor: Regina DeWitt

Optically stimulated luminescence (OSL) is a method used to determine the amount of radiation dose that has been absorbed by a sediment or rock sample when exposed to radioactive elements commonly found in the earth. This dose is released by the sample when it is exposed to sunlight, allowing OSL to be used to date the last sunlight exposure of sediments and rocks. In-lab irradiation is required for calibration purposes when using OSL to date these samples. A beta irradiation source such as $^{90}\text{Sr}/^{90}\text{Y}$ is usually used to irradiate the sample and mimic the naturally occurring radiation. Recently, attempts have been made to create a new, more mobile method of irradiating samples using a portable 50kV X-ray source. Experiments and results that characterize the output of the X-ray source will be presented.

The 50kV Magnum[®] X-ray tube was calibrated for irradiation spot size and energy profile using a radiation sensitive film and an X-ray detector. A series of measurements was taken with the radio-film at varying irradiation distances and with varying filters in front of the X-ray source to measure the spot size, emission angle, and intensity change. Another series of measurements was taken with an x-ray detector and varying filters to measure the energy spectrum of the X-ray source and how it changes depending on filter type.

Sugar Pills? Utilizing liquid chromatography-tandem mass spectrometry for an in-depth look at Humphreys' Homeopathic Specifics

Bronte' Gerber

Clinical Laboratory Science

Mentor: Eli Hvastkovs

Frederick K. Humphreys founded the Humphreys' Homeopathic Medicine Company during the rise in acceptance and popularity of homeopathy in the United States, rivaling that of orthodox medicine. Generally, homeopathy sought to individualize each treatment while allopathy followed the scientific trends of the period, leading to a lack of standardized principles. The relatively high cost and low success rate of allopathy furthered the popularity of homeopathic medicine, despite the claims of false advertisements and criticisms found scattered throughout a slew of patient success stories. In order to determine the validity of Humphreys' treatments, which were marketed by specific illness (i.e., Piles, Diarrhea, Diphtheria, etc.), the components of each were identified using mass spectrometry (MS) techniques.

Tandem mass spectrometry analysis (MS/MS) was used to pinpoint similarities in the ingredients of four "specifics" sold by Humphreys' company. Following the preparation of the samples in an environment that mimicked stomach acid, positive ion mode MS was used to acquire initial base peak ions and identify the unknown components. The spectra showed similar base peak ions for each pill, leading to the hypothesis that all four samples contained the same basic ingredients. Further MS/MS analyses identified these base peak ions as adduct peaks of sucrose, its related ions, and apigenin in each of the advertised remedies analyzed. Overall, through the analysis of Humphreys' Specifics, when combined with historical context, a more complete framework of homeopathy could be formed to scientifically contextualize the popularity and rise of this alternative regimen during the late 19th century.

Characterization of the maize floral development mutant, *Polytypic 1*

Leasia Glover

Biology

Mentor: Beth Thompson

Flowers are important to us because they provide edible seed-bearing structures called fruits as well as the beautiful bouquets, we give to loved ones. In maize, male and female flowers are formed on distinct inflorescences. The tassel makes long branch-like structures that allow the anthers to come out and shed pollen at maturity. Ears are a single spike of vertically arranged spikelet pairs that form the cob. Hair-like silks develop as the stigma (pollen catcher). All maize flowers (florets) produce two bract-like structures, the lemma and palea, two lodicules, three stamens, and three carpels, two of them fuse to make silk. Stamens arrest in the ear and carpels abort in the tassel. To understand normal floral development, we study mutants that don't make normal flowers. *Polytypic1* (*Pt1*) is a semi-dominant mutant that affects multiple aspects of floral development. The overarching goal of my project is to use positional cloning to identify the gene responsible for the *Pt1* phenotype. Previous work mapped *Pt1* to a 5.3 Mb region on chromosome 6 between markers phi129 and umc1352a. RNA-seq indicated that three genes in the interval are up-regulated in the *Pt1* mutants compared to the wild-type and are currently our top three candidate genes. To further narrow down the *Pt1*-containing interval and potentially eliminate one or more candidate genes, I'm choosing to continue fine mapping. Currently, I am screening for recombinants, which I will test with markers in the *Pt1*-containing interval. By narrowing the *Pt1* interval, I will identify a high confidence candidate gene for evaluation.

Intraguild predation and trophic transfer drive parasite transmission dynamics in mixed larval dragonfly communities

Sarah Goodnight

Interdisciplinary Biological Science

Mentor: Michael McCoy

Intraguild predation (IGP) occurs when consumers that share a resource also consume one another. IGP is common in ecological communities and can significantly influence the structure and dynamics of parasite populations. Cannibalistic anisopteran (dragonfly) nymphs exhibit high rates of IGP, and are parasitized by a variety of macroparasites with diverse life history strategies; thus, they are an ideal model system for examining how IGP in mixed communities affects parasite transmission and survival. Intermediate rates of IGP in mixed communities may be beneficial for macroparasites that exploit trophic transfer as a transmission mechanism, or have free-living life stages that are consumed by predators. Freshwater mesocosms ($n = 36$) were constructed to test the effects of IGP in Eastern Pondhawk (*E. simplicicollis*) dragonfly host communities on two parasites' prevalence and abundance (*Halipegus* and *Haematoloechus* spp. trematodes, respectively), in one mixed- and two single-parasite scenarios. I crossed my three parasite treatments with both High and Low IGP treatments, created using size-structured dragonfly cohorts (High IGP) and non-size-structured cohorts (Low IGP), as dragonflies of different sizes consume each other at much higher rates than similarly-sized dragonflies. Indeed, at the end of the experiment I recovered over twice as many nymphs from Low IGP treatments ($\mu=17.72$) versus High IGP treatments ($\mu=8.72$) on average. All individual dragonflies will be dissected separately to quantify individual parasite load as well as overall parasite survival. I expect IGP rate in the dragonfly host community to significantly influence both parasite survival as well as per capita prevalence. Parasites are important members of consumer communities and utilize a combination of shared prey, IG prey, and IG predators as hosts, thus I propose that IGP is a critical mechanism behind some parasites' life history strategies and population structure.

Investigating the role of TER94 in *Drosophila melanogaster* germ cells

Alyssa Gowdy

Biology

Mentor: Elizabeth Ables

Mutations in Valosin-Containing Protein (VCP) can lead to onset of Amyotrophic Lateral Sclerosis, a fatal neurodegenerative disease; however, the intracellular functions of VCP in cells remain unclear. To study the intracellular role of VCP in greater detail, this study utilized the model system *Drosophila melanogaster* to test the function of VCP in maintenance of the endoplasmic reticulum. Specifically, we evaluated the role of the *Drosophila* protein TER94 (an ortholog of VCP) in ovarian germ cells, which requires a prominent endoplasmic reticulum-like organelle called the fusome for proper cell division. We show that TER94 localizes to the endoplasmic reticulum and golgi in germ cells; however, Tnpo-SR, an intracellular transport protein, is not needed to achieve localization. Based on these results, our current studies investigate whether TER94 is needed for fusome/endoplasmic reticulum development and Golgi biogenesis. Our future studies will determine when TER94 levels are reduced, if germ cells continue to divide. By demonstrating the function of TER94 in *Drosophila* germ cells, we may begin to understand the function of VCP in humans, and its involvement in human disease.

Investigating the influence of framing techniques on self-efficacy, other-efficacy, and anticipated affect in an online fitness setting

Rachel Grantham

Sport and Exercise Psychology

Mentor: Christine Habeeb

Physical inactivity is a national issue, with over 75% of Americans being insufficiently active (Leavitt, 2008). This issue has resulted in a large body of literature focused on exercise behavior. One of the commonly studied variables in exercise literature is self-efficacy. Self-efficacy has been shown to have a strong and consistent positive relationship with exercise behavior (Samson & Solmon, 2011). Additionally, self-efficacy has been shown to be related to affective outcomes of exercise as well such as enjoyment (Joseph et al., 2014). However, much of this literature has focused on the individual exercise setting. Given the popularity of instructor based fitness, such as group fitness and personal training (Thompson, 2019), it is also pertinent to examine other-efficacy. Other-efficacy has been shown to be positively associated with self-efficacy (Jackson & Beauchamp, 2010) and affective response (Martin Ginis et al., 2006). Outside of the exercise field, evidence indicates that framing an activity for enjoyment rather than work results in increased self-regulation and makes tasks easier (Laran & Janiszewski, 2011). The purpose of this study is to examine the extent to which an online fitness instructor with an enjoyment focus versus a work focus framed message will impact exercisers' self-efficacy, other-efficacy, and anticipated affect among college aged females. Data will be collected from undergraduate students at ECU that are not pursuing a degree within the Kinesiology department via an online survey. This presentation will report on the female participants' results of the larger study. Participants will first complete a demographic section, including current exercise levels. They will then watch either a fun framed or a work framed excerpt from a workout video. After watching the first video, the participant will complete self-efficacy, other-efficacy, and anticipated affect measures. The participant will then watch the other of the two videos and respond to the same self-efficacy, other-efficacy, and anticipated affect measures a second time. Descriptive statistics will be used to describe the sample. Correlations will be used to examine the relationships between variables. A MANOVA will be used to test for mean differences between exercise framing and self-efficacy, other-efficacy, and anticipated affect. Results from this study will better inform fitness instructor motivation techniques and physical activity promotion.

The Symbolic Connection of Spiritual, Prophetic , and Ancestral dreams: Dreaming of Fish

Karena Graves

Sculpture

Mentor: Hanna Jubran

Dreams as defined by the Oxford dictionary are "A series of thoughts, images, and sensations occurring in a person's mind during sleep". In my family dreams can have spiritual meanings, ancestral/familial and prophetic connections to lived reality. There is some research that this symbolic relationship to dreaming is common among African American families as well. I propose to continue researching this commonality in depth while first examining my own familial dreams of fishing experiences that have prophesied the pregnancy of close relatives. I aim to investigate this idea by creating a series of sculptures. These sculptures will be representations and constructions of the pregnant body and fish form using found and manipulated materials.

Bands on the Book- Themes Found in a Facebook Laparoscopic Adjustable Gastric Band Support Group

Lindsay Gribble

Nursing

Mentor: Janice Neil

Bariatric surgery is a tool used when comorbidities and excess weight negatively impact the health of a patient. While there are several different bariatric procedures, the focus for this study are patients who had the laparoscopic adjustable gastric banding (LAGB), commonly known as the Lap Band® procedure. This study examined a group on the social media format Facebook, the "Lapband Support Group" where members use the platform to communicate and offer support throughout their journeys. A literature review revealed common themes seen in this population and these were compared to posts found on the support group page. An IRB was obtained, and permission was given by the administrators of the group to monitor posts for three months. The posts from the members of the group were collected and analyzed for common themes and concepts. The research question that drove this study is, "What are the responses and themes found in a Facebook Lap Band support group of bariatric surgery patients"? The analysis was done with a team using Colazzi's method. The concepts revealed were, "Fill fluctuations and frustrations", "Life with a band", and "Community collaboration". These themes can drive a discussion about the journey bariatric patients face and how it impacts them mentally and physically. These findings can also be used by nurses and providers to offer patient specific care for all bariatric patients. They may be able to promote better use of social media platforms to reach patients and support them post operatively.

A Neuropsychological Profile of College Students with ADHD

William Guiler

Multidisciplinary Studies

Mentor: Christyn Dolbier

Introduction: Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by a persistent pattern of inattention and/or hyperactivity and impulsivity resulting in significant impairment in multiple settings. Large scale studies have found that between 50% and 80% of those diagnosed with ADHD as a child have symptoms that continue into adolescence, and in about 40%, symptoms continue well into adulthood. This poor prognosis makes it imperative that adult ADHD becomes better understood at the neuropsychological level so novel therapies can be established and used as an alternative to or in conjunction with psychiatric medication.

Aims: My first research question concerns the neuropsychological abilities of college students with ADHD. How do neuropsychological abilities of college students with ADHD compare to those of college students without ADHD? My second research question focuses on how adult ADHD is diagnosed using various measures. How do scores on three of the most used measures of ADHD compare across groups?

Methods: Students (N=454) were recruited from two primary sources including introductory psychology classes and from Disability Support Services across the Fall semester of 2020. The average age of participants was 19.02, with the majority being female (69.38%), Caucasian (75.33%), and freshman (75.55%). The study was broken down into two phases. Participants were first asked to complete a Qualtrics survey (i.e., Phase One) covering psychological symptomatology (e.g., ADHD, major depressive disorder, generalized anxiety disorder) and a qualitative assessment on the ADHD student experience. Phase Two of the study involved an evaluation of neuropsychological functioning and ADHD symptom severity.

Results: Comparisons of each neuropsychological domain between groups will be conducted using Multivariate analysis of variance (MANOVA). To analyze the three diagnostic measures, the prevalence of positive screens across groups will be compared.

Conclusion: Results from this study will allow for more consistent, accurate diagnostic practices of Adult ADHD as well as providing the framework for the creation of targeted interventions to address neuropsychological deficits.

Fundamental Social Motives and Their Effect on Food Selection in Undergraduate Psychology Students

Kinsley Hagans

Psychology

Mentor: Michael Baker

Social motives affect multiple aspects of our daily lives with and without conscious awareness of these effects. Fundamental social motives play an important role in impacting how people think, make decisions and act. This research was designed to investigate how situational factors and fundamental social motives interact to affect food selection via an in-person experiment. Participants in this research were randomly assigned to complete the experiment in the presence of a same or opposite sex partner. Based on whether they were assigned to a "public" or "private" condition, they either disclosed to their partner what they would order at a restaurant, or they kept this information private by reporting the same information via a confidential form on their computer instead of to their partner. Following the food selection task, participants completed a series of questionnaires designed to measure social motives and tendencies to respond in particular ways during social interactions. Finally, they were asked to rate their partner based on factors such as friendliness and attractiveness. It was predicted that opposite-sex partners who are primarily or exclusively heterosexual and not involved in a committed romantic relationship will order fewer calorie meals in the presence of an opposite sex partner who they deem to be more attractive. Meal choices of heterosexual same-sex partners are not expected to be influenced by perceptions of partners.

Copper in FtrA

Jonathan Hall

Chemistry

Mentor: Sambuddha Banejee

FtrABCD is a proposed ferroxidase dependent Iron(II) uptake system. The ferroxidase in this system has yet to be identified, and is still debated. FtrA and FtrB are both soluble components of this system, and both have the conserved residues necessary to be classified as a ferroxidase. This has been shown through work in bioinformatics. Previous experiments conducted by our lab group have shown that FtrA does successfully bind to an Iron(II) mimic - Manganese(II) - and is dependent on Copper(II) in order for this binding to occur. As Zinc(II) is a biologically relevant metal, there is a high concentration of Zinc(II) in the natural niche of *Bruceella spp.* and is in many cases a mimic of Copper(II), I investigated if Zinc(II) could bind to FtrA, if it could replace/be replaced by Copper(II), and if Iron(II) binding would be affected by Zinc(II). It was proposed that since Zinc does not have redox activity, that binding this metal would inactivate the ferroxidase property if FtrA was identified as the ferroxidase. I showed that Zinc(II) does successfully bind to FtrA, with a ten-fold greater affinity, and that Iron(II) binding is ceased, even when the FtrA is simultaneously bound to Copper(II).

Identifying Nursing Home Resident Characteristics as Factors in Pressure Injury Development

Kelsey Halvorsen

Nursing

Mentor: Susan Kennerly

Pressure Injuries (Prl) occur primarily on the body's bony prominences and can often be prevented. Nursing home (NH) residents with challenges in mobility, activity, nutrition, moisture, sensory perception, and friction and shear are especially at risk for Prl development. NH residents represent a diverse population with various ages, heights, weights, BMIs, races, gender, and Braden Total Scores making implementation of Prl prevention protocols challenging. The Braden Scale is a tool used to assess a person's risk for developing a Prl. This study examined the characteristics of those residents who developed a Prl at 9 different NHs.

Data for this retrospective descriptive exploratory study were drawn from an existing R01 study (NIH R01NR016001; ClinicalTrials.gov: NCT02996331) (Turn Everyone and Move for Ulcer Prevention (TEAM-UP)). Basic descriptive statistics were calculated for the following characteristics: gender, age, race, height, weight, and Braden Total Score based on electronic health record data extraction.

The Prl incidence for the TEAM-UP project residents in the 12-month Baseline was (7.3% overall; 104/1425) with 23% obese and 77% non-obese (Underweight, Normal Weight, Overweight). Residents with Prls were most often of Normal Weight (n=45, 43.3%) with 18.3% (19) Underweight, 15.4% (16) Overweight, and 23% (24) Obese. Residents with a Prl were predominantly female (70.2%), had a mean age of 78.3 years (SD=12.7), and 54.8%% were white, 41.3% Black, and 2.9% unknown race. Overall resident characteristics will be presented in relation to BMI categories and Braden Total risk score.

The incidence of Prls varied significantly by BMI, race, ethnicity, and gender. However, further research is necessary to definitively identify which characteristics serve as causative factors for Prl development.

Windows into the Body: An Introspective of Health Psychology and Consequential Artificial Replacements

Nicholas Hesson

Metal Design

Mentor: Mi-Sook Hur

Our health is a top priority. In the world we live it is easy to push our health needs aside. This presentation will address parts of one's health that are unseen and often taken for granted. Medical research shows that people suffer and die from curable illnesses due to self-neglect and lack of access to medical treatment. My wearable enameled artwork examines the human anatomy, and the lack of awareness people have about their bodies. I reference imagery drawn from surgical operations, medical equipment, and medical illustrations. I highlight the internal elements of the body by exploring these forms. I want the viewers to appreciate their bodies and the importance of taking care of them.

A Systematic Review On Parental Vaccine Hesitancy Related To The Administration Of Human Papilloma Virus Vaccine To Adolescent Girls

Sydney Hewett

Public Health

Mentor: Sheena Eagan

Despite evidence of the significant individual and community benefit of vaccinations, vaccine hesitancy is an ongoing obstacle for both health care providers and public health professionals. Vaccine hesitancy is often informed by religious and social ideologies, as well as debunked studies and misinformation. The impact of these ideologies is particularly true in the case of Human Papillomavirus (HPV). As a sexually transmitted infection, this hesitancy is tightly bound to socially constructed ideas of sexuality and gender. This is particularly true in the case of parental hesitancy for adolescent patients. In order to promote vaccination in this population, it is critical to understand the beliefs and ideologies informing this hesitation to vaccinate adolescents. Research has shown that reasons for parental hesitancy and refusal can vary based on demographics such as: location, religion, socio-economic status, and education-level, among others. Within this growing literature, the majority of studies have focused on urban areas with limited attention focused on rural areas. This systematic review examines parental vaccine hesitancy in rural populations considering the HPV vaccine.

Culturally Responsive Community Palliative Care

Sarah Hoffman, Marianne Congema

Nursing

Mentor: Kim Larson

Early integration of palliative care after a diagnosis of cancer improves outcomes, yet such care for Latinx populations is lacking in rural regions of the country. We used a participatory action research design with Latinx community leaders from emerging immigrant communities in North Carolina to explore sociocultural perspectives on cancer and death. Thematic analysis was conceptualized as *Four Kinds of Hard* represented by four themes: Receiving an Eviction Notice, Getting in the Good Book, Talking is (Sometimes) Taboo, and Seeing Their Pain Makes Us Suffer. These themes captured fears of deportation, coping with cancer through faithfulness, ambivalence about advance care planning, and a desire to spare families from suffering. Findings suggest strategies to improve conversations about end-of-life wishes when facing advanced illness and death. This study demonstrates the importance of training Latinx community leaders to improve palliative care and bridge service gaps for Latinx families living in emerging rural communities.

Development of a Low-Cost Water Level Sensor Assembly

Billy Holloman

Engineering

Mentor: James Etheridge

Commercially available water level sensors typically have prices that range from several hundred to a few thousand dollars. Cost is often a factor that limits collection of water level data that could inform management practices, engineering design, and policy. For example, an increased quantity and density of water level sensors in eastern North Carolina would give federal and state organizations better data of the regional hydrologic conditions to inform models used to simulate flooding from extreme events such as hurricanes. Having more affordable technology could encourage the deployment of these types of sensors, allowing more informed decisions to be made.

Ease of customization and maintenance are other factors in the deployment of water level sensing devices. Commercial water level sensors are often made for one particular deployment scenario, which can limit the number of features that can be added to a particular assembly. Also, commercial sensor assemblies are typically made in such a way where replacing malfunctioning components is essentially impossible. Designing a sensor in such a way where consumers can easily interface with the sensor's components while also allowing parts to be replaced seamlessly could be another way to encourage the deployment of these types of sensors.

The purpose of this project is to design and implement a water level sensor assembly with costs less than \$200 and simple maintenance and customization. The sensor assembly needs to be able to reliably measure and store water level data at a consistent time interval. A microcontroller will be used to store the water level data along with determining when a measurement should be recorded. A waterproof housing for the low-cost sensor assembly will also need to be developed. This presentation will summarize the research and development process for the low-cost water level sensor assembly.

An Uncharacterized Exopolysaccharide is Linked to the Virulence of *Brucella abortus*

Dariel Hoppersberger

Microbiology and Immunology

Mentor: Roy Roop

Brucella abortus is an intracellular pathogen that causes spontaneous abortion in cattle and undulant fever in humans. To facilitate evasion of the host immune system, *B. abortus* colonizes macrophages and replicates within these cells; thus, the capacity of *B. abortus* to survive within the host relies on its ability to successfully infect macrophages. As a member of the α -proteobacteria, *B. abortus* is closely related to the bacterial species *Caulobacter crescentus* and *Agrobacterium tumefaciens*, which have been shown to produce a holdfast and unipolar polysaccharide (UPP), respectively. In both cases, a polysaccharide is generated at one pole of the bacterial cell and aids in its attachment to solid surfaces. While *Brucella* is known to produce exopolysaccharides (EPS), the function of these EPSs remains largely undetermined. Genes homologous to the *Agrobacterium* UPP biosynthesis genes have been identified in *B. abortus* 2308 and these genes can restore UPP production in *Agrobacterium upp* mutants. Moreover, production of a unipolar polysaccharide that reacts with the same lectin that recognizes the *Agrobacterium* UPP has recently been observed in *B. abortus* 2308. A mutant derived from this strain lacking two of the putative *upp* biosynthesis genes, *uppC* and *uppE*, exhibits significant attenuation in mice and an altered intracellular replication profile in cultured murine macrophages. Studies are underway to determine if the uncharacterized EPS produced by the *Brucella upp* genes is an authentic UPP and define the mechanism(s) by which this EPS contributes to virulence.

Generation Gap: A Study of the Views on Video Learning by Students and How Teachers Can Adapt

Tara Hulseley

Science Education MAED

Mentor: Tammy Lee

Teachers and students may not have the same views on using videos for learning, and teachers might not be aware of students' perspective. Videos have long been a staple of classroom education, but videos have also become a staple of students' everyday lives outside of school. The current generation of students have been living in a video-soaked world, and so may not appreciate classroom videos in the same way current teachers did when they were students. This difference may be causing teachers to believe that students love learning through classroom videos when they might not.

Though videos are often used in the classroom for a variety of reasons, they may not be as effective and enjoyable to their students as teachers imagine them to be. This study will survey students to find out what their preferences of and for videos in the classroom. Students will be furthered asked to provide details on what they do and do not like when watching videos to learn. Using that information, videos will be chosen that meet the criteria that students provide and will be tested on the students. Finally, the survey will be readministered, and the students will give feedback on the videos and if they changed their perspective of video use in the classroom.

Genre Arts and Society

Katya Hutchinson

Printmaking

Mentor: Heather Muise

Drawing upon the tradition of speculative fiction and influenced by the recent surge of Science Fiction themes in contemporary entertainment, my creative research explores re-imagining the isolation of recent quarantines through the filter of fiction. I am specifically driven by the covers of Pulp and Golden Age Science Fiction and Retro-Futurist imagery and palettes. More than mere escapism, the fantastical façade of Science Fiction and other genre arts can reflect public fears and anxieties and inform public opinion as well as influencing social constructs.

The effects of resiliency and compassion fatigue on student's burnout: A systematic literature review

Hailey Hutto

Nursing

Mentor: Robin Corbett

Background: Burnout is a significant psychological issue affecting the nursing profession, including clinical nurses and nursing students. As nursing students prepare for their clinical careers, they may learn negative patterns to deal with stress.

Purpose: To examine the influence of compassion fatigue and burnout on students' health and academic performance and recommend areas to promote students' resilience characteristics.

Methods: This systematic literature review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The databases searched include MEDLINE via PubMed, CINAHL, PsycINFO, and Scopus.

Results: Seventeen articles were found using the inclusion criteria. Each article was appraised by the 2018 version of the Mixed Methods Appraisal Tool (MMAT) to assess its quality. Two major themes surfaced: the negative influence of compassion fatigue and strategies to promote resilience characteristics and reduce burnout. The literature indicated that it is effective for nursing programs to include preventive strategies in nursing curricula to enhance student resilience and mindfulness to reduce educational, physical, and psychological stressors.

Conclusion: Nurse educators play a vital role in reducing students' burnout symptoms and promoting their current and future well-being. The findings indicate that it is essential for faculties to exemplify and influence students' resilience and mindfulness, which may reduce students' burnout and compassion fatigue. More research is needed to identify specific ways to enrich the educational environment for the nursing students.

Keywords: Burnout, nursing students, resiliency, mindfulness, compassion fatigue, nurse educators

Tough and Viscoelastic Hydrogel Composites for Articular Cartilage Repair

Mohammed Islam

Engineering

Mentor: Michelle Oyen

Articular cartilage is a thin connective tissue covering the ends of bones. It provides aqueous lubrication, supports load up to body weight, and dissipates energy to facilitate joint movement. Cartilage injury leads to permanent loss of these mechanical functions since cartilage has limited self-healing capabilities. Hydrogel-based tissue engineering is a potential strategy for treating cartilage injury. However, existing hydrogels lack an optimal combination of mechanical strength and energy dissipation ability to serve as a load-bearing cartilage replacement. In this work, a novel composite hydrogel consisting of polyvinyl alcohol (PVA) and agar is developed for cartilage tissue engineering. The composite gels are fully physically cross-linked and biocompatible as-synthesized using the freeze-thawing method without any toxic chemical agent. Systematic mechanical testing and infrared spectroscopy have been used to characterize the physical and mechanical properties of the hydrogels. The hybrid PVA-agar hydrogels exhibit synergistically increased tensile strength and fracture toughness compared to the individual gel components. The prepared hydrogels can sustain large and cyclic compression loading without significant permanent deformation. With the increase in agar content, the composite gels become more viscous and demonstrate pronounced time-dependent load-relaxation. Together, these properties make PVA-agar hydrogels excellent biomaterials for damaged cartilage repair.

Climate change and multiple stressors in marine environments: A meta-analysis and modeling study of interactions between ocean acidification and changing seasonality

Danielle Jackson

Biology

Mentor: Rebecca Asch

Anthropogenic activity has caused an increase in atmospheric CO₂, shifting the equilibrium of marine carbonate chemistry and decreasing oceanic pH. This process, ocean acidification (OA), has the potential to negatively impact the development of sensitive early life stages of many marine organisms by reducing calcification rates and increasing mortality. Warming temperatures associated with climate change have also influenced the life events of marine organisms, such as spawning and migration, since many organisms rely on environmental triggers, such as water temperature or solar irradiance, to initiate these events. As climate change impacts both seawater pH and phenology (i.e., the timing of life history events), there is a potential for interactions between the two. Organisms have evolved seasonal behavior to optimize the success of their offspring based on oceanic conditions, such as seasonal pH cycles, as well as food availability for offspring and the presence of predators. Little research has been done on the potential interactions between impacts of OA and shifting phenology on marine organisms, raising the question as whether changes in reproductive phenology might place sensitive early life stages in lower pH waters than they would have been exposed to otherwise. This meta-analysis sheds light on the overlap and gaps in the literature on these two stressors. Preliminary analysis of 170 studies of OA's effect on marine life shows that four phyla, Echinodermata, Arthropoda, Mollusca, and Chordata, are represented equally in the published literature while Cnidarians were only represented by five papers. Chordata was the most studied phyla in the literature reviewed on phenology. Further analysis will explore the representation of habitats, experimental methods, and life history events and stages studied in published literature on OA and phenology both independently and with a focus on overlapping species.

Springtime Onset of Isolated Convection in the Central and Eastern United States: Results From a Nine-Year Radar Analysis

Christopher Jarrett

Geography

Mentor: Thomas Rickenbach

In the southeast United States (SE US), precipitation is present year-round with a variety of distinct regimes. The mechanisms behind precipitation vary seasonally. During summer, convection organized as isolated precipitation features (IPF), notably isolated afternoon thunderstorms, account for nearly 40% of total rain. The seasonal evolution of IPF rain in the SE US is reminiscent of the summer monsoon in other parts of the world. Close examination of this monsoon-like regime may guide our understanding of how subtropical precipitation regimes change as the Earth warms.

Recent studies for the SE US have shown that onset of the IPF summer precipitation regime is abrupt, occurring over a few weeks in May. The spatial range of IPF onset across the US is not known. This work (1) extends the analysis to a nine-year temporal period (2003-2011), (2) expands the spatial extent into the Central Plains and northeast US, and (3) determines onset within an array of box regions of $4^\circ \times 4^\circ$ and $2^\circ \times 2^\circ$ in size, while using a new hourly radar dataset. Precipitation features for each hour have been separated into IPF and MPF categories using a feature maximum length threshold of 100 km. From the daily values, five-day average time series of IPF, MPF and total precipitation were constructed to determine the onset pentad in each box across the domain.

Results show that IPF onset on average is generally centered geographically on the SE US but extends into the mid-Atlantic and the lower Mississippi River valley. IPF onset begins at the end of April in south Florida and continues across the southeastern coastal plain into early and mid-May. Onset progresses northward and westward in early June, with the latest onset in eastern Ohio and the Texas Gulf Coast by mid-late June. Year-to-year, onset varies by as much as five or six pentads from average, but the spatial and temporal trends from the average still exist. These results support the hypothesis that the springtime increase in moisture and instability from the seasonal establishment of the North Atlantic subtropical high is mainly limited to the SE US, and is responsible for conditions leading to IPF onset.

Kids Run the World - Education

Elizabeth Johnson, Sarah Murphy, McKenzie Whitley, Hannah Ragsdale, Eric Wagner

English

Mentor: Timothy Christensen

Through education of volunteers and Boys and Girls Club attendees, we are working towards the betterment of physical activity regimes in school-age children. Volunteers have been educated on separate teaching styles for elementary and middle school-age children. Elementary techniques, including visualization, cooperative learning, and differentiation are being implemented into the explanation and execution of physical activities while at our weekly meetings. When the meetings transition to middle grade students, empathy and attention-grabbing techniques are more useful. We are also focused on managing risks such as unhealthy attachment and injuries. For children who come from low socioeconomic statuses, an unhealthy attachment can arise from weekly meetings. This unhealthy attachment is displayed when children become disappointed if a volunteer is not able to attend every week. This sort of attachment is being avoided by switching volunteers week by week and avoiding excessive physical touch, creating ambivalence between volunteers and attendees. This sort of secure attachment will allow the children to interact excitedly and freely when volunteers are present, but not become distraught for long periods of time after volunteers leave. Other forms of risk include injuries. Kids Run the World is committed to providing a safe and supportive environment which ensures the safety and well-being of all participants. Through careful selection of volunteers, maintaining environmental surroundings, and handling suspicions of harm, we are dedicated to minimizing risk of injuries. While educating ourselves on the methods previously listed, we are also understanding the importance of the physical and mental health benefits that stem from daily exercise. We are committed to educating ourselves and the Boys and Girls Club attendees about these benefits which include decreased depressive symptoms and increased social skills.

The Importance of Duck Hunting: Making the Connection

Madison Johnson

Ceramics

Mentor: James Tisnado

Hunters make connections to the land and to the people they hunt with. The hunt starts in the morning at dawn and continues until dusk. The connections are made to the land by their continuous conservation that happens year-round. Connections continue to be made by the people and the sport. To hunters, it is more than the kill, it is about saving the land and making long lasting memories.

When people think of hunting, they think of just the kill. They do not look further into the sport. Duck hunting is full of traditions. The time hunting is with their families, friends, dogs, and about the food. These traditions are passed down from generation to generation. Some people hunt to get as close as possible to their food, to know about what they are supplying their families with and to make sure that everything they serve is fresh and free from preservatives.

There has been a slow decline in hunting since 1982. Half the number of hunters between 16 or older hunt compared to 50 years ago. Duck hunters worry about what might happen if their beloved culture fades away. They hope that the health-conscious, outdoors-lovers and the millennial generation raised on grass-fed beef and nose-to-tail eating will save the sport. Taking game is about both tradition and filling the freezer.

My work shines a light on the values of hunt-to-table. Hunting is knowing where your meat comes from, the importance of local, sustainable, and ecologically conscious meat, and acts as a reminder why hunting is so important to our world.

City as A Space: Dostoevsky's *Crime and Punishment*

MaKenna Johnston

Multidisciplinary Studies

Mentor: Elena Murenina

My project will examine the use of space by Fyodor Dostoevsky (1821-1881) in his novel *Crime and Punishment* (1866) which takes place in 1860s St. Petersburg, Russia. What makes Dostoevsky's depiction of the city so profound in comparison with his contemporaries, both Russian and Western European? He uses area descriptions to provide a setting while giving insight to characters' mental, spiritual, and physical condition, as well as their social background. Through detailed textual analysis, aided by cross-referencing Dostoevsky's novel with literary criticism, intellectual and social history, an urban "profile" will be developed to emphasize Dostoevsky's unique perspective on the city, defined by his engineering background in topography. This novel is known for Raskolnikov's psychological complexity, but without relating space to characters' action, identity, and their relation to the city itself, any characterization would be incomplete. Examining this topic from an interdisciplinary perspective, I will provide the online reader with a balanced view of St. Petersburg as a Russian city and as a space of the iconic novel, supported by the creation of an interactive map.

While a textual analysis is crucial for spatial representations of the Dostoevskian city, how can modern readers visualize these locations in the 21st century? Using a historically accurate map of the city from the 1860s, I will geo-reference this template in a geographic information system, ArcGIS, established on buildings that have remained unchanged. Following the creation of my digital map, I will design a website allowing viewers to interact with the locations. Each spatial item, i.e., location or building, past and current, will be supplemented by a brief reference relating to Dostoevsky's text. My digital project will condense the textual analysis into an online platform allowing both students and scholars to better comprehend and visualize the Dostoevskian city as a historical and mythological space.

A Comparative Study of Direct Instruction to Remote Instruction Regarding Chemical Bonding Concepts in a High School Chemistry Class

Miguel Johnston

Science Education MAED

Mentor: Tammy Lee

The question really is whether or not remote instruction can be as effective as direct instruction. Within the context of a chemistry class, this study will focus on the ability of students to retain a usable understanding of concepts of chemical bonding. As the current trend is end-of-course testing, the ability to retain a working knowledge of these concepts is essential to student success and is actually more important than immediate application. A comparative study of post-instructional surveys between those receiving direct instruction and those receiving remote instruction will offer an initial determination of the efficacy of remote instruction. Ideally, remote instruction should offer no worse than equitable results to be considered a viable instructional method.

One flew over the pitcher plant: the first phylogeny of the pitcher plant fly genus *Fletcherimyia* and updated relationships with its carnivorous hosts

Peter Kann

Biology

Mentor: Alfred Lamb

North American pitcher plants (genus *Sarracenia*) are known for their carnivory, trapping primarily insect prey in modified cylindrical leaves (pitchers). Paradoxically, *Sarracenia* also supports an ecologically distinct community of arthropods that utilize the pitcher's resources. Many are obligate associates, including the fly genus *Fletcherimyia* (Sarcophagidae), whose larvae develop exclusively within pitchers and feed on captured insects. Eight species within *Fletcherimyia* are currently recognized, four of which reportedly use a single pitcher species as host; the others appear to associate with 2-5 pitcher species. However, certain fly-host affiliations are based on limited observation and remain tentative. Indeed, the fly species themselves are in need of genetic confirmation and have yet to be examined in any phylogenetic context. We conducted the most comprehensive ecological sampling of *Fletcherimyia* to date to 1) further examine host plant usage, 2) evaluate species constructs, and 3) generate a preliminary molecular phylogeny for the genus. We revise earlier perceptions of fly-host relationships, particularly for the two critically endangered species of *Sarracenia*. We also present the first phylogeny of *Fletcherimyia* using mitochondrial cytochrome oxidase 1 sequences for its eight species, each with range-wide coverage. Maximum Likelihood and Bayesian inference analyses provide strong molecular support for all eight nominal species and offer insight on the evolutionary impact of *Sarracenia*.

Behind the Brands: Analyzing the Relationships Among Social Media Influencers, Their Brand Partners, and Their Followers

Caroline Keeter

Communication

Mentor: Christine Kowalczyk

As social media channels become increasingly integral components in the marketing and advertising fields, companies have to find a way to stay relevant. The answer is influencer marketing, a type of social media marketing that utilizes endorsements from influencers to impact consumer behavior. As the number of influencers continues to grow online, the more important this research will become. This research will go beyond the brand by analyzing influencer characteristics that appeal to social media users. Researching the concept of closeness in relationships between social media influencers and their followers could likely lead to an increase in the profitability of brands who allocate their budgets toward social media influencing.

The questions guiding this research on the relationships between social media influencers and their followers primarily revolve around the characteristics of social media influencers. The primary research question to consider is, "What qualities make for the most effective social media influencer?" With social media being highly saturated with influencers, influencers have to find a way to differentiate themselves from one another and pinpoint their personal niche. An essential component in analyzing the relationship between social media influencers and their followers is to look at social media user engagement from the perspective of influencers. This leads to the question, "How do influencers gauge follower engagement?"

These research questions are going to be answered by a target group in a survey of 200 student participants. The survey will provide data on the names of specific influencers that students follow, which industries of influencers to examine, and from which social media platforms to derive data. Then, a round of five interviews will be conducted with specific influencers based on the survey results to better understand the influencers' perspective. Finally, the interview data will be coded and transcribed and incorporated into the final research presentation.

Ankle Joint Biomechanics During Progressive Loading Tasks in Persons with Chronic Ankle Instability

Summer Kenny

Health Fitness Specialist

Mentor: Stacey Meardon

Repeated trauma to the ankle, causing chronic ankle instability, is associated with altered movement strategies, cartilage damage and increased risk of developing post-traumatic osteoarthritis. Progressive loading following injury is recognized as a critical component of rehabilitation and necessary for recovery of function and optimal cartilage adaptation. Although mechanical loading is a key consideration for cartilage recovery, ankle joint contact forces have not been studied thoroughly during physical activity relevant tasks in persons with chronic ankle instability. Additionally, lower extremity load distribution consequent to altered movement strategies has not been fully examined. The purpose of this study was to compare lower extremity joint contact forces (JCF) across a continuum of physical activity related tasks to inform safe and progressive loading of the ankle joint in persons with chronic ankle instability.

3D kinetics and kinematics were collected during 8 conditions in 20 persons with chronic ankle instability (22.85 yrs ($s = 4.13$), 172.44 cm ($s = 9.33$), mass = 67.39 kg ($s = 11.03$)) and 20 persons without chronic ankle instability (21.40 yrs ($s = 1.90$), 170.43 cm ($s = 8.49$), 71.44 kg ($s = 19.41$)). Conditions included: walk (1.5 m/s), run (3.5 m/s), sprint (5.5 m/s), cut (3.5 m/s), double leg jump and land, and single leg jump and land. Motion capture data and subsequent joint moments from 5 trials were input to a musculoskeletal model to estimate ankle, knee and hip JCF during ground contact. Peak resultant JCF, ankle to hip JCF ratios and ankle to knee JCF ratios will be compared across conditions and between groups using mixed model ANOVA ($\alpha = .05$) and partial eta effect sizes (η^2).

Functional capacity, physical activity, and quality of life metrics will be reported to characterize our study sample. Primary outcomes of interest will be reported narratively and graphically. It is expected that JCF will be greater in single limb than in double limb activities for both groups. Persons with chronic ankle instability are also expected to display greater ankle relative to proximal JCF. Knowledge of ankle, knee, and hip joint contact forces across a continuum of weight bearing tasks is needed to provide safe return to play recommendations and titrate cartilage remodeling responses following injury. Outcomes of this research will provide critical evidence to guide return to sport activity progression for persons following ankle sprains.

Using GIS To Detect Spatial Contagion In An Urban, Riverine Rock Pool Metacommunity

Melissa Kernstine

Biology

Mentor: Michael McCoy

When selecting habitats, many invertebrate species exhibit strong patterns of preference and avoidance in response to various biotic and abiotic factors. For example, chemical cues from fish can deter mosquito oviposition from patches with predation towards those that lack predators. Furthermore, when mosquitos have incomplete information about conditions of nearby patches, they may make suboptimal habitat selection decisions. This spillover effect, of the ecological conditions of one patch onto another nearby patch, is known as spatial contagion. Spatial contagion can alter the distribution of species, like mosquitos, that must select among many circumscribed habitat patches. Within a riverine rock pool system along the James River (Richmond, VA), I conducted a two-phase investigation of oviposition site selection of mosquitos to test whether signatures of spatial contagion could be detected and used to predict distributions across the landscape. Using georeferenced maps, comprehensive occupancy surveys, and statistical modeling, I determined that spatial patterns in the distributions of mosquitos and their predators deviated from expectations of complete spatial randomness, suggesting that mosquitos exhibit habitat selection behavior. To empirically test whether the patterns were influenced by spatial contagion, I conducted a Before-After-Control-Impact-Paired-Series study using 6 clusters of rock pools, with 3-5 pools in each cluster. Mosquito larvae (as a proxy for oviposition) in all pools were counted and identified to genus weekly, for 9 weeks. After 5 weeks, I imposed an impact treatment consisting of the introduction of predatory fish (*Gambusia holbrooki*) into the focal pools of 3 of the 6 clusters. Deviations in larval abundances between the control and manipulated clusters, before and after fish introduction, also denote that the mosquitos are not following typical patterns of complete spatial randomness and their habitat selection behavior is being influenced by spatial contagion. While spatial contagion has been well-studied in theoretical or highly-controlled experimental settings, few studies have tested for its role in natural landscapes with complex organismal communities. By merging experimental methods with cartographic technology, this study links metacommunity and landscape ecology with experimental field ecology to understand how ecological interactions can cascade across levels of ecological organization and spatial scales.

Social Media Analysis for Real World Issues: An Overview of Applications and Approaches

Zeinab Khanjari Nezhad Jooneghani

Data Science

Mentor: Moha Nassehzadeh-Tabrizi

Users' activities and user-generated data on social media can generate useful and valuable information that can be used in policymaking and the decision-making process for real-world applications and issues. This paper presents a review of social media analysis approaches and application areas by sampling and reviewing studies from IEEE Xplore, Science Direct, and SpringerLink. This study's primary focus is on the role of social media data in mining public opinion and assessing public behavior for different applications in the real world. At the end of our study, we found these application areas disaster studies, urban planning studies, public health studies, political studies, business, and marketing studies. The more used approaches in these areas were topic analysis, sentiment analysis, SNA, spatial and temporal analysis. Moreover, this study provides insight for those who wish to know about social media's role as a data source for research related to physical world issues.

Relationship Between Seasonal Precipitation in the Ganges-Brahmaputra-Meghna (GBM) River Basin

Muna Khatiwada

Geography

Mentor: Thomas Rickenbach

Ganges-Brahmaputra-Meghna (GBM) river basin is the world's third-largest river basin covering Nepal and Bhutan and certain parts of China, India, and Bangladesh. Many natural disasters such as drought, flood, landslides, and riverbank erosion are a function of precipitation in the GMB river basin. This study focuses on seasonal precipitation based on HydroBASIN watershed GIS layer and flow length in GBM. Flow length of a point is the distance from that point to the outlet of the watershed. Satellite-based Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Climate Data Record (PERSIANN-CDR) at 0.25-degree latitude/longitude resolution was retrieved from 1983 to 2019. The result shows positive correlations between precipitation within the nearby hydrological sub-basins of the GBM during pre-monsoon and monsoon seasons. Only two sub-basins of the GBM show a significant correlation between pre-monsoon and monsoon precipitation among 32 hydrological basins. No significant correlation was found based on flow length. The correlation between ENSO and seasonal precipitation was also studied. A higher correlation of ENSO with precipitation in the monsoon season was found than in the pre-monsoon season.

Keywords: Ganges, Brahmaputra, Meghna, precipitation, PERSIANN-CDR

Neural Activity and Oculomotor Trends in Individuals with mTBI

Bradley Kleinert

Public Health

Mentor: Nicholas Murray

Mild Traumatic brain injuries (mTBI) can lead to vision and visual processing deficits, including decreased visual acuity, visual field impairment, eye movement dysfunction including vergence, saccadic, smooth pursuit movements, and an increase in mental workload during visual tasks. Also, evidence shows a relationship between visual tracking performance and brain activity function. Recent brain activity research (as measured via EEG) has indicated differences between mTBI patients and healthy controls. Specifically, mTBI patients demonstrated decreased alpha activity with a corresponding increase in theta activity and an overall increase in cognitive effort during visual and motor tasks. The purpose of this project is to examine the relationship between brain activity and visual motor deficit in patients with mTBI compared to healthy controls. Our hypothesis is that individuals who have experienced mTBIs within the past year will show changes in alpha desynchronization and perform poorer in visual tracking tasks than healthy participants. We also hypothesize a relationship between EEG desynchronization and visual tracking performance. To test these hypotheses, 30 participants (15 concussed and 15 non-concussed) will wear a 32-channel dry EEG cap while completing a series of RightEye visual tracking tasks. Eye movements will be recorded using an infrared remote eye tracker and theta and alpha power within event-related spectral activity (ERSP) will be used to indicate changes in brain function. Currently, our data suggests deficits in circular tracking efficiency, horizontal tracking efficiency (HTE), vertical tracking percentage, and horizontal speed and targeting. HTE revealed the largest disparity between healthy participants ($M = 16.57$) and mTBI participants ($M = 10.80$). The results will be discussed in light of neural activity and visual motor control dysfunction in mTBI.

Impact of Chinese Foreign Direct Investment on Developing Countries

Jacob Klug

Political Science

Mentor: Marie Olson-Lounsbery

As China continues to grow as a global power, its wealth and influence has expanded into developing countries through Foreign Direct Investment (FDI). With this research, we hope to understand the consequences of developing countries accepting Chinese FDI has on the stability of the country. Because of China's foreign policy and history of disregarding human rights violations, I believe that Chinese FDI in a developing country raises the probability and intensity of armed conflict happening in a target country. To test this, data will be collected on foreign direct investments given to developing countries by major powers such as the United States, United Kingdom, France, and China, to determine if Chinese investments are more volatile to developing countries compared to its western counterparts.

Characterizing Salt Tolerance of *Arthrobacter aureoscens* TC1

Ananya Koirala

Biology

Mentor: Erin Field

The most widespread metal contaminant in soil systems is chromium. Chromium is extremely toxic and persistent environmental pollutant that is not degradable thus when disposed into the environment they can cause disturbances that prevent environments to recover. One certain form of chromium is Cr(VI), a harmful compound that is a water-soluble anion resistant in water solutions and thus is a key containment in waste sites. Previous research has emphasized the utilization of microbes to aid in detoxification of Cr (VI) to Cr (III), a less toxic naturally occurring chromium. Bioremediation is a process used to stimulate strains of microbes to aid in Cr reduction. One such organism identified is of a metal resistant *Arthrobacter aureoscens*TC1 strain. Due to climate change, increased osmotic stress such as saltwater intrusion or evapotranspiration can disrupt *Arthrobacter* TC1 bioremediation capabilities. To understand how *Arthrobacter* TC1 handles these conditions, experiments with a salt stressor were carried out to study the effects of salinities during a 24-hour period on microbial growth and Cr(VI) reduction. Isolates of *Arthrobacter* TC1 were organized in 96 well plates and inoculated in wells of salinity concentrations (1% to 9%) in the presence and absence of Cr (VI) and microbial growth was measured using optical density (OD600) in a spectrophotometer. Results suggest that *Arthrobacter* TC1 responds to stressful osmotic conditions by slowing down its growth capabilities. Salinity concentrations from 1% to 3% showed most productivity, moreover the presence of Cr (VI) with the isolate affected both the overall growth and Cr (VI) concentrations with a decrease in specific salinity ranges. This study will aid in highlighting how osmotic stress affects *Arthrobacter aureoscens*TC1 to reduce chromium concentrations in environments particularly affected with global warming and the rise of sea levels that hinder the isolates full capabilities.

Children Watching Fantastical Content and Executive Functioning

Melissa Koster

Psychology

Mentor: Marion Eppler

The purpose of this study is to better understand the effect of fantastical content in children's TV shows as it is related to executive functioning (EF). This project will examine the research question:

Is there a relationship between the percent of fantastical shows watched and a child's EF?

Fantastical content is described as breaking naïve physics, impossible transformations (character's body changes shape, character spins and their clothes change, etc.), and fantastical beings (fairies, unicorns, etc.)

The target group is typically developing children age four- to six- years. Parents will first complete the demographic and EF section of the questionnaire by themselves. The EF section is the Ratings of Everyday Executive Functioning (REEF) questionnaire. It contains statements that a child with a well-developed EF would exhibit and assigns a score for EF. The higher the score, the more developed the EF. Following that sections, the parents will help their child complete the fantastical section. This section is comprised of forced-choice questions that make a child choose between a fantastical show and a non-fantastical show. This allows up to gain an understanding of how many fantastical shows the child prefers to watch over non-fantastical shows. After finishing the questionnaire, the percent of fantastical shows selected will be calculated and correlated to the corresponding EF score.

A Pearson correlation will be computed to assess the relationship between the percent of fantastical shows selected and the EF score. It is hypothesized that the larger the percent of fantastical shows selected, the lower the EF score will be.

Inheritability of the “Athlete’s Paradox”: the impact of maternal exercise on offspring skeletal muscle health

Polina Kassovskaia

Cellular and Molecular Bioengineering

Mentor: Nicholas Broskey

The accumulation of ectopic lipid in skeletal muscle has been connected to insulin resistance in individuals with obesity and type 2 diabetes. A major benefit of exercise training is increases in insulin sensitivity and enhancements in fatty acid oxidation in skeletal muscle. In 2001, the term “Athlete’s Paradox” was coined and refers to the finding that individuals with obesity and type 2 diabetes have high intramyocellular lipid content, which is associated with low insulin sensitivity; athlete’s, however, have a similarly high intramyocellular lipid content but high insulin sensitivity. Exercise training increases the oxidative capacity of skeletal muscle, subsequently influencing this lipid content concomitant with improvements in insulin sensitivity. Exercise during pregnancy as a mode of transferring the benefits of exercise to the developing fetus has gained traction and offers promising results in rodent models; however, it is not certain if these benefits can be translated to humans. Umbilical cord-derived mesenchymal stem cells (MSCs) are of fetal origin and are precursors to skeletal muscle cells in infants. Thus, MSCs can be used as an *in vitro* model for infant cellular metabolism. We hypothesize that MSCs from women who exercised during pregnancy will retain the “Athlete’s Paradox” phenotype and display higher lipid content and higher insulin sensitivity compared to MSCs from women who are metabolically impaired (obesity and gestational diabetes) in pregnancy. Closer insight into the programming of offspring metabolic tissue would allow for a better understanding of the benefit that maternal exercise has on offspring health and provide a potential early target for combating metabolic disease risk.

Repeatability of AERO for Improved Lymphedema Assessment

Grace Krell

Engineering

Mentor: Stephanie George

AERO works by administering an air puff to a patient to detect fluid or swelling under the skin. This device offers improved assessment of lymphedema through objective measurement, unlike individual and biased assessments from clinicians. The goal of this work is to assess the repeatability of AERO's automatic air pulse and quantify the pressure and flow output of the device. To do this, the BIOPAC MP36 system was used with the BIOPAC TSD117B Flowmeter and BIOPAC TSD110-MRI pneumogram (pressure) sensor. Flowmeter data was collected at seven different pressure measurements, ranging from 20psi to 80psi, all from a uniform distance. For pressure testing, the AERO nozzle was placed in a rigid stand one inch away from the pressure sensor. 12 total tests were conducted for four angles and three pressures. The results of this experiment demonstrated that AERO has repeatable flow and pressure output. This is seen through the standard deviation measurements of each test. The flowmeter testing had an average standard deviation of 1.04 L/s (0.5495 L/s -1.65 L/s) across all operating pressures. Pressure pad testing measures had average standard deviations of 11.26 mmHg, 16.68 mmHg, 11.93 mmHg, and 15.62 mmHg, for each angle. When looking at a pattern in standard deviation, for the flowmeter, the standard deviation generally increased proportionally as the pressure increased, maintaining a value about 25% of the average height. When viewing the pressure pad data, this standard deviation increased as the pressure increased with the exception being Angle 3, where the standard deviation decreased between the final two pressure measurements. This standard deviation is negligible, because the coefficient of variation for every measurement is less than one. In conclusion, the data supports that the air pulse is repeatable across varying pressures and angles. These results inspire confidence that changes in AERO measures are not due to variability of the air pulse and support clinical translation.

Energy Status and Sex Differentially Modify Feeding Behavior in response to Acute Treadmill Exercise in Untrained Mice

Taylor Landry

Bioenergetics and Exercise Science

Mentor: Hu Huang

Background/Aims: Despite the numerous health benefits of physical activity, exercise programs inconsistently result in caloric deficit and weight loss. Interestingly, recent studies have demonstrated exercise-mediated remodeling of hypothalamic feeding circuits alters feeding behavior; however, these studies yield mixed results depending on exercise protocols and animal models used. Thus, the current study aimed to investigate the differential effects of exercise intensity, energy status, and sex on appetite and appetite-regulating hypothalamic neurons.

Methods: 8-9-week-old untrained male and female mice were exposed to a sedentary trial, as well as acute low (10m/min), moderate (14m/min), and high (18m/min) intensity treadmill exercise in a randomized crossover design with 7 days between trials. Ad libitum fed and 10-hour-fasted mice were used, and food intake was monitored for 48 hours post-exercise. Additionally, immunohistochemical detection of cFOS was performed to determine changes in hypothalamic NPY/AgRP, POMC, tyrosine hydroxylase (TH), and SIM1-expressing neuron activity concurrent with changes in food intake.

Results: In fasted males, high intensity exercise suppressed food intake 1-2 hours post-exercise compared to sedentary trials. Interestingly, all fasted exercise intensities resulted in increased food intake 6-12 hours post-exercise; however cumulative 24 and 48 hour food intake was overall decreased after high intensity exercise only. The appetite-suppressing effects of high intensity exercise were associated with increased anorexigenic POMC and SIM1 neuron activity 1-hour post-exercise. While no changes in arcuate nucleus TH neuron activity was observed, TH activity was increased in the paraventricular nucleus. Notably, fasted female and fed male mice experienced opposite feeding behaviors, where moderate and high intensity exercise promoted additional food intake.

Conclusion: Our data suggest that fasted high intensity exercise may be beneficial for suppressing food intake and creating caloric deficit in males, while low intensity may prevent compensatory increases in food intake in females. Overall, this study demonstrates a complex and dynamic feeding response after acute exercise, that varies significantly depending on energy status, sex, and exercise intensity.

Can invasive seaweed *Agarophyton vermiculophyllum* protect eastern mud snail *Tritia obsoleta* from thermal stress caused by rising sea temperatures?

Timothy Lee

Interdisciplinary Biological Science

Mentor: April Blakeslee

Seaweeds serve as ecosystem engineers and foundational species. Many seaweeds are structurally complex and provides habitat, refuge, and nursery grounds for various fish and macroinvertebrates alike. Seaweeds also protect its associated communities from thermal stress. The red alga *Agarophyton vermiculophyllum*, native to the coastal habitats of northwestern Pacific, has invaded much of temperate Atlantic coasts. While invasive, *A. vermiculophyllum* is a foundational species because it has introduced novel structural complexity in soft sediment estuarine habitats where such physically complex macrophytes originally did not exist. A common macroinvertebrate that co-occurs with *A. vermiculophyllum* in the U.S. east coast is eastern mud snail *Tritia obsoleta*. Its abundance makes this a model study organism to understand organisms' response to rising sea temperature. Furthermore, their strong association with *A. vermiculophyllum* also makes them ideal study organisms to understand how invasive seaweeds may or may not reduce thermal stress of its associated faunal communities. In early February 2021, we began a lab experiment to assess survival rates of *T. obsoleta* across three temperature treatments (27, 32, and 36 deg. Celsius), which were selected based on temperature gauge data from summer 2019 & 2020 in Beaufort, NC. In each temperature treatment (n = 100), we distributed *T. obsoleta* into two habitats using jewelry boxes: with and without *A. vermiculophyllum*. Within three days, all the *T. obsoleta* in 36 deg. perished; those with *A. vermiculophyllum* perished within two days. The gastropods in the 32 deg. Celsius treatment survived longer, but those in this treatment with *A. vermiculophyllum* all perished within eight days, while those without *A. vermiculophyllum* persisted for nearly two weeks. However, the gastropods in 27 degrees treatment suffered very low mortality and had over 90% survival rate through the end of the trial. While the second trial of this experiment is ongoing, these preliminary results suggest that in higher seawater temperatures, *A. vermiculophyllum* does not appear to reduce thermal stress and dramatically increases mortality of its associated macroinvertebrates. The mechanisms behind such high mortality is unknown, but requires further attention to fully understand how *A. vermiculophyllum* will shape its associated faunal communities in rapidly changing estuarine habitats.

Exploration of Public Health Students' Remote Course Learning Experience and Mental Wellbeing during the COVID-19 Pandemic

Chelsea Lennon

Public Health

Mentor: Chia Jung Yeh

The COVID-19 pandemic has significantly impacted students' learning experiences. While many universities have switched the in-person courses to online courses during the COVID-19 pandemic, few have taken the next steps to explore students' learning experiences, concerns, and their learning obstacles. The purpose of this study is to explore the implications of COVID-19 on Public Health Studies undergraduate students at East Carolina University and explore the varying effects that these students may be experiencing on their remote course learning experience and overall wellbeing. Public Health students represent a key demographic in that they are training in the prevention and management of diseases such as COVID-19, and subsequently experience a unique curriculum. A mixed-method embedded design will be utilized in this project to examine (1) the course delivery method of the students prior to the pandemic and how it has changed, (2) the students' online learning experiences and obstacles, and (3) how the wellbeing of the students has been affected, including their mental health and use of coping strategies. The data will be collected through an online Qualtrics survey and virtual semi-structured interviews. Participants will have an option to complete an online survey only or participate in the survey and attend a virtual interview. This study is important because it will add to the small amount of pre-existing knowledge on the impacts of COVID-19 on Public Health students. Although there is some existing information on the impacts of the pandemic on university students and other students studying medicine or health, there is not as much information that specifically pertains to Public Health students. This study will be beneficial because it will shed light on the perspectives and experiences of a crucial demographic in society. Public Health students will one day be leading professionals who will provide crucial advice to communities around the world, so it is important that they are being supported both personally and academically. This study will help to uncover how Public Health students are being affected and how University and societal resources can contribute to the students' wellness and smooth transition from traditional campus courses to distance learning courses. It will also provide data to support future infrastructure plans for students and faculty members to succeed in their academic learning during the pandemic.

Pirates for Academic Success, Assessing Dropout and Retention Rates at Universities

Allison Levesque

Management Accounting

Mentor: Tim Christensen

Dropout rates and academic probation is a significant problem at any university and has only escalated due to the COVID-19 pandemic. Based on data that was received from the ECU admission office in 2019, one thousand students drop out each year due to academic problems. While dropout and retention rates affect students, they also affect the budget of the school and the resources they can provide students. The pandemic has forced students to transition to online learning environments with little to no transition period. Transitioning to online classes has made it more difficult for students to learn effectively and efficiently. The university has made some efforts to combat this with introducing the pass or fail options for students. However, the goal of our group is offering students a centralized hub online to access videos on popular software used across campus, information on learning styles, class preparation and planning, and information on other resources that ECU provides. These videos will not only provide student's resources and important information, but since these videos are created by students, they are more likely to be understood by students.

More recently, we have partnered with Joyner Library to create content aimed at helping students even further. Through our research we discovered there is a lack of awareness about the resources offered through the library. As a group, we feel that many of these resources would help hundreds of students on campus if they knew these systems were in place for them. We are very excited to be able to help them raise awareness through our videos.

Socio-demographic Predictors of Culinary Knowledge, Self-Efficacy and Skills of Rural Individuals in Eastern North Carolina

Amy Lewis

Nutrition and Dietetics

Mentor: Lauren Sastre

Introduction: Research has found culinary self-efficacy is predictive of diet quality. Few studies have examined culinary knowledge, skills and self-efficacy; therefore, the objective of this research was to investigate sociodemographic variables as predictors of culinary skills, knowledge, and self-efficacy.

Methods: Participants were virtually recruited from rural areas in Eastern North Carolina and completed a validated culinary knowledge, skills and self-efficacy questionnaire that included questions regarding confidence in the areas of culinary skills, shopping, budgeting and label reading/consumer awareness. Data were analyzed using IBM 26.0 SPSS using linear regression and socio-demographic co-variables were examined including race, age, sex, gross income and education.

Results: The majority of participants (N=40; 47 ± 13.4 years) were female (82.1%). Age was associated with significant positive increases in participants' self-reported abilities to prepare or cook a healthy meal with only a few ingredients ($p=0.022$), use leftovers to create another meal ($p=0.024$), and create healthful balanced meals ($p=0.011$). Sex (female sex) was predictive of significant positive increases in participants' self-reported abilities to follow recipes ($p=0.035$) and shop with specific meals in mind ($p=0.013$). Gross income did not have any significant impact upon participant responses. Higher education levels were associated with a significant and adverse impact upon participants' self-reported abilities to compare prices when shopping ($p=0.004$).

Conclusion: This study suggests age, sex, and education are potential predictors of certain aspects of culinary self-efficacy among study participants. Further research is warranted in order to better understand the relationship between these variables and culinary self-efficacy, knowledge and skills.

Radiosensitization of human cells to proton radiation by PEG-coated gold nanoparticles

Nichole Libby

Biomedical Physics

Mentor: Jefferson Shinpaugh

Increasing the efficacy of radiation therapy for the treatment of cancer has been widely explored using radiosensitizers to enhance tumor cell killing and reduce the effective radiation dose to healthy tissue. In our current studies, sensitization of malignant prostate and breast epithelial cells to charged particle radiation by PEG (polyethylene glycol)-coated gold nanoparticles is investigated. In these experiments, malignant cells grown in the Cell Culture Laboratory in the Department of Biology will be treated with PEG-coated gold nanoparticles, and then will be irradiated in vitro with 1.5-MeV protons in the ECU Accelerator Laboratory in the Department of Physics. The sensitizing effect of the nanoparticles is subsequently assessed by metabolic and clonogenic assays on the irradiated cells.

Our studies will focus on the radiosensitization effects of the tumor cells to 15-nm PEG-coated gold nanoparticles. The experimental system will include movement of the cell irradiation apparatus to the microbeam line with upgraded high-vacuum hardware and enhanced beam control for more precise radiation dosimetry.

The Impact of Virtual Lab Use on Student Achievement in Secondary Chemistry

Patricia Livingston

Science Education MAED

Mentor: Tammy Lee

With online learning on the rise, the use of virtual labs and other virtual learning tools becomes more commonplace in the traditional science classroom. In order to provide realistic lab opportunities for remote learning, or for those with limited resources and little time, the need for virtual lab use has increased in many science classes. Numerous studies have analyzed the use of virtual labs, and most find positive results for student learning. However, most studies conducted on virtual labs involve college level students and courses, making the data irrelevant for high school teachers. Data at the high school level is necessary for teachers to make informed decisions on the best implementation of virtual labs in their classrooms for optimal student benefits. This study takes a closer look at student performance when using virtual labs in the high school Chemistry classroom by measuring student performance on assessments and incorporating information from surveys on student perception about this type of learning.

Artificial incubation of birds' eggs: investigating the role of egg dimensions on variation in incubation period

Jessica Long

Biology

Mentor: Susan McRae

Chicken eggs come in a variety of different sizes. The aim of this study is to determine whether there is a standard relationship between incubation period and egg dimensions. Previous studies on the incubation period of chickens focused exclusively on individual strains. My approach was to do a common garden experiment using multigenerational cross-bred chickens to attempt to tease out the effects of egg dimensions. I incubated chicken eggs artificially in common incubators at Sylvan Heights Avian Breeding Center. Egg length, width and mass were measured upon collection from the chicken coop. Groups of eggs were set in incubators under consistent conditions in batches. Incubation duration was recorded at the initiation of hatching (considered for the purpose of this study to be the appearance of an external pip on the eggshell). Eggs were evaluated for pips every six hours once the chicks entered the airspace, as determined by candling. I expect total incubation duration to be inversely related to egg size. When chicks are dry, weight and tarsus length are measured as an index of condition. Chickens serve as the domestic animal model for exotic study species and barnyard flocks produce eggs of varying sizes. Past research on chicken physiology and nutrition has had broader positive implications for human-managed exotic bird species. This study will specifically add to the existing knowledge base of artificial incubation in aviculture.

The Effects of COVID-19 on Social Media Use and Social Support in Young Adults

Kaitlyn Longest

Communication

Mentor: Jin-Ae Kang

The COVID-19 pandemic has created a quarantine culture. Young adults across the United States are sent home from school, working from home, and losing income and resources. Such changes increased mental health disorder symptoms and decreased face-to-face social interaction. Consequently, social support has been taken away from the young adults' life during the COVID-19 pandemic. When social support is essential especially in a young adult's mental well-being and survival, then, how did young adults seek or offer social support in a physically isolated environment? Our research team tries to find an answer from the way in which young adults use social media.

The purpose of this study is to understand the effects of social media on mental health during the stay-at-home orders in 2020 to limit the spread of COVID-19. Social media may be a resource for social support during a pandemic. These networks can allow for interaction with those outside of an individual's immediate environment.

Research offers mixed messages on the impact of social media on its users' mental wellbeing. Some previous studies have explored how oppressed groups such as LGBTQ+ or transgender adolescents groups utilized social media for obtaining social support when they cannot find suitable social support face-to-face (Han et al., 2019; Selkie et al., 2020). However, more recent studies regarding social media usage and COVID-19 coping strategies reported that intense use of social media would create a mental health crisis on top of the pandemic (Zhong, Huang, & Liu, 2020). With the concept of social support, our study explores the possible positive impact of social media use in the context of COVID-19. Some of the key concepts such as the intensity of social media use, informational motive of social media use, and interpersonal motive of social media are also navigated.

General and Special Educators' Level of Preparedness in Supporting Students with Behavioral and Mental Health Challenges

Sydney Lowe

Public Health

Mentor: Tosha Owens

Students with EBD and/or mental health challenges require to access to sound behavioral support from "bell to bell." However, due to lack of educator training, this need is often unmet. The purpose of this study is to obtain current data on the preparedness of general and special educators in order to better recognize and move toward filling in these support gaps. This is to benefit students with, or at-risk for behavior and/or mental health disorders, and teachers responsible for providing supports. A survey was conducted to gauge educators' preparedness in supporting students requiring behavior support. Results, implications, and suggestions for future research will be provided.

Biological Interactions among Hosts, Parasites, and Mercury

Laura Lukas

Biology

Mentor: April Blakeslee

Sea level rise is becoming an inevitable fate for coastal regions worldwide. The North Carolina coast and wetlands have seen, and will continue to see, significant impacts from rising seas. One biogeochemical impact of sea level rise is a chemical reaction by anaerobic bacteria in the sediment, which converts inorganic forms of mercury into methyl mercury. Inorganic methyl mercury then can bioaccumulate and magnify through trophic levels. Research suggests that parasitized animals tend to have lower levels of methyl mercury within their bodies than unparasitized conspecifics. Parasite diversity has also been shown to positively correlate with salinity, providing opportunities for estuarine species and their parasites to enter into new areas with enhanced salinization. Sites were chosen within two estuaries in North Carolina, the Pamlico and Neuse Rivers. Collection methods of target species include deployment of passive sampling devices. Target species collected from each site include residential species: naked gobies and mud crabs. Because these species are residential, they are good models to study the in situ impacts of mercury levels and parasite abundance along a salinity gradient.

Predicting HBZ Interaction With *BATF3* Enhancer Regions Through ChIP-seq

Mikayla Luke

Public Health

Mentor: Nicholas Polakowski

Human Lymphotropic Virus Type 1 (HTLV-1) is a complex retrovirus that causes Adult T-cell Leukemia (ATL), an often fatal form of cancer characterized by uncontrolled proliferation of infected CD4+ T-cells. The viral protein HTLV-1 basic leucine zipper factor (HBZ) has been proven as essential for HTLV-1 proliferation and is believed to contribute to progression to ATL and maintenance of the disease. HBZ functions as a transcriptional regulator. The knock-down of the *hbz* gene suppresses ATL proliferation, supporting that HBZ is essential for leukemogenesis. Recently, the basic leucine zipper transcription factor ATF-like 3 (*BATF3*) and interferon regulatory factor 4 (*IRF4*) were shown to help drive the ATL-specific transcription program. Both *BATF3* and *IRF4* promote T-cell differentiation and proliferation. HBZ was found to control *BATF3* transcription by binding an enhancer region of the *BATF3* gene. However, the molecular mechanism used by HBZ to control *BATF3* transcription was not resolved. This review utilizes data analyses of chromatin immunoprecipitation specimens evaluated by next generation sequencing (ChIP-seq) to predict how HBZ interacts with the *BATF3* enhancer region and then produces the elevated transcription level.

A New Model for Fibrinolysis

Spencer Lynch

Physics

Mentor: Nathan Hudson

Fibrin is an exceptionally elastic protein that acts as the primary structural component in blood clots. When fibrinogen and thrombin meet in the blood, chains of fibrin monomers form into protofibrils which bundle together to form web-like fibrin networks whose role is to catch blood cells resulting in a blood clot. Once a clot has reached the end of its usefulness a lytic enzyme called plasmin begins to break fibrin down in a process called fibrinolysis which ultimately leads to the dissociation of blood clots. While clot dissolution has been observed, a lot is not known about the details of fibrinolysis in a single fiber context. Previously, there were two theorized models for fiber dissolution: transection and uniform radial digestion. Transection claims that plasmin pools at a single location on fibers making a precise cut while uniform radial digestion says plasmin evenly distributes along fibers and digests every location an equal amount until the fiber becomes too thin and breaks. Our results show that while plasmin is distributed along the length of fibrin fibers, digestion is not uniform. Additionally, rather than a single digestion site, multiple distinct degradation sites have been observed on fibers during fibrinolysis. Fluorescence microscopy was used to collect timeseries of fibers during fibrinolysis. Using average radial intensity across the width of fibers as a metric for fiber diameter we investigate correlations between fiber properties including estimated cleavage location, initial maximum and minimum radial intensity locations, and overall change in radial intensity over time. In observing the change in average radial intensity over time it can be seen that intensity slides along fibers away from degradation sites which we interpret as the recoil of protofibrils after they are cut. Results showing the shifting of average radial intensity trends over time are presented. Additional effort is being put into investigating a potential positive feedback mechanism which accelerates digestion. 3-D stochastic modeling is also being used to help gain insight on how plasmin diffuses to fibrin fibers. Better understanding fibrin fiber digestion could help us understand why 20% of clots are resistant to digestion when plasmin is introduced which would aid in developing treatments for blood clot related diseases like deep vein thrombosis and stroke.

IL-34 and sIL-6rb are Highly Expressed by the Epicardial Adipose Tissue of Patients with Type 2 Diabetes and Correlate with Atrial Fibrosis

Divya Madipally

Pharmacology and Toxicology

Mentor: Jacques Robidoux

Background: Cardiac fibrosis is characterized by excessive deposition of extracellular matrix proteins, especially collagen and contributes to the development of diabetic cardiomyopathy. Epicardial adipose tissue (EAT) and inflammation have been independently suggested as contributing factors to cardiac fibrosis. The aim of this study was to measure the secretion of various chemokines and inflammatory mediators by EAT and evaluate their correlation with the level of ECM deposition in the atria of patients with type 2 diabetes mellitus (T2DM). Without this knowledge, our ability to formulate evidence-based hypothesis on the pathophysiological basis of atrial fibrosis in patients with T2DM will remain somewhat limited

Materials and Methods: Sixty-four patients (32 without and 32 with T2DM) undergoing coronary artery bypass grafting (CABG) participated in this study. Masson's Trichrome staining was performed on the resected right atrial appendage (RAA). 20 mg of EAT was carefully dissected and explants were incubated for 24 hours and the production of 49 chemokines and inflammatory mediators were measured by multiplex Elisa. Glycated hemoglobin (A1c) was measured in all patients. Further, primary human cardiac fibroblasts were cultured in the presence or absence of IL-34 (50,100ng/ml) or TGF- β (10ng/ml). Immunofluorescent staining was performed to measure the expression of α -Smooth Muscle Actin (α -SMA). The study was approved by the Institutional Review Board of Brody School of Medicine at East Carolina University (UMCIRB09-0669)

Results: Histological findings revealed that despite all the patients to be advanced middle ages (62.9 +/- 1.2) atrial fibrosis is more marked in the RAA of patients with T2DM (P < 0.001) and that it correlates with A1c (P < 0.05). Of the adipocytokines released from the adipose tissue explants, 11 correlated with fibrosis (INF-A2, IFN-R, IL-12, IL-20, IL-22, IL-27, IL-29, IL-34, Osteocalcin, sIL-6Rb, and TNFSF-13B) and 3 correlated with the presence of T2DM (IL-11, IL-34 and sIL-6Rb). Of these, IL-34 and sIL-6Rb were both elevated in T2DM and correlated with RAA fibrosis. In cultured heart fibroblasts IL-34 promoted the formation of myofibroblasts and increased the expression of α -. In conclusion, IL-34 was identified as the candidates for the pathophysiological basis of cardiac fibrosis in patients with T2DM

Retinoic Acid Regulates KIT Expression in Peritubular Myoid Cells in The Mammalian Testis

Taylor Malachowski

Biology

Mentor: Christopher Geyer

Spermatogenesis (production of sperm) takes place in the testis, which is composed of seminiferous tubules. Within mammalian seminiferous tubules, there are two cell types: germ cells and supporting somatic cells. The somatic cells found inside the tubules are Sertoli cells, and those surrounding the tubules are peritubular myoid cells (PTMs). Evidence supports roles for PTMs in the following critical functions: 1 - contracting to perform peristalsis to extrude the immotile testicular sperm from the testis; 2 - generating critical juxtacrine and paracrine signaling molecules for germ cells; and 3 - providing an insulating barrier to protect germ cells inside the tubules from signals in the outside interstitial tissue. However, almost nothing is known regarding how PTMs are instructed to regulate these distinct functions. Recent data from our lab are beginning to shed light on this - we made the exciting discovery that expression of the essential "KIT proto-oncogene receptor tyrosine kinase" (KIT) is regulated in PTMs by retinoic acid (RA) signaling. As a morphogen, RA signals in discrete portions of the testis to drive germ cell differentiation, and we observed that RA dramatically modified the regional expression of KIT. In germ cells, RA upregulated KIT protein expression, but did the opposite in PTMs; KIT protein was downregulated in PTMs *in vivo* by exogenous RA, and upregulated by WIN 18,446/BDAD-mediated inhibition of RA synthesis. We are currently investigating the extent to which RA regulates the regional and temporal expression of KIT in PTMs. We treated mice with WIN 18,446 for ten days and then injected exogenous RA. At different time points after RA injection, mice were euthanized and tissues were collected for immunostaining to detect KIT in PTMs, which express "actin, alpha 2, smooth muscle, aorta" (ACTA2/a-SMA). We next determined the percentages of ACTA2+ PTMs that were KIT+. Our preliminary results suggest that numbers of KIT+ PTMs declines drastically, as early as two days in response to RA. Future goals include defining, in PTMs, how RA downregulates KIT expression and identifying the specific responsive downstream kinase signaling pathways. Results from this work are expected to begin to uncover the mechanisms by which RA and KIT cooperatively regulate the diverse cellular functions of PTMs in the mammalian testis.

The Impact of Healthcare Providers' Prescription of Physical Activity on Cancer Survivors' Physical Activity Levels

Brian Maloney

Sport and Exercise Psychology

Mentor: Bhibha Das

Introduction: Cancer survivors may experience adverse health effects (e.g., fatigue, anxiety, depression) even after cancer treatment is completed. Physical activity is one way cancer survivors may suppress or treat these side effects. Despite the known benefits, nearly 82% of cancer survivors do not meet ACSM physical activity guidelines. One strategy that may increase cancer survivors' physical activity is for health care providers to prescribe a physical activity prescription. This study's purpose was to compare physical activity levels between cancer survivors who were prescribed physical activity by their healthcare provider and those who were not. We hypothesized that cancer survivors who received a physical activity prescription post-treatment would report higher levels of physical activity than survivors who did not.

Methods: Participants completed an online survey that inquired about demographics, cancer history, physical activity prescription, physical activity levels, anxiety, depression, fatigue, sleep quality, stress, and health-related quality of life.

Results: Participants (N =39) were mostly female (74.4%) and Caucasian (92.3%), with a mean age of 48.1 ± 17.9 years. Participants reported being diagnosed with breast (41%), "other" (e.g., lymphoma, ovarian, stomach) (30.8%), leukemia (12.8%), kidney (7.7%), prostate (5.1%), and endometrial cancer (2.6%). Post-treatment physical activity prescription was reported by 46% of participants. Data revealed no significant difference in physical activity levels ($p=.896$; $d=.042$), anxiety ($p=.400$; $d=.400$), depression ($p=.510$; $d=.510$), fatigue ($p=.207$; $d=-.412$), sleep quality ($p=.984$; $d=.007$), stress ($p=.968$; $d=.017$), and health-related quality of life ($p=.435$; $d=.254$) scores between participants who received a physical activity prescription post-cancer treatment and those who did not.

Discussion: Findings indicated no differences in physical activity levels in individuals who were prescribed physical activity versus those who were not. With the discrepancy in effectiveness between written and oral physical activity prescriptions, future research should inquire about what type of physical activity prescription participants received (e.g., written, oral, etc.), while also considering a larger sample size. From a public health perspective, it is worth investigating how patients receive physical activity prescriptions to improve their effectiveness.

Sensory Inclusion in College Athletics

Hannah Martin, Emily Tucker

Management

Mentor: Jennifer Hodgson

When the senses are overwhelmed by competing stimuli, such as at a sporting event, a sensory room can be a beneficial tool for regaining sensory calm for an individual and their family. This pilot project analyzes the ways in which sensory spaces can be advantageous for an athletic facility and the community that hosts these facilities. Whether through economic and therapeutic benefit, increased quality of work among facility employees, boosted athlete morale, or a change in family experience when utilizing a sensory space, promoting sensory inclusion using a sensory room provides a variety of enhancements to the college athletics realm. The goal of this pilot project is to increase the amount of knowledge about these benefits and encourage athletic facilities to pursue the addition of these inclusive spaces.

Understanding the Impact of Coronavirus on Student Experiences and Success

Tara Martin

Sociology

Mentor: Robert Edwards

The Coronavirus began with a small outbreak in Wuhan, China during the latter part of 2019. As a way to “slow the curve” and stop the spread of the virus, countries all around the globe closed their borders and implemented social distancing protocols. Schools and Universities chose to also close and transition to online learning to prevent the spread on campus and protect all students, staff, and faculty. East Carolina University (ECU) decided it was in the best interests of its students to make the transition to distance education. Many people faced new challenges that they had never experienced before including taking online courses for the first time, changes in employment status and responsibilities, and new living environments.

During Spring semester of 2020 and again Fall semester of 2020, two separate surveys were administered online to a random sample of ECU students focusing on their experiences with the school’s transition online. That data was analyzed, and a report was written up examining the academic, financial, and domestic stressors faced by students. It investigated the experiences of students by gender, race, and political party differences. The second half of the project focused on rental and housing issues students faced as a result of the pandemic. Virtual interviews were conducted between students of the Sociology 3213 Research Methods course. The aim was to gain a qualitative view into the gender, racial, and economic status differences in rental and housing related issues stemming from the pandemic.

Understanding Large Organization Marketing Strategies by Analyzing Event Promotion Techniques Implemented through Campus Recreation & Wellness Social Media

Malinda Massey

Marketing

Mentor: Jenny Gregory

Effective social media marketing is a vital tool essential for organizations to facilitate brand growth and development. This project has been developed to create a marketing portfolio for the Communications and Promotions department of Campus Recreation & Wellness. The goal of this project is to offer a means of insight to the Communications and Promotions team on how to develop the most effective marketing strategy for meeting reach, engagement, and target market goals. CRW practices a variety of social media marketing techniques to promote events and campaigns developed by departments within the organization. Several currently used techniques have been successful, but there is room for improvement and deeper understanding. Results of the project will determine how the department should grow and develop current practices that will further keep and attract the preferred student base. This portfolio uses data analytics from CRW social media platforms to conclude which facets of promotion are most successful.

The success rate of various marketing strategies is based on results collected following the completion of events and campaigns over the last three years. Variables used to determine marketing strategy success include overall changes in account following, post engagement, post shares, and post views. Tabling engagement techniques have also been taken into consideration because of their pre-COVID-19 relevance. This project serves to analyze marketing processes that have been reconstructed because of the effects of COVID-19, and how this variation in marketing has changed job responsibilities in the Communications and Promotions department at CRW.

Understanding the marketing mix and consumer behaviors of an organization has proven to be a critical aspect of creating an engaging social media platform. The marketing mix of this portfolio evaluates the engagement patterns of young adults and college students. This project analyzes the social media engagement patterns of students at ECU. As a marketing team, CRW will be better able to communicate effectively with their target market by incorporating methods of audience attraction and retainment on all social media platforms. The findings of this research will be incorporated as new initiatives during program production and promotion in the Fall semester of 2021. This implementation has been postponed because of the virtual marketing environment created to comply with COVID-19 standards within the University.

Characterizing the Role of Pectin in Cell Wall Recomposition and Organ Initiation in Maize

Daniel Maynard

Biology

Mentor: Beth Thompson

Plants grow and initiate organs throughout their life cycle, one mechanism by which plants regulate their organ development is modification of the cell wall. For plants to grow their cells must expand and then undergo cell division, both of which require modification of the cell wall. How cell wall modification affects plant growth and organ initiation is an active area of research. In the past, it was thought that the cell wall played a passive role in development, but more recent research indicates that it is highly modifiable in response to stimuli. One modifiable component is pectin, a polysaccharide sugar acid derived from galactose, and a component of the primary cell wall. Pectic polysaccharides, like homogalacturonan, are capable of cross-linking with cellulose and other pectins to form a supportive matrix. This matrix can be modified to give the cell wall rigidity or elasticity depending on changes in the composition of pectin itself. Previous research has shown that organ initiation in *Arabidopsis* requires demethylesterification of pectin to increase cell wall elasticity. Grass cell walls, including maize, contain significantly less pectin than *Arabidopsis* and what role, if any, pectin plays in organ initiation is unclear. Recently our lab has shown that demethylesterified homogalacturonan pectin is also associated with floral organ initiation in maize. To explore cell wall dynamics more broadly I plan to examine pectin modifications in the shoot as well as the inflorescence at multiple stages of development. Furthermore, we will extend our examination to mutants that have abnormal floral development to determine if pectin cell wall remodeling plays a role in the mutant phenotype. We will be able to visualize pectin remodeling of the cell wall through the use of antibody staining with antibodies that bind to specific epitopes of pectin. Further investigation may be done to identify the role of other types of pectin such as rhamnogalacturonan-I, rhamnogalacturonan-II, and xylogalacturonan on floral development.

Are There Common Characteristics among Alcohol Retail Outlets that make them more likely to be reported as unsafe, commonly pass Alcohol Purchase Surveys, and commonly fail Alcohol Purchase Surveys?

Lindsey McCallum

Public Health

Mentor: Jennifer Matthews

Underage consumption of alcohol is a serious public health issue all across the United States. Identifying the stores and institutes where youth are obtaining alcohol is the most important step towards inhibiting and eliminating underage drinking in most communities. Alcohol Purchase Surveys (APS) and Alcohol Environmental Scans (AES) were used to determine common characteristics of alcohol retail outlets that may cause them to be reported as unsafe, commonly pass an Alcohol Purchase Survey experience, or commonly fail an Alcohol Purchase Survey experience. Identifying these common characteristics between retail outlets is an important step towards detecting the factors in different communities that increase the probability that an underage individual can purchase alcohol. APSs are conducted annually for all off-premise alcohol outlets. Environmental scans of the same off-premise alcohol outlets were conducted during the fall of 2020. Environmental Scans were conducted by using a windshield survey method, which involved making observations about an alcohol outlet from a car parked in the outlet's parking lot. Results indicate that there are common characteristics between all of the outlets that failed their APS more than 2 times within the last 5 years of data collection, such as the identifiable racial/ethnic group that frequent the outlet, the amount of traffic around the outlets, and the type of outlet. Common characteristics were also identified for all of the outlets that passed their APS more than 2 times within the last 5 years. The results from the Environmental Scans also show that there are trends between certain types of outlets that influence its likelihood of displaying signs regarding a minimum age to purchase alcohol. This research that involves conducting Alcohol Purchase Surveys and Alcohol Environmental Scans has the potential to greatly decrease the number of outlets who sell alcohol to underage individuals, as well as identify the factors of an outlet and its surrounding environment that may increase its likelihood to serve the underage population.

Preferred Self-Care Behaviors of Participants Who Have Completed a Caring Science Online Course

Erin McGinnis

Nursing

Mentor: Kathleen Sitzman

The online Caring Science Course that this study will collect its data from is taught by Dr. Kathleen Sitzman and follows her book she co-authors with Jean Watson: *Caring Science, Mindful Practice: Implementing Watson's Human Caring Theory*. Although this book discusses many different ways to apply the Human Caring Theory, this specific study related to the course is particularly interested in the aspects pertaining to self-care. Exploring and identifying preferred self-care activities among nurses will help facilitate relevant and meaningful self-care support and education for nurses.

The main aim of this study is to discover the preferred self-care behaviors of participants of who have completed a Caring Science, Mindful Practice Massive Open Online Course (MOOC). The study will be looking at the most popular self-care activities through analyzing qualitative data from discussion board responses posted in the MOOC. The data collected will also be analyzed to see if the participant's focuses are on improving home life with self-care or to improve their quality of work. Patterns and themes will be identified and analyzed to help determine if the preferred activities are dependent on whether or not it is self-care to improve work life or self-care to improve home life.

The study was done in the form of a descriptive qualitative review of narrative responses related to the topic of self-care, caring-science, and mindfulness practice. Data collected will be summarized, organized and presented in the form of a poster presentation. This study was conducted by an undergraduate Honors College Student at East Carolina University.

The Effects of the COVID-19 Pandemic on Athletic Trainers of the UNC System

Joshua Meeks

Physical Education

Mentor: Elizabeth Hodge

The COVID-19 Pandemic will cause university athletics to never be the same. COVID-19 has up-ended the world of sports and challenged athletic programs to adapt practices, events, and policies to ensure the safety of coaches, athletes and fans. However, little attention has been given to the impact the pandemic has had on athletic trainers. Athletic trainers are an essential member of athletic programs and a vital part of the healthcare system to ensure athletes are healthy, safe, and without injury. Athletic trainers have been on the front lines in the effort to keep athletic programs running smoothly and athletic teams safe. This research investigated the question of how have athletic trainers within the UNC System been impacted by the COVID-19 Pandemic. To answer this question, this research surveyed athletic trainers within the UNC System. Data collected from the survey revealed four key themes. These four themes include; 1) an increase in workload and responsibilities, 2) furloughs, 3) mental health, and 4) the changes brought on due to COVID-19.

Testing a Parton Transport Model with an Exact Solution to the Boltzmann Equation

Todd Mendenhall

Biomedical Physics

Mentor: Ziwei Lin

Transport models can provide numerical solutions to the Boltzmann equation. However, causality violation is a common problem for parton or hadron transport models at high densities and leads to inaccurate solutions. The parton subdivision method can suppress the causality violation, but it changes event-by-event correlations and fluctuations and is also computationally expensive. Recently, we have found a new collision algorithm that gives much more accurate solutions.¹ In addition, a novel parton subdivision method was proposed for box calculations and found to be much more efficient. This new subdivision method allows one to choose a large subdivision factor (on the order of 10^6) to essentially eliminate the causality violation and has been implemented in a parton cascade code (ZPC).¹ The parton transverse momentum (p_T) distributions from the new collision algorithm were shown to agree well with the theoretical equilibrium values; however, it is not yet known if it also gives the correct time evolution, e.g., the correct $p_T(t)$ distribution before equilibrium is reached.

The dynamics of dilute relativistic gases can be modelled by the relativistic Boltzmann equation (RBE). Unfortunately, this equation is notoriously difficult to solve analytically. Recently, an exact analytical solution to the RBE was found for a system of massless particles in a Friedmann-Lemaître-Robertson-Walker (FLRW) metric.² This solution gives the exact time evolution of the particle momentum (p) distribution function $f(t,p)$, from which $p(t)$ and $p_T(t)$ can be derived. In this work we compare our ZPC results in box calculations with this exact solution. For the first time, we verify that results from the parton subdivision method fully agree with the exact time-dependent solution of the Boltzmann equation at finite densities. In addition, we find that the time evolution of $p(t)$ from the new collision algorithm agrees well with the exact solution.

[1] X. L. Zhao, G. L. Ma, Y. G. Ma, and Z. W. Lin, Physical Review C 102, 024904 (2020).

[2] D. Bazow, G. S. Denicol, U. Heinz, M. Martinez, and J. Noronha, Physical Review Letters 116, 022031 (2016).

What impact does student-centered classroom discourse have on students' use of scientific language?

Myrna Mercurio

Science Education MAED

Mentor: Tammy Lee

The purpose of this study is to determine if student-centered classroom discourse affects student's use of scientific language. This is a qualitative research method. Collection of data will rely on video recordings and descriptions of the classroom discussions to determine whether the use of discourse will improve a student's use of scientific language. The purpose of classroom talk is to get students to expand their thinking and increase their knowledge of the topic. Science classrooms are expected to be hands-on learning environments that allow students to interact with their peers. Students are expected to spend more time talking and discovering things together and for the teacher to become more of a facilitator. Not to supply all the information up front, but to provide an idea or question and have the students take the lead in the discussion of the information.

Workflow for developing multi-generational geometric models of the lung for computational fluid dynamics

Shea Middleton

Biomedical Engineering

Mentor: Ali Vahdati

Computational modeling is well suited to furthering understanding of respiratory mechanics, with the capability to accurately simulate the complex geometry of the lungs. The creation of an image-based computer model of COVID-19 afflicted airways can increase our knowledge of how lungs work in a diseased state. This novel approach will consist of a realistic *in silico* macroscale lung (3D) model coupled with a microscale mathematical (0D) model of the alveoli. Thus far, a patient-specific three-dimensional geometry model has been developed by segmenting and algorithmically expanding on CT imaging data using ANSYS Fluent, ANSYS Workbench, Slicer Chest Imaging Platform, MATLAB, Meshmixer, and Materialise Mimics software. A computer model development workflow has been established and optimized in order to convert data from CT scans retrieved from COVID patients at Vidant Medical Center to a realized, 16-generation 3D lung model that is capable of running computational fluid dynamic simulations that can be validated with results from existing *in silico* respiratory simulations. The workflow consists of using Mimics to segment the geometry of the largest airway generations, then creating a centerline for import to ANSYS, where it can be meshed and represented with node and edge files using a MATLAB script. Lung lobes are also segmented using Slicer software and used along with an algorithm that generates up to the 16th smallest airway generations. The algorithm creates a 3D geometric body that can be refined in Meshmixer to provide a functional, high-quality mesh for CFD simulation purposes. This model will be refined until suitable to couple an adjustable mathematical model representing the alveoli and respiratory airways. Successful completion of this project will further our understanding of respiratory mechanics, which can better inform future clinical approaches and mechanical ventilation parameters of COVID-19 treatment and pulmonary disease treatment.

Exploring the Role of Telehealth to Improve Writing Self-Perception in 7-12 Year Old Students

Virginia Middleton, Emily Berrier

Occupational Therapy

Mentor: Denise Donica

Handwriting is an important skill for students. Good writing skills are needed to communicate with peers, demonstrate classroom knowledge, and prepare children for higher education. Children with handwriting deficits struggle to demonstrate their knowledge in the classroom. These deficits not only lead to poor classroom performance but can also result in a negative perception of their academic capabilities and reduce their self-esteem. Early handwriting intervention addressing letter legibility, shape, size, orientation, alignment, proper postural control, and pencil grip can greatly improve a child's handwriting skills, classroom performance, and perception of performance.

Occupational therapists are equipped to address each of these handwriting difficulties. While these interventions traditionally take place in-person with the therapist physically near the student to provide physical assistance and verbal guidance as needed, during the age of COVID-19, occupational therapy students at East Carolina University explored the use of telerehabilitation services to address this previously identified need. A group of five students between the ages of 7-12 participated in an 8-week long program to address writing skills. Each week students participated in a group warm-up session that incorporated speech and occupational therapy skills followed by two individualized therapy sessions: one with an occupational therapy student addressing handwriting skills and another with a speech-language pathology student addressing spelling skills. After assessing the student's beginning skill level and self-perception, students received unique interventions specifically addressing areas for growth. After the 8-week intervention program, students were reassessed.

This poster session will focus on the occupational therapy-focused portion of this program. It will include an introduction to the benefits of using the assessment tools, an explanation of the Handwriting Without Tears intervention techniques, and include an indication of how the students' outcomes related to their perception of their writing skills. Recommendations for future studies will also be included.

Adsorptive filters to further reduce phosphorus concentrations from treated wastewater

Ashley Miller

Environmental Engineering

Mentor: Natasha Bell

This lab-scale study investigates the effectiveness of using recycled crushed concrete, expanded slate aggregates (Stalite brand), and expanded clay aggregates (Filtralite brand) as adsorptive filters to reduce total phosphorus concentrations from treated wastewater. Elevated concentrations of phosphorus and other nutrients in wastewater treatment plant (WWTP) effluent may contribute to the proliferation of harmful algal blooms (HABs) which commonly lead to fish kills related to aquatic hypoxia, prompting stricter regulatory limits in the near future. The use of low-cost and potentially regenerative phosphate sorbing filters, such as those examined here, has the potential to decrease phosphorus concentrations in WWTP effluent. Experimental adsorptive materials will be packed in 4 inch by 12 inch columns and treated wastewater effluent will be continuously pumped into each column at a target hydraulic retention time of approximately 8 hours for 8 weeks. The efficacy of the phosphate-sorbing filters will be determined by comparing influent total phosphorus concentration to that of the effluent. Based on findings in past experiments, a high removal rate of phosphorous from the wastewater is expected.

The Relationship between Hamstring Strength Deficits and Performance following ACL Reconstruction.

Dasia Mitchell

Athletic Training

Mentor: Anthony Kulas

The anterior cruciate ligament (ACL) injury of the knee is a common and devastating injury in sports requiring reconstruction. Following an ACL reconstruction (ACLR), 81% of patients return to sport, 65% return to their pre-operative sports participation level, and only 55% return to competitive sports. Following ACL reconstruction (ACLR), restoration of knee range of motion and quadriceps and hamstring muscle strength are paramount. The hamstring muscles resist anterior tibial translation and are protective of the ACL. However, cross-sectional studies demonstrated a 20-28% hamstring strength deficit in the surgical limb of ACLR participants compared to the non-surgical limb at 10 years post-operation. In addition, following a 4-week hamstring strength training program, a 19.4% increase in knee angle towards full extension was demonstrated. This shift in knee angle of peak torque to a more extended knee resulted in vertical jump height increases of 6.6%. Therefore, neglecting the importance of hamstring strength deficits after ACLR potentially puts the athlete at risk for re-injury and suboptimal performance. The purpose of this study was to determine if hamstring strength and the knee angle at peak hamstring torque following ACL reconstruction were associated with performance.

10 participants who had undergone ACL reconstruction and 10 healthy participants completed this IRB approved study. Hamstring peak torque and knee angle at peak hamstring torque were measured on a dynamometer under isometric and isokinetic conditions. The performance measures were single leg hop distance, triple leg hop distance and a timed 6-meter hop. For the ACLR group, single leg hop distance was correlated ($r=0.644$, $p<.05$) with isokinetic hamstring strength; triple leg hop distance was correlated ($r=.669$, $p<.05$) with isometric hamstring strength. Lastly, the timed 6-meter hop distance was negatively correlated ($r=-.710$, $p<.01$) with isokinetic hamstring strength. In the healthy group, only the triple hop distance was significantly correlated ($r=.773$, $p<.01$) with isokinetic hamstring strength. The importance of this thesis was to establish association of hamstring strength after ACLR because the importance of hamstring strength tends to be overshadowed by the focus on quadriceps strength. Due to the limitation of sample size, further research should be conducted with larger sample sizes to support or refute these relationships between hamstring strength and performance.

Analyzing the Life History of Southern Flounder through Otolith Microchemistry and the Gonadosomatic Index

Justin Mitchell

Biology

Mentor: Rebeca Asch

Southern Flounder (*Paralichthys lethostigma*) is a key species in the fisheries of North Carolina for both commercial and recreational fishermen but is currently being overfished. Much of this species' behavior and life history remains unknown, but this information is needed to allow for better management of the species. Analysis of the otolith microchemistry and gonadosomatic index (GSI) analysis will be conducted to gain an understanding of the life history of southern flounder. Otolith microchemistry will reveal the movements of these fish, either throughout the waters of North Carolina or if they potentially settle in one body of water as they mature, with maturation determined with the use of GSI. Samples were taken during October through November 2020, 151 fish were collected with 51 individuals from Mann's Harbor in the Albemarle Sound, 55 individuals from West Bay in Pamlico Sound, and 45 individuals from Harker's Island in Core Sound. For each fish we will measure weight (g) and tail length (mm) and remove their left and right sagittal otolith for aging and their gonads. The left otolith will be processed, aged again, and sent for microchemistry analysis. The gonads will be weighed to calculate GSI. Upon initial otolith aging of the flounders sampled, all individuals were aged between 2 and 3 years old. All individuals currently processed have been females. No males have been recorded within the sample group. Males are known to be smaller than females and our capture methods for sampling favored larger fish, possibly excluding the males. Measuring the gonads, the average GSI of the individuals currently processed is 0.89% with a standard deviation of 0.28%. Previous studies on southern flounder GSI in North Carolina provided similar results with average values less than 1%. The anticipated results of this study will shed light on the movements of southern flounder throughout North Carolina's estuaries and sounds and will evaluate whether maturity and size at age schedules differ between these habitats. This will help fisheries managers determine appropriate spatial scales for managing the population, hopefully leading to its recovery.

The Effect Of Mowing and Fertilization on Species Diversity

Kalia Moore

Biology

Mentor: Carol Goodwillie

It is thought that species diversity is maximized when ecological disturbance is present because both weedy species and good competitors can coexist. In addition, nutrient availability maximizes species diversity when it is neither abundant or poor because plant species will not outgrow one another causing light resources to become limited. To be able to determine the validity of this I examined the effect that mowing, fertilization, and the interaction between both have on plant species diversity at East Carolina University's West Research Campus. My research was a part of a long-term study that has been running for 17 years. I analyzed species diversity by recording the stem count and percent cover of all species in four different treatments. The treatments included mowed and fertilized, unmowed and fertilized, mowed and unfertilized, and unmowed and unfertilized (control). After calculating all species present within the treatments, I conducted an analysis of variance (ANOVA) to test what effect my independent variables (mowing and fertilization) had on my dependent variable (species richness), which is defined as the number of different species present within a 1 by 1 m quadrat. The results from my ANOVA test revealed that all independent variables had an effect on species diversity. Fertilization alone decreases species diversity, mowing alone increases species diversity the most, and the effect of fertilizer is greater in mowed treatments. This was concluded by comparing the averages of each independent variable to my control. Mowing and fertilization had an average of 12.25 plant species per quadrat, fertilization alone had an average of 7.71, mowing alone had an average of 15.96, and the control (unmowed and unfertilized) had an average of 7.79. These results show that species diversity is indeed maximized when ecological disturbance is applied but decreased when nutrients are overly abundant.

Maintaining Social Participation and Quality of Life Through Community Mobility After Driving Cessation With Transportation Planning

Kathryn Moore

Occupational Therapy

Mentor: Lynne Murphy

Older adults experience decreased social participation and quality of life after they retire from driving (Donoghue, McGarrigle, & Kenny, 2019). The resources available to older adults after driving cessation can be difficult to access and may not sufficiently address the mobility needs of this population; therefore, older adults' health and quality of life are in jeopardy (Webber, Porter, & Menec, 2010). Occupational therapists have a responsibility to ensure that their clients engage in valued occupations; and for seniors, this is particularly relevant for community mobility. It is critical that they continue participation in valued roles, occupational engagement, and social interaction, ultimately contributing to quality of life.

Individualized transportation planning is occupational therapy's solution to supporting older adults' continued community mobility. The purpose of this study was to explore the influence of transportation planning on the social participation and quality of life of older adults who must cease or restrict driving. Personalized recommendations for alternate means of community mobility were made, utilizing resources such as the *Plan for the Road Ahead*;" website, AARP and insurance guidebooks, and neighborhood-specific mobility options. These tools may facilitate a smoother transition out of the driver's seat, while keeping clients informed, confident, safe, and engaged. Researchers met with retiring drivers and their families, via in-person and virtual hybrid format, to develop individualized transportation plans. Older adults' social participation and quality of life was measured by the Role Checklist (version 3) and the CASP-19 (Control, Autonomy, Self-Realization, Pleasure- 19 questions), administered before and after the transportation planning process. It was hypothesized that transportation planning would prevent the decline in quality of life and social participation that accompanied retirement from driving.

Preliminary results of a small sample have determined that quality of life improved following implementation of the transportation plan, while role participation remained stable. Ongoing data collection and analysis is needed to determine if these results are statistically significant. However, transportation planning appears to enable older adults to remain active, engaged, and satisfied with their quality of life.

Impact of statin therapy on cardiorespiratory fitness (VO₂peak)

Madison Moore

Exercise Physiology

Mentor: Gabriel Dubis

As the third most common prescription in the US, statins are the primary prescription for patients with hyperlipidemia, cardiovascular disease, and metabolic disorders. The American College of Cardiology has also recently recommended health care providers use statins as a preventive measure as well. Nearly 60 million Americans could be prescribed statins to help treat cardiovascular disease in the near future. As a result, research into the side effects of statins has become increasingly important. Recent studies have suggested that statins may interfere with the increase in whole-body cardiorespiratory fitness that normally occurs with aerobic training. Exercise can increase VO₂, which is an indicator of fitness and all-cause mortality. Previous case studies have shown that statins could potentially inhibit the exercise adaptations in regards to aerobic capacity; however, all of the participants were on the same dose of the medication and it was not carefully controlled. The primary aim of the study is to investigate the mechanisms by which statin therapy blocks cardiorespiratory adaptations to exercise training. Cardiorespiratory fitness (VO₂peak) will be measured before and after 12 weeks of aerobic exercise training. Each participant will either be on either a placebo, 20 mg, or 80 mg of atorvastatin. We hypothesize that statin therapy interferes with the cardiorespiratory adaptive responses to exercise.

The rally cry heard across the seas

Mackenzie Mulkey

Anthropology

Mentor: Charles Ewen

In 2019, while excavating a Colonial tavern, the ECU Archaeology summer field school discovered an artifact that would capture international attention. A dirty, pea-sized pebble, was bagged and brought back to the Anthropology department, which after being cleaned, turned out to be a blue glass cufflink gem inscribed with "Wilkes and Liberty 45." John Wilkes, a radical member of parliament criticized King George III in the 45th issue of the pamphlet *The North Briton*. Wilkes was arrested but won his court case signaling a shift in power away from the Crown. The rallying cry "Wilkes and Liberty 45" could be heard from London all the way across the Atlantic to Charleston and Boston and even in the small port of Brunswick, NC where one of the first rebellions against the Stamp Act took place. The revolutionary passion of the American colonies is symbolized in this seemingly insignificant piece of costume jewelry.

PTSD and Opioid Use: Challenges Facing Veterans of Iraq and Afghanistan Wars

Laura Mundt

Nursing

Mentor: Patricia Fazzone

The Opioid Crisis is a national problem caused in large part by the high rate of prescribing or misuse of prescription pain medications. Health care providers are prescribing opioids at high rates to wounded veterans to treat their pain. Post-Traumatic Stress Disorder (PTSD) is a common diagnosis among war veterans and makes such veterans potentially vulnerable to opioid use and misuse. Data indicate that veterans with PTSD are more likely to develop an opioid use disorder than veterans who did not have a prior PTSD diagnosis. For these reasons, the goals of this honors project were to: a) explore select issues about the opioid crisis in this country, and b) to explore the impact PTSD, and opioid use and its addictive nature can have on veterans of the Iraq and Afghanistan Wars. Emphasis was placed on those veterans with co-occurring PTSD. This honors project has both a scholarly and a creative focus: an evidence-based critical review paper synthesizing data from the literature, and two major works of original representational art.

Methods included a focused PubMed search to identify the select data-based articles for relevance and inclusion. The scholarly review consisted of 20 quantitative and qualitative evidence-based publications. A matrix model, and a narrative review served to guide the review process. The qualitative data provided a deeper understanding of the veterans' human experiences when dealing with PTSD, and co-occurring PTSD and opioid use or opioid use disorder. The student kept an ongoing record of recurring themes and powerful images that emerged from the veterans' stories found in the qualitative studies. These themes and images are discussed in the paper and served to inspire her original representational paintings of the veterans' experiences.

This honors project offers an overview of select issues about the opioid crisis as well as a window into the lived experiences of veterans from the Iraq and Afghanistan Wars challenged by PTSD and opioid use or opioid use disorder. The scholarly paper and the veterans' stories in artform offer nurses and other health care providers knowledge and insights into how they can more effectively and compassionately assess and provide care to veterans facing these challenges.

Physical Health Outcomes of Bereaved Parents

Savannah Murphy

Nursing

Mentor: Nancy Dias

Purpose: The purpose of this study is to identify bereaved parents' long-term physical health outcomes, including sleep, and changes in health risk behaviors, such as smoking and drinking alcohol.

Background and Significance: A child's death is one of the most traumatic events an individual can experience. Individuals who experience it are more likely to have adverse health outcomes including increased morbidity and mortality. There is little evidence of long-term health outcomes of bereaved parents in the United States. It is important to study bereaved parents' health outcomes to plan parental bereavement care.

Methods and Analysis: This study used a cross-sectional, survey design to assess bereaved parent's health whose child (0- <19 years) had died within the past 10 years. A convenience sampling technique was used to enroll participants using the decedent database from a tertiary care hospital. Questionnaires were sent to eligible parents using a secured database (REDCap). Questionnaires included a demographic data survey and a survey to assess sleep disturbance (PROMIS Sleep). The demographic survey included assessment of history of past illness (e.g. diabetes or hypertension) and change in smoking and alcohol intake. Participants indicated their overall health perception on a visual scale of 0 to 100. Health risk indicators were summarized using descriptive statistics.

Findings: The data analysis identified sleep disturbances (83%) with 6% reporting more than 1 SD worse than normative data. Sleep disturbance was associated with increased alcohol use since the child's death ($F=8.0$; $p=0.006$). Participants (20%) reported initiating or increasing tobacco or alcohol use after their child's death.

Optimizing Magnetic Mechanical Actuation of Nitrodopamine PEGylated Iron Oxide Nanoparticles for Cancer Therapy

Mahboubeh Nabavinia

Physics

Mentor: Juan Beltran-Huarac

One of the latest cancer treatment approaches focuses on the use of superparamagnetic iron oxide nanoparticles (SPIONs) as magneto-mechanical actuators due to their superior magnetic properties and biocompatibility. SPIONs can target specific tumor areas evading the immune system. Under alternating magnetic field exposure, intracellular SPIONs usually bounded to lysosomal membranes are activated translating magnetic forces into mechanical motion (mostly oscillatory torques). Consequently, these shear forces induce membrane permeabilization and lead to extravasation of lysosomal contents into the cytoplasm thus ultimately inducing cell death. The physico-chemical properties of SPIONs and magnetic field play an essential role in the success of this approach. In this paper, star-like SPIONs are synthesized via thermal decomposition with controlled size distribution. The surface was modified with nitro dopamine polyethylene glycol (ND-PEG) to avoid agglomeration and promote stability in cell culture media. Fourier transforms infrared (FTIR) spectroscopy is used to confirm the chemical bonding between PEG and the surfaces of magnetite. Dynamic light scattering (DLS) data show an average hydrodynamic size of 125 nm with narrow size distribution and proper cell culture media stability for up to 24 hours. This is further confirmed by zeta potential studies in cell culture media at the same time points. Cell proliferation and viability studies for breast cancer (MCF-7) and normal (MCF-10A) cell lines indicate that the nanoparticles are biocompatible even up to 100 $\mu\text{g}/\text{mL}$. Intracellular ND-PEG SPIONs can be activated when exogeneous alternating super-low frequency magnetic fields are turned on. The magnetic field power, frequency, and duration on cell proliferation rate were evaluated to optimize the magnetic field doses and parameters. In this regard, the data were optimized based on the maximum cancer cell death with minimum effect on normal cells. Our finding reveal that star-like ND-PEG SPIONs have the potential to be used as therapeutic actuators in clinical applications.

Greebles, Wiggets, and Bips: The Art of Coalescent Materials

Anthony Naimo

Metal Design

Mentor: Mi-Sook Hur

This presentation will cover how filmmakers use the design technique known as greebling. Greebling refers to detailing an object's surface to make it appear larger, more complex, or technologically advanced. These visual intricacies make the props and sets feel realistic in film franchises like *Star Wars* or *Alien*. I will discuss the narrative function of greebling in film and discuss its various applications over the last 60 years. From this historical overlook, I will analyze how greebling's theme of coalescing materials manifests itself in my art. Though an artwork's raw components may be readily identifiable, these materials surrender their autonomous forms and meaning to generate a new, collective identity when presented together. This phenomenon of transcendence through togetherness is the essence of my artistic process.

Endurance Training to Improve Functional Status in Older and Adult Mice

Nainika Nandigama, Alyssa Fennell

Public Health

Mentor: Theodore Graber

One seemingly inevitable consequence of getting older is a progressive loss of physical function and exercise capacity. Ancillary and contributory to this functional decline are the diseases of sarcopenia (age-related loss of muscle mass and strength) and frailty (inability of the body to maintain homeostasis). We know that exercise can help to preserve muscle mass and improve function in older humans. However, we need to develop animal models to study the underlying molecular mechanisms of functional loss, with the hope of uncovering potential therapeutic targets. In this study, we compare older and adult mouse functional abilities following four months of individualized endurance training: voluntary wheel running (VWR, n=8) or a high intensity interval training (HIIT, n=10) mimetic on a treadmill. We hypothesized that both exercises would improve function, but that HIIT would promote more extensive adaptation. Additionally, we hypothesized that adult mice would receive greater benefit from an equal exercise dosage than will older mice. For four months, the VWR mice spent 4 days/week with a running wheel (outcome is km/day) and the HIIT group ran 3x/week on a progressively difficult protocol (number of intervals interspersed with a resting active recovery) based upon their maximum treadmill running speed. There was significant improvement in physical function and body composition in both exercise groups, similar to that expected by older adult humans undertaking a similar training protocol. However, the results did not support our hypothesis that HIIT would improve function more than VWR. We conclude that our models will be useful for future mechanistic investigations of the intersection of aging, exercise, and functional decline.

Nanoarchitecture and Molecular Interactions of Epithelial Cell Junction Proteins Revealed by Super-Resolution Microscopy

Amna Naser

Biomedical Sciences

Mentor: Yan-Hua Chen

Epithelial cells are polarized with defined apical tight junctions (TJs), lateral adherens junctions (AJs), and basal integrin-matrix interactions. However, it is increasingly recognized that their characteristic resident proteins can be found in each other's territories with previously unrecognized functions. This study presents the nanoarchitecture and nano-colocalization of cell junction proteins in culture and in tissue by Stochastic Optical Reconstruction Microscopy (STORM). Protein distances within each junction were visualized to be < 50 nm but ~ 100 nm or more between different junctions. The Z-axial view of non-cancerous MDCK-II cell-cell junction resolved β -catenin and p120ctn localizations into milieu of TJ and AJ. This is accompanied by the distinctive displacement of p120ctn being apical to β -catenin. Towards the basal direction, p120ctn and β -catenin become colocalized. Interestingly, this topography is lost in isogenic Ras-transformed MDCK cells (MDCKf3), in that p120ctn localization becomes basal to β -catenin. The deletion of TJ protein claudin-7 is sufficient in altering the polarity of p120ctn to β -catenin localization like that seen with MDCK-II to MDCKf3 or normal prostate to metastatic prostate cancer cell phenotypic transformation. Loss of claudin-7 also disrupted distribution of several other cell junction proteins. Therefore, STORM revealed the regional nanoarchitecture of cellular junctions that were previously unavailable, providing new insights in their potential trans-compartmental modulation of protein functions.

Machine Learning Techniques Applied in Software Development Life Cycle, Where and how?

Maryam Navaei

Software Engineering

Mentor: Moha Nassehzadeh-Tabrizi

This research concludes an overall summary of the publications so far on applied Machine Learning techniques in different phases of Software Development Life Cycle (SDLC) that includes requirement analysis, design, implementation, testing, and maintenance. We have performed a systematic review of the research studies published from 2015-2020 and show why the numbers vary significantly from one phase to another. Based on our observations, Software requirements analysis phase has the least number of papers published focused on Machine learning techniques due to lack datasets available, in contrast, Software testing is the phase with the greatest number of papers in data analytics because of its mathematical nature.

A Cross-sectional Assessment of Human Milk Oligosaccharide Composition of Breast Milk of Vegan, Vegetarian, and Non-vegetarian Mothers

Jessica Neville

Nutrition

Mentor: Roman Pawlak

Background/Objectives: Human milk oligosaccharide (HMO) composition is influenced by genetics, geographical location, lactation stage, and gestational age. Recently, maternal nutrient intake has been associated with HMO composition. The primary goal of this study was to assess HMO composition in breast milk samples from vegan, vegetarian, and non-vegetarian lactating women. The secondary goals were to assess the impact of a mother's 2'-Fucosyllactose (2'FL) secretor status, BMI, age, parity, and lactation stage on HMO composition.

Subjects/Methods: A cross-sectional analysis of HMO from vegan (n=26), vegetarian (n=22), and non-vegetarian (n=26) lactating women. The majority of participants reported taking vitamin supplements.

Results: In an unadjusted, bivariate model, there was no difference in individual HMO composition, total fucosylated and sialylated HMOs, or diversity and evenness scores by diet group. When adjusted for between-group differences (i.e., maternal BMI and lactation stage), no significant difference in HMO composition were observed. Maternal secretor status was significant for 13 of the HMO analytes, with the strongest positive relationship found in total HMOs ($\beta = 0.922$), total fucosylated HMOs ($\beta = 0.910$), and 2'FL ($\beta = 0.790$), and the strongest negative relationship with LSTb ($\beta = -0.544$). Additionally, lactation stage was significant for 8 of the HMO analytes, with the strongest positive impact on 3SL ($\beta = 0.433$), and the strongest negative impact on 6SL ($\beta = -0.519$). Maternal BMI had a significant positive relationship with total HMOs ($\beta = 0.113$) and 3SL ($\beta = 0.325$).

Conclusions: These findings suggest that lactating women who consume a vegan diet that includes B-vitamin supplements do not produce nutritionally inferior breast milk as it relates to HMOs composition

Phenology in a Changing Environment: Ecological Forecasts of the Albemarle Sound/Roanoke River Striped Bass Stock Migration

Quentin Nichols

Biology

Mentor: Rebecca Asch

Climate change and climate variability are leading to shifts in the seasonal timing of fish migration and reproduction (i.e., phenology) across many ecosystems and species, with changes especially common among anadromous fishes, such as Striped Bass (*Morone saxatilis*). Understanding how Striped Bass will be affected by climate change is an important issue for stakeholders across the US East Coast given its use as a recreationally and commercially targeted species. Other spawning populations of this species vary their spawning migration timing with respect to seasonal temperatures. North Carolina hosts the Albemarle Sound/Roanoke River (A/R) stock, which is the southernmost major spawning population of Striped Bass. This study's objective is to create an ecological forecast of the timing of the Roanoke River spawning run, which can be used to determine the best time to protect large spawning females. The study will use historical data from a Striped Bass egg survey and creel survey conducted from 1959-1993 to model spawning migration timing as a function of river and coastal temperature, regional climate indices, dissolved oxygen concentration, wind speed, river flow pulse duration timing, and Striped Bass population size structure. The forecast will be split into two different models, one based on egg survey data and the other based on creel survey data due to the differences in the average date of key phenology events. The two surveys have a two-week difference in average day of the beginning of the migration and the creel survey suggests that the migration length is eighteen days longer than the egg survey suggests. These key differences reflect that spawning activity and migratory patterns of adult Striped Bass are different biological processes. Initial analysis of temperature data from Roanoke River and Virginia Beach area shows very similar modes of variability from 1960-1993. The forecast will make the fishery and the management of the fishery more efficient by providing a predictive tool to its stakeholders, which could allow them to adapt the seasonal closure, seasonal fishing effort, or water releases from dams to changing spawning times.

Dining Choices in Social Situations

Alexandra Nicoletti

Psychology

Mentor: Michael Baker

Social interactions play a key role in meal choice. Decisions on meal choice are made on factors such as personal preference, nutrition knowledge, convenience, hunger levels, economic factors, and psychological factors. When dining with a stranger, individuals may choose a meal they believe will leave an impression on their dining partner. The purpose of the current study is to understand the role of social factors on meal choice, specifically the role of perceived attractiveness of an individual. After arriving at the laboratory, two participants who were previously unacquainted spent time getting to know each other. Next, participants were provided with a menu to a fast-casual restaurant and asked to consider what they would order if they were in a restaurant ordering a meal for themselves. Participants who were randomly assigned to a private order condition were asked to not discuss their order with their partner, while those who were randomly assigned to a public group condition were asked to discuss and take their partner's order. Finally, participants completed questionnaires measuring their relationship status, social motives, social interaction anxiety, self-presentation, and their opinions about the other participant who they met during the experiment. Our primary hypothesis is that among heterosexual individuals who are not currently in a romantic relationship and who tell their partner their order, individuals will choose meals with fewer calories when they perceive their opposite-sex partner as attractive. We also predict that the appearance of face-masks during the second-half of data collection will result in higher ratings of attractiveness for heterosexual individuals.

An investigation into the accurateness of assessments for English Language Learners

Tanya Novakowski

Science Education MAED

Mentor: Tammy Lee

Concerns about how to ensure equitable assessment of English-language learners (ELLs) are longstanding. This study looks at the relationship among reading and science in relationship to the fairness of science assessments. It addresses the differences in multiple choice and open-ended assessment results. Both open-ended and multiple-choice items have warrants for their use. Multiple choice items can be written that require sophisticated mental processing and an understanding of complex ideas to answer them correctly (Herrmann-Abell, 2019). Open-ended response items require students to form their own response, something that multiple choice-items cannot (Herrmann-Abell, 2019). According to the Next Generation Science Standards, open-ended assessments are a more authentic way to assess students' content knowledge and ability to use practices in science. Students are able to form their own answers and use language they are comfortable with. Assessment results from sixth grade ELL and non-ELL students will be analyzed to determine which assessment type shows greater achievement results.

Doves on their Milky Way: Exploring the Effects of Crop Milk on Captive Bird Health and Microbiome Composition

Kristen Orr

Biology

Mentor: Susan McRae

Mammals are often thought to be unique among animals in that they alone produce milk for their offspring. In reality, a range of animals across the tree of life have evolved to produce substances that are functionally similar to mammalian milk. This unique provisioning ability can be observed in pigeons and doves where both males and females produce a substance called crop milk that they feed to their young. Crop milk has been shown to not only provide nutrition, but also to help jumpstart offspring immune systems. However, many questions remain: How exactly does crop milk impact chick health in the short term and long term? Are there microorganisms present in crop milk that are essential to chick health? What happens to chicks raised without crop milk? To better understand how this substance impacts the health of chicks, we reared thirty ringneck dove chicks within one of three treatment groups: hand-raised with a formula, hand-raised with a formula plus crop milk supplements, and parent-raised with crop milk. As the chicks aged, we measured growth rates and took fecal samples to determine the composition of their gut microbiome. Preliminary analysis of growth rate data shows that parent-raised birds have higher body condition later in life when compared with hand-raised birds receiving formula plus crop milk supplements. Birds receiving no crop milk showed higher variability in body condition. We'll discuss the implications of these findings as well as other potential findings that could emerge from this study.

Components of Sexual Satisfaction As Identified By Emerging Adults

Ramsey Osborn

Public Health

Mentor: Karen Vail-Smith

Background and Objectives: Presented are preliminary findings of an examination of the components of sexual satisfaction as identified by college students. Sexuality researchers and educators support the incorporation of the components of desire, pleasure and satisfaction in comprehensive sex education, but most research in this area focuses only on adult populations. The goal of the present research is to examine how sexually-active, heterosexual emerging adults rated the importance of various factors to sexual satisfaction during partnered sexual activity.

Method: Self-reported, anonymous electronic surveys were administered to a convenience sample of 2151 undergraduate students in a required personal health class. **Results:** The majority of both males and females indicated that all but one of the 27 satisfaction factors presented were "somewhat important" or "important" to their their own satisfaction during partnered sexual activity. Differences between males and females are identified.

Conclusions: Among emerging adults, positive and satisfying sexual experiences can lay an important foundation for achieving the developmental task of becoming sexually healthy adults. These and findings from further analysis of our data can inform comprehensive sexuality education efforts that effectively incorporate the teaching of satisfaction into sexual health curricula.

Dissertation update: Safe havens and hotspots; ionizing radiation in Martian permafrost and its influence on the survival of ancient life

Offormata Osunkwor

Biomedical Physics

Mentor: Regina DeWitt

Mars was once warmer and wetter and permafrost on Mars is considered a primary target for the search for dormant life. If microbial life has once existed on Mars, different environmental factors would have influenced the survival of dormant life and preservation of DNA. Among these are safe havens and hot spots in the radiation environment. I am carrying out a quantitative study to characterize microscopic variations of ionizing radiation in permafrost and their impact on dormant life. In this presentation I am summarizing the initial two phases of the project and my current progress:

(1) Experimental: I use Optically Stimulated Luminescence (OSL) dosimetry to measure local dose variations. Well-characterized analog samples have been prepared and different types of dosimeters have been buried in the samples.

(2) Computer models: I am developing a Monte Carlo model for radiation transport in sediment, based on the Monte Carlo code *DosiVox*. The model has been set up and initial simulations have been carried out to validate the code

In the presentation, I will discuss the rationale for selecting specific analog samples. I will present the Monte Carlo model and initial results. I will discuss how the code will be validated by means of the measurements and I will describe the next steps toward characterizing radiation in Martian permafrost.

Investigating the Role of Cysteine Residues in Acyltransferase Functionality

Matthew Pahl

Molecular Biology and Biotechnology

Mentor: Patrick Horn

Triacylglycerols (TAG) are biomolecules found in all organisms comprised of three fatty acid chains esterified to a glycerol backbone. In humans, TAGs are important energy storage reserves whose overproduction are associated with diseases such as obesity, diabetes, and heart disease. TAGs are also important for plant growth and development, in particular for seed lipid (or oil) reserves, as decreased TAG production is associated with poor quality seeds incapable of germination. As extractable chemical feedstocks, TAGs are a major component of biodiesel production, a green fuel source that is domestically produced and burns cleaner than typical petroleum-based fuels. Biochemically, the most common and rate-limiting final step for generating TAGs requires a diacylglycerol acyltransferase (DGAT) enzyme. This enzyme esterifies a fatty acyl-CoA to a diacylglycerol molecule. Despite its importance, the membrane-spanning topology and hydrophobicity (40% hydrophobic amino acid residues) of DGATs has prevented determination of its three-dimensional structure until recently. Plant DGAT enzymes contain cysteine-associated domains (e.g. CXXC) that are reminiscent of redox-regulated switches and may be important for DGAT structure/activity (and therefore TAG accumulation). We are performing site-directed mutagenesis on several highly conserved cysteines and characterizing the associated lipid production levels in the model systems yeast, tobacco, and *Arabidopsis thaliana*. The lipid amounts and compositions produced from the mutated enzymes, along with protein amounts from western blots, will be compared to the wild-type to determine how the cysteine mutations affect DGAT-catalyzed TAG production. This study will result in information to guide the strategic bioengineering of DGATs that could lead to improvements in biodiesel production, animal feed, and specialized dietary supplements produced by oleaginous plants or microorganisms.

Comparative analysis of testicular tumors in man and man's best friend

Megan Pallozzi

Biology

Mentor: Christopher Geyer

Testicular cancer is the most common cancer in men aged 15-35 and is thus a diagnosis that negatively impacts many men early in their lives. Testicular cancer is also quite common in dogs, but comes with several differences compared to the human counterpart. While testicular cancer typically occurs in young men, it is commonly found in older dogs. An additional difference is the cell type of origin - in men, the vast majority of testicular cancers are germ cell-derived, while in dogs most originate from epithelial Sertoli cells or interstitial Leydig cells. The exact cell type of origin can be difficult to define, as tumors often have a mixture of involved cell types. Also, the etiology of testicular cancers is poorly understood, and there are few molecular markers available for the clear diagnosis of specific tumor type. Although the prognosis for men (and dogs) diagnosed with testicular cancer is relatively good following surgical removal of the affected testis, the decision to follow up with radiation or chemotherapy is a difficult one to make based on our limited understanding of testicular cancer development and progression. Here, we present an analysis of human and canine case studies that examines distinct histological and protein marker expression changes in normal and abnormal (tumor-containing) testes. Results will be compared to published reports in the literature and data of previously conducted studies, with the goal to provide clearer diagnostic and prognostic tools for testicular cancers in both humans and dogs.

Emergent Coordination of the *Chkb* and *Cpt1b* Genes in Eutherian Mammals: Implications for the Origin of Brown Adipose Tissue

Bhavin Patel

Public Health

Mentor: Brian Shewchuck

Mitochondrial fatty acid oxidation (FAO) contributes to the proton motive force that drives ATP synthesis in many mammalian tissues. In eutherian (placental) mammals, brown adipose tissue (BAT) can also dissipate this proton gradient through uncoupling protein 1 (UCP1) to generate heat, but the evolutionary events underlying the emergence of BAT are unknown. An essential step in FAO is the transport of cytoplasmic long chain acyl-coenzyme A (acyl-CoA) into the mitochondrial matrix, which requires the action of carnitine palmitoyltransferase 1B (CPT1B) in striated muscle and BAT. In eutherians, the *CPT1B* gene is closely linked to the choline kinase beta (*CHKB*) gene, which is transcribed from the same DNA strand and terminates just upstream of *CPT1B*. *CHKB* is a rate-limiting enzyme in the synthesis of phosphatidylcholine (PC), a predominant mitochondrial membrane phospholipid, suggesting that the coordinated expression of *CHKB* and *CPT1B* may cooperatively enhance mitochondrial FAO. PC is also a crucial component of many other cellular membranes including the formation of multilocular lipid droplets present in activated brown adipocytes. Our findings indicate that the transcription of the eutherian *CHKB* and *CPT1B* genes is linked within a unitary epigenetic domain targeted to the *CHKB* gene, and that this regulatory linkage appears to have resulted from an intergenic deletion in eutherians that significantly altered the distribution of *CHKB* and *CPT1B* expression. Based on the timing of this event relative to the emergence of BAT, the phylogeny of *CHKB-CPT1B* synteny, and the insufficiency of UCP1 to account for eutherian BAT, our data suggest the regulatory linkage, as a result of the intergenic deletion between the *CHKB* and *CPT1B* genes, allowed for an elevated basal metabolic rate and the emergence of BAT through the acquisition of a novel ability for adipocyte FAO in eutherian mammals where UCP1 was already present but not fully equipped to perform nonshivering thermogenesis.

Knowledge and Perception of Aging and Older Adults among Allied-Health Students

Puja Patel

Public Health

Mentor: Oyinlola Babatunde

Background: The population of older adults (65+) is rapidly increasing globally.^{1,2} The demographic shift is becoming a public health concern due to the socio-economic impact and demands on the healthcare system to support this vulnerable population and ensure healthy aging. However, published work have reported misconceptions and stereotypes, which may impact future healthcare workers' choice to work in geriatrics.³⁻⁵ The allied health professionals are a vital part of the workforce, but compared to other health sciences (medicine/nursing), there are few published works on the knowledge and perception of older adults.⁶⁻⁹ The purpose of this study was to evaluate ECU College of Allied-Health Sciences (CAHS) students' knowledge and perception of aging and older adults.

Methods: A cross-sectional study design, using the Revised Palmore Facts on Aging Quiz (FAQ),¹⁰ administered online via Qualtrics assessed CAHS students' knowledge and perception of older adults and aging. Demographic data was collected. Data was analyzed using SPSS 27 with significance set at $p=0.05$.

Results: A total of 130 students, [mean age 26.30 (S.D. 7.39)] from all the CAHS majors (undergraduate/graduate) completed the survey. Majority of the participants were female (91%). The total correct responses on the FAQ ranged from 11-41 [mean 27.83 (S.D.5.58)]. Correct responses were categorized into three groups, similar proportion (36.6%) had low ($=<26$) and medium (27-31) scores, and 26.2% scored $=>32$ (high). Age and number of gerontology focused courses previously taken made significant contributions to the total FAQ score ($p = 0.026$).

Discussion/Conclusion: Based on the findings, knowledge of older adults and aging was low among the participants, similar to other published work.⁶ Researchers recommend that increasing knowledge about the aging population may help improve perception towards the elderly and possibly gain interest in working with older adults to meet the workforce demand.^{5,8} Considering number of gerontology focused courses taken contributed to total knowledge score, including coursework about aging and experimental learning in the curriculum might promote positive perception towards older adults and attract allied health graduates to respond to the healthcare workforce need. The gender difference, a limitation in the study, is a representation of ECU and College student demographics. Further research with a larger pool of students and longitudinal design is recommended.

Characterizing the role of *Tnpo-SR* in Oogenesis

Kaylee Patterson

Biology

Mentor: Elizabeth Ables

Roughly 7.3 million women in the United States use fertility services in their lifetime. Understanding how cellular signaling pathways impact reproductive health is vital to improve human health. In humans, germ cells undergo mitotic divisions prior to establishing an oocyte that will undergo meiosis. Mitotic divisions establish the pool of available oocytes; however, these occur early in embryonic development, long before females reach reproductive maturity. *Drosophila melanogaster* ovaries are a good model to study reproductive processes because the mitotic divisions of a precursor cell, called the cystoblast, happen in adulthood, where they are easier to study. Cystoblasts form from germline stem cells (GSCs) and undergo exactly four mitotic divisions before specifying an oocyte that switches to meiosis. *Drosophila* have many genes that have human homologues, allowing research in the *Drosophila* ovary to be applied to human reproduction. This research investigates the role of a transporter protein, Transportin- Serine/Arginine rich (*Tnpo-SR*), a homologue of mammalian *Tnpo3*, in the cell cycle. Previous research in our lab utilized the *Flippase/Flippase Recognition Target (Flp/FRT)* mediated clonal analysis in *Tnpo-SR* mutants and discovered mitotic divisions cease prematurely. In cases where mitotic divisions do complete, meiosis fails to start, and the oocyte is not specified. This technique does not allow for the specific timing of *Tnpo-SR* to be regulated; so, it is unclear why the mitotic divisions stopped and whether meiotic induction depends on timely *Tnpo-SR* expression. Using the UAS-Gal4 RNAi system in conjunction with a variety of germline drivers, the timing of required *Tnpo-SR* will be determined. Based off preliminary RNAi data, *Tnpo-SR* shows to have a role in cyst division, oocyte specification, and cyst encapsulation in as early as the GSCs - matching the *Flp/FRT* results. This project will showcase findings from germline-enhanced knockdown of *Tnpo-SR* at different time points and utilizing different tools developed in this lab to showcase these defects. This data will also shed light onto new hypotheses regarding the role of *Tnpo3* in human oogenesis.

The Genus *Cantius* and the Phylogenetic Importance of North American Primates

Dakota Pavell

Anthropology

Mentor: James Loudon

This research focuses on the morphological adaptations of *Cantius*, a genus of extinct nonhuman primates that lived in North America during the Eocene Epoch approximately 56-32 million years ago. My research focuses on the facial and dental morphology of these primates. To examine these elements, I have scanned fifteen *Cantius* specimens, which include several teeth and mandibles, using a micro computed tomography (CT) scanner. These scanned images are then imported into Avizo, a visualization software which creates three-dimensional reconstructions. Avizo reconstructions allow for precise analyses of the skeletal elements and teeth, and allow for quantitative comparisons not only between specimens in this study, but also to hundreds of specimens published to an online platform such as MorphoSource. Preliminary results would suggest that the morphological traits of the genus *Cantius* are primitive and may be ancestral to other extinct North American primate genera including *Northarctus*, *Smilodectes*, *Copelemur*, and *Pelycodus*. A complete analysis of these data may improve our understanding of current nonhuman primate resiliency and provide insights into the factors that have led to the extinction of some species, and the persistence of others.

Independent Study on How Small Businesses Are Utilizing Ecommerce and Social Media Platforms During Covid-19.

Amelia Pellow-Summers

Fashion Merchandising and Consumer Studies

Mentor: Tiffany Blanchflower

The purpose of this study is to see the effects that Covid-19 has had on local, small owned businesses and whether or not they have incorporated e-commerce and social platforms to aid in overall economic prosperity. These small businesses are located throughout several North Carolina cities such as Raleigh, Wilmington and Greenville. To obtain results, interviews are being conducted with each business and being recorded via Zoom for further reference. Based on the responses from the interviews, data will be collected from their feedback in order to identify if smaller businesses are utilizing online platforms to generate business. There will also be a post survey, delivered several weeks after the interview takes place in order to see if the businesses are still approaching e-commerce and social media the same. This will also produce another set of data, that will reflect a time difference. The hope is that these interviews and data collected will create insight into the world of small businesses, how they are currently operating and how they are shifting their strategies in order to still be successful.

Validation of a Novel Mouse Model of Cox6a2 Knockdown

Ananya Pentakota

Biology

Mentor: Joseph McClung

Peripheral arterial disease (PAD) is a vascular condition caused by atherosclerosis in the peripheral arteries, most commonly the ones supplying blood to the lower extremities. Chronic limb threatening ischemia (CLTI) is the most severe clinical presentation of PAD. CLTI is characterized by ischemic pain at rest, tissue necrosis, and gangrene. There are currently no effective treatment options for CLTI patients, despite its association with high mortality rates and limb amputation. We identified a unique mitochondriopathy in CLTI patient limb skeletal muscles that is recapitulated in a preclinical mouse model of PAD, hindlimb ischemia (HLI). We further identified reductions in cytochrome oxidase 6a2 (Cox6a2), a regulatory protein subunit of cytochrome c oxidase (complex IV of the mitochondria) in the limb skeletal muscle mitochondria of both CLTI patients and BALB/c mice. Cox6a2 is expressed only in mature, striated muscle (skeletal and cardiac) and is a potential genetic modifier of tissue loss in HLI. This project was designed to: 1) validate a novel, inducible model of skeletal muscle specific Cox6a2 knockdown in ischemia resistant C57BL/6J mice, and 2) determine whether Cox6a2 was required for muscle survival and regeneration after the onset of HLI. After following a prescribed breeding scheme, genotyping confirmed the creation of the desired HSA-MCM;Cox6a2^{fl/fl} mice. Subsequent experiments established the validity of skeletal muscle specific Complex IV deficiency as central to the ischemic mitochondriopathy and myopathy that occurs in the peripheral limb of mice. Together, this data suggest that skeletal muscle Cox6a2 is necessary for the effective resistance of ischemic limb tissues to myopathy and mitochondriopathy and establishes a new target for therapeutic intervention.

JSTOR Miner: A Software Framework for Data Mining Archival Bibliometric Metadata

James Philips

Software Engineering

Mentor: Moha Nassehzadeh-Tabrizi

Text mining is the application of data mining techniques to semi-structured and unstructured text. Traditionally, it has been extensively applied in the field of bioinformatics. In contrast to the structured, relational data often utilized in traditional data mining tasks, text mining often targets the mining of various types of “documents”, including web pages, e-mail messages, social media posts, electronic publications including e-books and digital articles, and even simple plain text files. It is an interdisciplinary domain, incorporating techniques from several subfields of computer science, including machine learning, information retrieval, and natural language processing. Unlike information retrieval's emphasis on matching relevant documents with a user's query, text mining emphasizes the analysis of text and recognition of patterns in textual data. Bibliometrics are attributes regarding published works that can be measured and studied quantitatively. Frequently, they are used to measure impact of contemporary publications and track research trends. Yet, archival bibliometrics are “forgotten data” that is likewise rich with potential for data mining methodologies. In this research, we present a novel software framework in the Python programming language for text mining bibliometric metadata from archival datasets. After discussion of related work in the fields of bioinformatics and humanities text mining, we discuss our project's methodology, the implementation of our framework, and results. We discuss the crafting of association rules for metadata extraction. We evaluate our framework on an archival historiographic dataset drawn from the JSTOR academic archive and demonstrate the viability of our framework's approach for data mining comparative, historiographic bibliometrics from archival datasets.

EXPLORING NORTH CAROLINA HEAD START TEACHERS' PERCEPTIONS OF THE PROFESSIONAL LEARNING COMMUNITY COLLABORATIVE FRAMEWORK

Lane Philips

Human Development and Family Science

Mentor: Archana Hegde

Professional learning communities (PLCs) are acknowledged within the field of education as a tool to foster professional collaboration, but empirical research into their development and use within early childhood education contexts is uncommon. There is a large body of research that reports the benefits of PLCs on student achievement and the professional development of teachers at the K-12 level, while more recently scholars have reported that the characteristics of effective school-based PLCs may also be applicable to early childhood settings. This existing research guides the current study on teacher perceptions of collaboration and PLCs in North Carolina Head Start programs. The research conducted in K-12 settings suggests there are various critical areas that must be considered to successfully implement the PLC framework. These critical areas include, but are not limited to, administrative support, positive teacher attitudes, and accessibility to a space and time to meet. While these critical areas have been identified in the K-12 context, we do not know the relevance of these considerations to North Carolina Head Start teachers. The goal of the current study is to identify which, if any, of these considerations apply in the North Carolina Head Start context. We address this gap in the current literature by conducting semi-structured interviews with North Carolina Head Start teachers that investigate the following research question: What are the common lived experiences of North Carolina Head Start teachers with professional collaboration? We further examine their perceptions, beliefs, and thoughts about PLCs, specifically, as a professional development tool. Teachers are the key members of a PLC in any educational setting, so it is important to know their perceptions in order to foster long-term success and buy-in.

Zooming Through Number Talks

Savannah Phillips

Elementary Education

Mentor: Monica Gonzales

In this time of COVID-19, teachers across North Carolina are learning a variety of new technologies to teach online. As a preservice teacher, I felt like my experiences of learning a new teaching practice while simultaneously learning to teach online are relevant to the current teaching conditions. My thesis advisor and I wanted to share my story of what I learned about implementing virtual number talks with North Carolina teachers in hopes that they too would try this beneficial teaching practice with their students.

This article provides background information on number talks and how it helps third grade students build fact fluency with multiplication. Then I describe the study I completed for my honors thesis project when instruction moved online in the spring semester of 2020. Finally, I provide insight into the tensions that arose during this study and how to address those tensions if other teachers decided to implement virtual number talks with their own students.

Effects of Dual-Task Training on Cognitive-Motor Learning and Cortical Activation in Healthy Young Adults

Tyler Phinizy

Exercise Physiology

Mentor: Swati Surkar

A dual-task (DT) paradigm requires concurrent performance of two tasks, usually a cognitive and motor task that can be performed independently and have distinct, separate goals. Since attention needs to be divided, limited central processing capacity results in interference and functional performance deficits. Numerous studies have investigated the effects of DT training in healthy individuals and individuals with neurological disorders. However, the DTs included are limited to simple tasks that do not involve complex interactions of various systems required for dynamic postural control. Moreover, there is a paucity of knowledge in understanding the effects of complex DT training on cortical activation. Hence, the purpose of this study is to assess the effects of dynamic stability DT training on performance and prefrontal and vestibular cortical activation in healthy young adults. Dynamic postural stability is an integral aspect of postural control, which involves complex interaction of somatosensory, vestibular, and visual systems. It is important to systemically study the interference of an additional attention-demanding task, such as an auditory reaction time task on interaction of these systems. Moreover, it is important to investigate if complex DT training can reduce motor-cognitive interference and improve postural stability. Our DT paradigm involves balance on a dynamic stability platform combined with a simple and complex auditory reaction time task. The motor task requires participants to stand on a dynamic stability platform and keep it as level as possible. The cognitive task requires response to auditory stimuli. Prefrontal and vestibular cortical activation is assessed with a neuroimaging technique, functional near-infrared spectroscopy. Baseline testing involves performance of each task, the DT, and cortical activation while performing tasks. Twenty adults will receive DT training for 5 consecutive days. Training involves practice of 18 DT trials. Post-training performance on the same baseline measures is assessed immediately after 5-days of training and again 1-week post-training to assess retention effects. Preliminary analysis with two participants showed improved balance performance, reaction time, and DT performance across visits. Plateaus in motor learning were not observed. These preliminary findings suggest promising effects of DT training in healthy young adults to improve postural stability and reduce cognitive-motor interference.

Neuromotor Control Differences in the Upper Extremity Between Those With and Without Rheumatoid Arthritis

Whitney Pierce

Exercise Physiology

Mentor: Nicholas Murray

Rheumatoid Arthritis (RA) causes inflamed synovial membranes that can affect functional ADL's, motor performance, and neuromotor control. The constraints of RA limit the range of motion and functionality of the upper extremity, which will influence movement patterns and potentially modify neural processing. The purpose of this study is to assess neuromotor control differences in the upper extremity between those with and without RA. Using brain activity measurement and motion capture, we expect to find that RA patients generate slower movement times and perform less accurate movements. We also expect that RA patients will adopt different movement patterns than healthy controls due to increased neural processing within the frontal cortex. Fifteen RA patients and 15 age-match controls will complete eight trial blocks manipulating fifteen marbles of varying size while having their brain activity assessed through EEG and fine motor performance measured via Vicon Nexus motion capture system. Results are expected to demonstrate changes in theta and alpha power within event related spectral activity (ERSP) and will correlate with restricted movements in RA patients. Overall, the results will demonstrate the use of EEG as an effective tool to measure cognitive workload in RA patients while performing fine motor tasks.

Numerical Study on Blue Energy Harvesting Under Extreme Ocean Wave Conditions

Hunter Pigg

Engineering

Mentor: Tarek Abdel-Salam

Ocean energy is a promising source of renewable energy, with an estimated potential of approximately 337 GW worldwide, which could re-shape the power generation mix. Reducing the cost of wave energy converters (WEC) is key for the advancement of the technology. One of the biggest cost reduction potentials has been associated with the device structure. WECs must be designed to withstand the largest waves experienced during storms of magnitude equal to their design condition. In this research, computational fluid dynamics (CFD) analysis is conducted to study the performance and the survivability of an enhanced WEC design. The converter selected for this study is an Oscillating Surge WEC. The OSWEC is designed to be operating in shallow waters and it has multiple flaps. The OSWEC is designed to convert ocean wave energy directly to pressure energy that will be used for water desalination. The physical model was created using the SolidWorks CAD program. Numerical analyses are carried out using the boundary element code AQWA for hydrokinetics and the finite element code ANSYS Fluent for extreme wave conditions.

The Impact of Social Media on Individual Interactions with and Experiences in Nature

Jason Pilkington

Recreation and Park Management

Mentor: Jeffery Skibins

Social media has many uses and its reach spans the entire globe. A common theme of posts is people's experiences in nature. This research aims to explore the motivations of why people post about nature and how content affects the interactions with nature for others. This will be evaluated by analyzing the data from a quantitative survey using SPSS software under the approval of the IRB. The hypotheses of this research are as follows:

H1: The motivations for interacting with nature will directly impact the quantity and quality of nature-based experiences.

H2: The motivations for using social media will directly impact the quantity and quality of social media use (i.e., activity and type of posts).

H3: Motivations for nature experiences and social media use will be correlated.

H4: Motivations for nature experiences and social media use will directly impact the quantity and quality of nature-based social media posts.

Based on the analysis of the data gathered, these hypotheses will be supported or not supported, and the subsequent results will be reported. The total impacts of social media are unknown, but the goal of this research is to explore the impact it has on individuals' interactions with nature.

The effects of low-energy protons on the optically stimulated luminescence and thermoluminescence of $\text{Al}_{203}:\text{C}$ and BeO

Joel Pogue

Biomedical and Physics

Mentor: Regine DeWitt

Radiation worker exposure levels are typically measured using personal dosimetry badges. Optically Stimulated Luminescence (OSL) and Thermoluminescence (TL) are methods used to evaluate the radiation dose absorbed by the crystalline material inside the badges. It is necessary to test these materials in a controlled environment to better understand the underlying luminescence processes involved and improve dosimeter properties. One way of delivering a radiation dose in a laboratory setting is via a particle accelerator. The goal of this work is to investigate the effects of heavy ion bombardment on the OSL and TL signals from $\text{Al}_{203}:\text{C}$ and BeO . This presentation describes the design and application of a particle accelerator luminescence beam line, gives an overview of the two types of dosimeters used in this study, and presents heavy charged particle (HCP) luminescence results.

Experimental parameters were systematically varied during proton irradiation to better understand the fundamental TL and OSL luminescence processes of $\text{Al}_{203}:\text{C}$ and BeO . Specific parameters investigated in this work include total energy delivered (irradiation time), proton energy, and energy per unit time (i.e. proton current). Experimental results are shown, and the resulting luminescence signal characteristics are discussed.

Effects of N-linked Glycans on Fibrinogen Turbidity Assay

Grega Popovic

Chemistry

Mentor: Nathan Hudson

Objectives: It has been previously shown that there are four N-linked glycans on the fibrinogen molecule with terminal sialic acids on the carbohydrate chains. They also serve as low-affinity binding sites for Ca^{2+} , whose presence is required for the fibrinogen to fibrin conversion to occur. By using turbidity, which is a method to quantitatively determine the cloudiness or haziness of a liquid, we can observe rate of fibrin polymerization over time. Our goal is to observe the effects of glycan structure on fibrin polymerization by using wild type recombinant fibrinogen and different deglycosylated forms, by treating fibrinogen with two enzymes, PNGase and neuraminidase.

Methods: Turbidity measurements were performed in triplicate, using a BioTek Synergy HT Spectrophotometer in 96 well plates by mixing equal volumes of fibrinogen and thrombin solutions. Kinetics of fibrin polymerization were observed as a function of increase in absorbance over time. Observations on how the deglycosylated forms affect the lag phase (time for change in $A \geq 0.015$), maximum absorbance at 260 nm, and the rate at which the fibrin polymerization was occurring.

Results: The maximum absorbance of the recombinant WT fibrinogen was the lowest amongst all three variants and PNGase treated fibrinogen showed the highest absorbance reading, shortest lag phase and highest rate of kinetics, while neuraminidase treated sample showed higher absorbances and slightly longer lag phase than WT.

Conclusions: With the complete removal of carbohydrate chains after the treatment with PNGase, maximum absorbances that are linked to morphology of fibrin networks showed a drastic increase. Higher maximum absorbance than the WT indicates formation of thicker fibers or higher density of the fiber network in comparison. The initial rate of absorbance increase, which can give us an insight on fibrin polymerization, was also increased in PNGase treated when compared to WT and neuraminidase treated samples. Neuraminidase treated samples showed a delayed lag phase, which indicates that removal of sialic acids potentially diminishes the formation and aggregation of protofibrils, delaying the clotting process, while opposite effects were observed with the PNGase treated samples.

Statin therapy and its impact on muscle mitochondrial function

Harley Powell

Public Health

Mentor: Rosemary Haddock

In the United States there are more than 40 million Americans that treat or prevent hyperlipidemia and cardiovascular disease (CVD) through the use of statins. There is now a growing opinion that there should be a more wide-spread use of statins. With this change in medical views on the use of statins, it is expected that the number of Americans that use this therapy will increase to over 60 million (Stone, et al. 2013); according to the new usage guidelines from the American College of Cardiology and the American Heart Association (ACC/AHA) (Pencina, et al. 2014). While the use of statin therapy has increased and for many is generally well-tolerated, there are still risks. The side effects most commonly reported among statins users include fatigue and/or pain, and moderate muscle weakness, which increases with dosage and length of time statin therapy is used. More serious risks of statins use are developing more severe metabolic conditions which include insulin resistance and type 2 diabetes. It is currently unknown what the underlying causes for these impediments are. In the last few years though, there has been evidence from cell culture and animal models that suggests statins interfere with mitochondrial function in muscle. Based on data provided from *ex vivo* and *in vivo* initial studies in humans, it is suggested that the use of statins invokes a gradual and alarming reduction in the respiratory function of the muscle mitochondria in the skeleton. The aim of this study is to determine if different doses of statin therapy impact the mitochondrial function of skeletal muscle, insulin sensitivity and cardiorespiratory fitness. This study hypothesizes that the decline of mitochondrial respiratory function in skeletal muscle through the use of statin therapy is a result of dose and duration of use, affecting metabolic and cardiorespiratory function.

Balance in Myth

Thaddeus Prevetie

Sculpture

Mentor: Hanna Jubran

Mythology and storytelling have clung to relevance, regardless of the passing of time. This compilation of sculpture represents my fascination with storytelling and inner conflict. The sources of my inspiration and research come from the tales of Greek and Norse mythology. Elemental beings, fantastical creatures, deities, and spiritual balance in the world are the common themes in my sculpture.

Reproductive Coercion: A Systematic Literature Review of the Current Research (2010-2020)

Madalyn Pridgen

Nursing

Mentor: Cheryl Kovar

The purpose of this honors project is to provide a systematic review of reproductive coercion research published through 2021. A search will be done using PubMed, Scopus and Proquest Search. The results will then be imported into Covidence, a systematic review management program. Throughout the screening process, a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart will be used to visualize the narrowing of the literature to the final number of reviewed publications. The PRISMA flow chart will be included in the final systematic review. The studies will be organized using a matrix with five sections. The five sections will consist of authors, sample, methods/instruments, major findings, and a final column to detail the outcome variables used in each individual study (e.g., birth control sabotage, pregnancy pressure, pregnancy outcome pressure, or all three, or one, etc.). The studies will be separated between those that are descriptive of the concept and those that tested an intervention. This tool will be used to synthesize the most up-to-date reproductive coercion literature and find any gaps within the literature. The main goal of this research is to add to the body of knowledge and literature so that future researchers have access to the all published primary research on reproductive coercion and their findings.

Effects of progesterone nuclear receptor on dopaminergic nuclei involved in social aggression in zebrafish (*Danio rerio*)

Allison Priest

Biology

Mentor: Fadi Issa

Aggression is tightly controlled by hormonal and neural regulation in all social animals. Although extensive effort has been invested in studying the neuroendocrine bases of aggressive behavior, our knowledge of the role progesterone plays in regulating aggression remains poorly understood. This is due to the fact that most research investigating progesterone function has been limited to female ovulation and reproduction. Recently, we demonstrated that progesterone nuclear receptor knockout (Pgr KO) male zebrafish display heightened aggression toward conspecifics compared to wildtype (WT) cohorts. However, the neurophysical bases underlying this observation remained unknown. Here we examined morphological differences of brain nuclei associated in social aggression between Pgr KO and WT male zebrafish using the *Tg(dat:EGFP)* transgenic line. Progesterone and dopaminergic systems are tightly intertwined and Pgr is known to be expressed widely in hypothalamic dopaminergic neurons. We hypothesized that heightened aggression will be manifested morphologically in differences in the number of dopaminergic neurons in hypothalamic brain nuclei implicated in social regulation. To test this hypothesis, we measured the number of DAT neurons in the telencephalon and lateral recess (nuclei associated with aggression) and the pre-optic area and pretectum (nuclei associated with submissiveness). Preliminary results of confocal microscopy and automated quantification suggest a reduced number of DAT positive cells in the lateral recess of Pgr KO animals compared to control WTs; while the number of cells in the telencephalon was higher in Pgr KO compared to WTs. Finally, preliminary results show no differences in the number of neurons in the preoptic area or pretectum between Pgr KO vs. WTs. Our results highlight the importance of Pgr in inducing morphological plasticity of brain nuclei associated in social aggression.

The Effects of A Distracted Jump Landing Protocol on EEG and Lower Extremity EMG

Brittney Purcell

Biomechanics and Motor Control

Mentor: Patrick Rider

Previous research has found that lower extremity injuries are predominant in athletes. It has been identified that poor landing mechanics are a strong contributor to the rates of knee and ankle injuries. Electroencephalography (EEG) of motor learning has been researched through simple motor tasks, however, there is limited research on EEG of complex motor movements. The previous research has shown changes in EEG after repetition of the task. The question, however, becomes what knowledge can we gain by observing EEG in dynamic movements? During intense situations, such as during a game, the athlete's attention is typically on the goal of the game and not on things such as landing mechanics. We want to observe landing in athletes in the presence of a distraction to put them in a game-like mindset and observe changes in neural control mechanisms.

Purpose: The purpose of this study is to assess the effects of a distracted jump landing protocol on EEG and lower extremity EMG.

Methods: Recreationally active students from East Carolina University between 18-25 with no pre-existing injuries to the lower extremity will be eligible for the study. EEG of each participant will be taken with a 64 lead cap. Alpha and beta band activity will be observed. The study will consist of 3 conditions, one focused and 2 distracted. EMG of the biceps femoris, lateral gastrocnemius, tibialis anterior and the vastus lateralis will be taken of the participant's dominant leg. Force plate data and 3D motion capture will also be taken during testing.

Significance of the results: The results of this study could aid in finding a deeper understanding of motor learning that can be used to decrease the rates of lower extremity injuries in basketball players. We would also like to use this research to add to the literature by understanding the effects of a landing protocol on EEG for dynamic movements (jumping/landing).

Medspectives - the Podcast about Health Professionals, the Stories of Their Practice, and Their Diverse Perspectives into the World Around Us

Arvind Rajan

Biochemistry

Mentor: Sheena Eagan

Medspectives is the podcast about health professionals, the stories of their practice, and their diverse perspectives into the world around us. The goal of the show is to capture the viewpoints of health professionals in all areas of healthcare, and to ultimately foster a greater public understanding of their different roles. Medspectives currently has a focus on covering the viewpoints and opinions of healthcare workers around the world in addressing the COVID-19 pandemic, as well as the struggles they are facing. The healthcare professionals on the show speak about their personal anecdotes and experiences in medicine in a way that anyone can understand, whether the listener has a background in medicine, or not. This past year, I've had the honor to speak with so many amazing people and they've shared countless stories: empowering stories of overcoming the odds when everything was stacked against them, funny and cute stories about the kid in the emergency room who just wanted a sticker, and heartbreaking stories about the feeling of powerlessness that arose from treating the elderly COVID patient with heart conditions who wanted nothing more than to just breathe. I've learned so much from talking to professionals ranging from an ICU nurse, emergency medicine doctors, paramedics, a trauma surgeon, spine surgeon, a nurse anesthetist among others, and this experience has been extremely eye-opening. A big goal I have in 2021 is to talk with health professionals around the globe to understand their stories and the different issues that face them. This podcast is also my Senior Honors Project, but I hope to continue working on it as a medical student, physician, and beyond.

Find more information here: <https://www.instagram.com/medspectives/>

Kids Run the World, Boys and Girls Club Honors 4550

Lily Redick

Nursing

Mentor: Timothy Christensen

The Boys & Girls Club services children ages 6 to 18 with programs and activities that emphasize development strategies. It provides role models, a safe environment, and constructive activities that focus on overall health. The club depends heavily on community engagement in the form of donors, partnerships, and volunteers. As a group, we noticed the club provided programs focusing on financial responsibility, leadership, and mental health, but lacked the physical health component. We strived to bring this to them in the form of organized activities to promote physical wellbeing. In order to do this, we created a program run by volunteers that work with elementary and middle school-aged children to show them fun and safe ways to exercise. Before implementing this program, we did research to understand the dynamics of the local Boys & Girls Club, what it takes to be effective role models and successes of similar programs. This is when "Kid Run the World" was established and put into action. After volunteering at the Boys & Girls Club for three semesters, we have observed increased physical activity levels and overall morale when group members and athletes are there leading activities. This was successful because of consistent attendance and positive interactions with the children. We learned we needed to have a youthful perspective and engage the kids with exercises they found familiar. Up until COVID-19 restrictions were put into place, our group continued to attend the Boys & Girls Club in Winterville every Thursday for two hours. We engaged with middle school children for the first hour and elementary school children for the second hour. With new community guidelines in place, we have continued our program virtually. The club has many underserved children, and this has provided our group with a unique platform that has benefited both us and the children through increased physical activity levels and community involvement.

Exploring Writing Differences Across Gender in Relation to Self-Efficacy of STEM Students

Elizabeth Reed

Psychology

Mentor: Stephanie George

Research has shown that women frequently report a lower sense of self-efficacy or confidence when compared to male counterparts in STEM fields. Post-surveys from East Carolina University's NSF-funded Research Experience for Undergraduates program, Biomedical Engineering in Simulations, Imaging, and Modeling (BME-SIM), found a significant difference between self-reported confidence levels in research skills between male and female participants. This study utilizes writing samples, faculty feedback and perceptions, and self-reported beliefs regarding research abilities to better explain the lower confidence in research abilities found in the female participants. A sample of 18 pre- and post-program statements were evaluated by a group of 11 faculty reviewers. Reviewers marked-up statements with both comments and highlighting, then completed a survey for each statement rating their perceptions of the student's personal characteristics, statement quality, and their predictions of the student's success. Following data collection, faculty comments were categorized by theme: motivation, confidence, experience in research, experience in other activities, collaboration, and metacognition. Personal statements were also processed through Dr. Ai's writing analysis software, the Web-based Lexical Complexity Analyzer and the Web-based L2 Syntactic Complexity Analyzer, to explore differences in syntactic complexity and lexical complexity among students. Collected data has shown differences between men's and women's personal statements through comparing student's self-reported data, faculty reviews, and writing analysis; however, the finer details of this data are still being worked out.

Supplemental differentiation in a blended/remote classroom via teacher-made videos.

Gerald Reedy

Science Education MAED

Mentor: Tammy Lee

Schools today, of all types and for all ages, have struggled to operate successfully in pandemic mode, with most choosing to go with either a fully online or partially-online-partially-in-person attendance option, and this comes with new, significant difficulties. Although some of the literature on online learning begins with flipped or blended classrooms as early as 1992, it got its first real examination in the first semester of Covid19 management, spring 2020 (Nioki, 2020). This study will investigate whether using teacher-made videos to extend differentiated content to middle and low performing students in a blended/remote honors chemistry class, will impact their test scores positively. Specifically, we wonder if offering interest provoking background (context) information will inspire them to stay with their classwork rather than slack off and/or quit trying (Habig, Blankenburg, van Horst, Fechner, Parchmann, Sumfleth, 2018).

Understanding eHealth and the Patient-Provider Relationship for Undergraduate Students

Michelle Reyes

Biology

Mentor: Heather Vance-Chalcraft

eHealth, defined by WHO as “the use of information and communication technologies (ICT) for health”, is an innovative tool which broadens accessibility of health information and communication between patients and physicians. It can be utilized as an at home method of learning medical information which is cost-effective and can be tailored to an individual’s needs. Within the past few decades, eHealth has grown exponentially in usage alongside technology and become more prevalent for individuals who are proactive in their health, but little is documented about how undergraduates use eHealth or view the patient-provider relationship. This research uses surveys and interviews to evaluate how undergraduates perceive eHealth and the patient-provider relationship. College students frequently use technology and have been assumed from previous studies to utilize eHealth due to convenience and comfort using technology. Little is known about the specific patient-provider relationship model for undergraduates, but a guardian or paternalistic relationship, in which medical decisions are dictated solely by the physician, is perceived as the traditional model with general populations. 528 students enrolled in introductory biology lab courses responded to the survey. We found that students are familiar with eHealth but prioritize medical information from their provider as their medical source followed by family members. Most students indicated that they view their physician more as a counselor or advisor than a guardian, but many other students indicated they were not comfortable meeting with a physician. Students believe they have the skills to understand and utilize health information gathered from the internet although a test of their eHealth literacy revealed many students to have low/median eHealth literacy. This research highlights how physicians and family have a greater influence on undergraduates’ health decisions than information discovered through eHealth sources and demonstrates that undergraduates may view the patient-provider relationship differently than the traditional guardian or paternalistic model. In addition, it raises questions about how to improve the patient-physician relationship so that more undergraduates will be comfortable seeking medical advice from a physician, when needed.

The Monster in Me: Navigating Towards the Mainstream

John Rhodes-Pruitt

Printmaking

Mentor: Heather Muise

The sociological concept of the Other, an object that exists apart from the majority of society, is rooted in ancestral and generational fears. It manifests not only in our media as monsters like the Wolf-Man or The Thing, but also in the fear of those that are different and on the fringes of society. This inevitably leads to the marginalization and disenfranchisement of such groups. My research is an exploration of the experience of the social Other as a fat, gay man through the metaphor of the monstrous Other via images of polycephalic animals.

Investigation into High School Biology Students Academic Performance Using Laboratory Simulations

Connie Richards

Science Education MAED

Mentor: Tammy Lee

This paper investigates the effectiveness of science simulations post the global pandemic in North Carolina high school biology classes. Students that participated in this study spent one-year learning through digital tools and programs. Computers have become increasingly important among educators and play important roles in the classroom and laboratory science instruction (Srisawasdi & Panjaburee, 2015). There was a total of 65 student participants including honors, inclusion, and blended classes. Prior to the Explore Learning Gizmo laboratory simulation, students had synchronous instruction on the topic of cellular energy. They were administered a pretest before the simulation from Schoolnet, a North Carolina End of Course aligned question data base, in Canvas a Learning Management System. The questions were selected by the researcher and the posttest administered immediately following the simulation. The assumption was made that after spending a year in a virtual setting, the laboratory simulation would increase the student's conceptual knowledge on cellular energy. The 1386 students in the high school are primarily Asian and Caucasian. The simulation program used by the students is called Gizmo, designed by Explore Learning, a Marzano based instructional tool. The student data was collected in Canvas and the scores were compared and analyzed using the t-test analysis.

Dynamic social perception in adults with autism spectrum disorders

Hannah Ring

Psychology

Mentor: Kathrin Rothermich

Autism spectrum disorder (ASD) is a neurological condition that is typically diagnosed by the age of three years old. ASD can have a profound life-long impact on social perception, the maintenance of relationships, and communication abilities (Marshall et al, 2008). These impairments have been associated with issues with Theory of Mind, perspective taking, and executive dysfunction, as well as structural brain differences when compared to neurotypical adults. The ToM account seems to be most related to our research question, and it states that individuals with autism are unable to attribute mental states to themselves and/or others. This deficit is apparent through a failure to take other people's mental states into account (Frith, 1989). While many studies, such as Whyte and Nelson, 2015, have described the effects of ASD on social perception in children, there is a lack of research involving adults with ASD. Additionally, there's a need for assessment and training tools that encompass ecologically valid, dynamic stimuli. In order to test the perception of social intentions such as sarcasm, teasing, and prosocial lies, a video inventory (Relational Inference in Social Communication or RISC) that allows for the investigation of inter-personal communication in both neurotypical adults and clinical populations has been developed. The current study uses the RISC videos to examine how adults with ASD and neurotypical adults understand nonliteral language and social intentions. We will also analyze how individual differences in empathy and perspective taking influence the way adults with ASD evaluate social intentions using a set of standard questionnaires. We expect that people with ASD will show a deficit in recognizing the speaker's intention, especially when being confronted with nonliteral language such as teasing and sarcasm. We also predict that participants with higher empathy scores will have an advantage when evaluating what the speaker is intending. The study is currently in the recruitment and data collection phase, and the goal is to recruit n=50 participants from the general population.

An investigation of the effects of manipulated efficacy on reaction time performance in a virtual tennis task

Allison Rogers

Exercise Physiology

Mentor: Christine Habeeb

Teammates impact one another behaviorally as well as emotionally. In sports teams, self-efficacy (Bandura, 1977), the belief in oneself to perform successfully, and collective efficacy (Bandura, 1997), the belief in one's team to perform successfully, are critical to team effort and team performance (Coetzer, 2015). However, it is unknown how self and collective efficacy impact performance of virtual teams. To understand the effect that the new virtual world has on the performance of teams, we need to investigate confidence and virtual performance. This study as a whole will focus on two phases. Phase one will be completed within this semester and solely focuses on how a participant performs individually in a tennis reaction time task. Phase two will include the addition of a virtual partner while completing a modified version of the tennis reaction time task. The task will show a tennis ball at random on either the right or left side of the computer screen, and participants will be directed to click corresponding keys to measure their reaction time and accuracy. The procedure will repeat 30 times within a trial. After the trial, the participant will be given false feedback on their performance in one of two conditions: a) the individual performed in the 93rd percentile, or b) the individual performed in the 37th percentile. Participants will then complete a questionnaire assessing efficacy, emotional states, and attributions for their performance. The participant will complete a second reaction time trial identical to the first and after completion will be informed, they received false feedback after trial 1. Data extracted from 156 participants in the individual version will be analyzed using independent sample t-tests so that differences in efficacy, emotional states, attributions and performance will be compared as a function of performance feedback. Findings from another in-person study conducted using similar protocols indicated that confidence and performance tended to be lower when participants were told they were in the 37th percentile versus the 93rd percentile. We expect to see similar trends within the virtual task as seen in this in-person task. The results of this virtual tennis task will help to understand the impact of how virtual tasks affect teams to further make the connection of how to develop better, more efficient teams for coaches, businesses, and universities in the future.

A Pragmatic Approach to the Evil-God Challenge; Does it Fail?

Zachary Roupe

Philosophy

Mentor: John Collins

I propose that pragmatic reasoning for believing in a good god does not fall prey to the Evil God challenge. The "Evil God challenge" is a philosophical argument that holds that the belief in favor of a supremely good god can be equally mirrored or parodied for the existence of a supremely evil god. God is understood in the traditional theist account as being morally perfect, righteous, omnipotent, omniscient, and omnibenevolent. The challenge raises why it is that belief in this type of god is any more reasonable than the belief in an omnipotent, omniscient, "all-evil" god. Most theists typically dismiss the possibility of such an evil god from existing by claiming the sheer amount of goodness in the world as an obvious example of god's grace. Yet, why is it that the same logical pattern could not point to an "all-evil" god existing, based on the sheer amount of evil and terror that we experience as humans? Theists might also argue that the only reason evil occurs is because it works with the free will given to us by a good god, thus allowing us to choose good actions over evil actions on our own accord. Yet, this can also be mirrored by the evil god challenge by saying that the only reason good exists is because the evil god wants us to have the ability to freely choose evil actions over good actions. These are examples of the type of arguments seen in the evil-god challenge. These defenses are often epistemic in nature. An epistemic reason for believing something is based on direct evidence that that thing is true. Since our direct knowledge of god's existence is quite limited, it can be difficult to epistemically undermine the possibility of the evil-god challenge. It is my belief that in order for the evil-god challenge to be weakened, it can only be pragmatically. A pragmatic reason to believe something is based on the believer's ability to accrue some sort of benefit from believing it. There are several pragmatic arguments for believing in the existence of god that can be merged into the evil-god challenge. I will use philosophical arguments such as Pascal's Wager, the Pragmatic Skeptic, and the Equal Treatment for Belief theory in order to show where the evil-god challenge fails. While skeptics might claim there are pragmatic arguments that can be parodied in support of an evil god, I believe these arguments ultimately fail. Therefore, I conclude that pragmatic reasoning for believing in a good-god cannot be undermined by the evil-god challenge.

Violent Video Game Consumption and Trait Aggression Levels

Tanner Ruffin

Psychology

Mentor: Mark Bowler

Violent video games have been a subject of controversy for the better part of three decades. Concerns about the potential psychological impacts of consuming such content has prompted a number of investigations, all of which seem to come to different conclusions. While many research endeavors have yielded results supporting a positive correlation between violent game consumption and negative behaviors such as aggression, others have found no significant correlations whatsoever. Nevertheless, the continued commercial success of video games that feature violent content makes understanding their psychological impact on consumers ever more imperative. This study will examine the correlation between violent video game consumption and levels of implicit and explicit aggression. Through the distribution of surveys designed to measure video game usage, explicit, and implicit aggression levels to a pool of 1,000 university freshmen, the researchers hope to shed light on the psychological impacts of violent game consumption. This correlational study will build on, and make connections between, existing research regarding trait aggression and potential harmful effects of violent video game usage.

Power Dynamics in Intergroup Interactions, Resource Allocation, and Implicit Theories of Prejudice

Jessica Ruiz

Psychology

Mentor: Marion Eppler

Interracial relations have made their way back to the forefront of the media in recent years. The face of racism has changed, shifting from overt, blatant discrimination, to aversive racism, meaning passing off racist actions as being caused by anything other than prejudice (Dovidio et al., 2002). Implicit theories, also called mindsets, are the internal beliefs held by individuals (Dweck, 1999). In relation to prejudice, those with a growth mindset believe that people are capable of changing their prejudiced beliefs. Those with a fixed mindset believe that prejudiced beliefs are static and unchanging. The present study is a replication of a 2009 study conducted by Saguy, et al. By manipulating power dynamics among groups of students, the power imbalance seen between White Americans and Black Americans can be replicated in a controlled setting. ECU students from Introductory Psychology courses will be randomly assigned to one of two, three-person groups (advantaged or disadvantaged) per session. While the advantaged group will have the power to allocate extra course credits between the two groups, the disadvantaged group will only be able to allocate stickers. Both groups will then participate in a discussion of either similarities or differences, after which they will complete surveys related to attention to inequality, feelings towards the other group, and implicit theories of prejudice. We hypothesized that advantaged group participants will treat disadvantaged group participants unfairly, regardless of whether they had previously discussed similarities or differences. The disadvantaged group members, namely those with a growth mindset, will expect to be treated more fairly and have more positive out-group attitudes after discussing similarities than their counterparts in the difference-focused condition. This study will use various 2x2 designs in order to assess the relationship between out-group attitudes, resource allocation, and implicit theories of prejudice.

Investigating the Role of Ecdysone Signaling in Somatic to Germline Communication

Rasgeanah Russell

Biology

Mentor: Elizabeth Ables

Oogenesis is a complex process essential for maintenance of animal life cycles. It relies heavily on the intricate balance and timing of hormonal activity to connect organismal health with optimal reproduction. Disruptions to oogenesis cause a range of issues, including infertility, miscarriage, and birth defects. In the model insect, *Drosophila melanogaster*, ecdysone is one of the primary steroid hormones necessary for development and oogenesis. The myriad of mechanisms by which ecdysone promotes oogenesis, however, has not been fully characterized. Here, we investigate the role of ecdysone signaling in somatic to germline communication during early oogenesis. Although preliminary studies demonstrate that cell to cell communication between somatic and germline cells is vital for oogenesis, it is unclear if EcR is necessary in somatic escort or follicle cells to mediate this process. Using EcR dominant negative mutants combined with the UAS/Gal4 system for cell-specific manipulation of EcR, we will determine which subpopulations of somatic cells EcR favors for communication to the germline. Our preliminary data indicate that EcR controls germ cell polarity, impacting the localization of the oocyte-specific RNA binding protein Orb. This investigation can give insight about how steroid hormones and their receptors may function to promote oocyte development in humans.

Higher efficacy of nanoparticles when combined with common antibiotics against nosocomial infections

Stephiya Sabu

Public Health

Mentor: Lok Pokhrel

Nosocomial infections, also called hospital-acquired infections (HAIs), are caused by multidrug-resisting organisms (MDROs), particularly in the healthcare settings such as hospitals and nursing homes and have emerged as a new burden on healthcare systems and patients admitted to the Intensive Care Unit. According to the CDC, an estimated 1 in 31 hospital patients have an HAI on any given day and leads to approximately 75,000 deaths per year in the United States. Globally, HAIs are also a problem, especially in low-income and developing countries. Common antibiotics are becoming obsolete against HAIs/MDROs and thus a need for novel antibiotics are warranted. This study aims to examine how *Escherichia coli* (*E. coli*) as a model MDRO responds to different surface modified silver nanoparticles (AgNPs) and antibiotics, alone and in combination. Specifically, it will determine the LC₅₀ values of the surface modified silver nanoparticles and common antibiotics against *E. coli* using the Kirby-Bauer Disk Diffusion susceptibility test protocol. Our preliminary results showed that NH₂-AgNPs had higher toxicity to *E. coli* when combined with a common antibiotic such as Kanamycin as compared to individual chemicals. Additional experiments are underway, the results of which will be included in the poster. As we determine the LC₅₀ values for each test chemical, we hope to identify an optimal concentration for each nanoparticle that could act synergistically with each antibiotic tested against the *E. coli* that has been linked to majority of urinary tract infections.

Institutional betrayal: A qualitative study of college women's experiences with sexual assault reporting

Kayla Sall

Clinical Health

Mentor: Heather Littleton\

Nearly one-in-five U.S. women who attend college will experience a sexual assault (SA) while enrolled. Unfortunately, college SA survivors who seek help or report their assaults may receive inadequate or harmful reactions from their college/university. Specifically, individuals to whom they disclose may blame them for the assault, minimize or dismiss it, or not provide them with the help they need (e.g., counseling, academic accommodations, protection from the perpetrator). These failures of an institution to prevent or respond adequately to harms experienced by its members is termed institutional betrayal (IB). The present study examined the frequency with which a sample of college SA survivors ($n \geq 28$) received IB and supportive reactions when they reported or sought help from three types of campus resources: confidential sources (e.g., counselor), mandated reporters (e.g., faculty member), and Title IX, through both administration of a quantitative measure of IB/support and by conducting a thematic analysis of survivors' narratives of their help-seeking experience. Results showed that those who disclosed to Title IX experienced the most IB, while those who disclosed to a confidential source reported the greatest support. Further, the thematic analysis revealed that some survivors experienced high levels of support from the institution and others experienced different types of betraying responses, ranging from receiving inadequate help and accommodations to having their assault dismissed and being blamed for its occurrence. Survivors who experienced IB further described its negative impact on their well-being and frequently described an undermining of their trust in the university. Overall, findings reveal the frequency and harm of IB on college SA survivors, and suggest that both the adversarial Title IX reporting process and the lack of sufficient resources available for SA survivors may increase the likelihood of IB. It is imperative that universities prioritize providing adequate resources for SA survivors and consider ways to ensure that survivors are supported throughout the reporting process.

Technology-Assisted Care for Veterans Experiencing Homelessness in North Carolina: A Program Case Study

Margaret Sanders

Rehabilitation Counseling Administration

Mentor: William Atherton

Veterans experiencing homelessness are a hard to serve population, for whom access to various mental health and medical services is a common challenge encountered. One method used to address the needs of this specific population is technology-assisted care (TAC). The Operation Re-entry North Carolina: Resiliency and Reintegration (ORNC: R&R) project explored the use of TAC among veterans experiencing homelessness. The ORNC: R&R project provided TAC-based services to 318 homeless veterans in rural areas of eastern North Carolina. This paper provides an overview of the benefits and challenges of TAC services available to this population. A case study of the ORNC: R&R project is reviewed to generate discussion regarding the advantages and challenges of using TAC to provide healthcare-related services to populations that are underserved within the medical field.

Keywords: homelessness, medical field, mental health, veterans, technology-assisted care

Find Your Voice: The Results of a Student-Lead Community Initiative on Sexual Assault Education

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Rehabilitation Services

Mentor: Timothy Christensen

Find Your Voice is an initiative that focuses on sexual assault education and prevention. Our project is based on the foundation of Educating, Advocating, and Empowering survivors and the ECU community. This program originated in the Honors 2000/3000 seminars and is currently being pursued as a Signature Honors Project.

Our first goal is to educate the student body and general public about sexual assault, the rights and resources available to survivors, and about being an active bystander. We use our Instagram page (@findyourvoice.ecu) to provide evidence-based material in a way that is accessible to readers and empowers them to share with their community. We also held educational events and discussions for participants to discuss and ask questions about sexual assault and how they can be a part of prevention. Our second goal is advocacy for survivors of sexual assault by working with the campus community to promote safety and consent, as well as support and justice for survivors. We do this on our social media as well but also through involvement in events and organizations on campus such as Pledge Purple. We have a blog to discuss current issues and educational media, as well as a podcast. Our third goal is to empower survivors to express their emotions and tell their stories. Our primary method of this is through our online art gallery, a program that we were able to shift and maintain even during COVID. The gallery, which is hosted on our website (<https://www.findyourvoiceecu.org/>), is open for anyone to submit a piece of visual art, graphic art, poetry, spoken word, or just tell their story. We hold themed submission events throughout the year and work with other organizations to uplift survivor voices.

The results of our project have included a steady increase in engagement and positive feedback on our social media posts, a gallery with submissions from many artists over multiple mediums, and a registered student organization to help us sustain the project long term. We plan to continue to foster a community that is supportive and inclusive, to use the arts as a way to promote advocacy and healing, and to empower people to action against sexual assault.

RNA Methyltransferase METTL16: Targets and Function

Emily Satterwhite

Biochemistry and Molecular Biology

Mentor: Kyle Mansfield

Recently identified Methyltransferase-like 16 (METTL16) is responsible for binding and depositing a methyl group on the N6 position of adenosine (m6A) in several different RNA targets. However, only a few of these targets have been intensely studied, including messenger RNA MAT2A, the long noncoding RNA MALAT1, and the small nuclear RNA U6. Methylation of RNA can cause a change in its stability and its ability to interact with other proteins, overall fine-tuning the role of the RNA in cellular processes. There are several RNA methyltransferases in human cells, however METTL16 is the only m6A RNA methyltransferase considered to be essential for life and commonly shows aberrant expression in cancer. Our goal was to verify these previous observations and identify additional RNA targets. Immunoprecipitation of both native and exogenously-introduced METTL16 was used to verify known targets as well as identify other novel RNA targets. The results of these experiments differed, which led us to perform biochemical fractionation of these cells to determine the cellular localization of METTL16. From this, it was revealed that METTL16 protein localized to both the cytoplasm and the nucleus. RNA interference studies of METTL16 resulted in differential RNA expression of identified targets, suggesting this protein is involved in RNA regulation of a number of targets including MYC. We next chose to investigate each domain of the METTL16 protein to determine which is essential for life, and to determine which RNAs are affected by loss of a particular domain. We have produced several METTL16 mutants that deactivate a certain domain, namely: the N-terminal RNA-binding domain, the methyltransferase domain, the nuclear localization sequence-containing region, and the C-terminal RNA-binding domain. Cell lines were produced to stably express the mutated METTL16. We are currently employing CRISPR-Cas9 technology to remove the native METTL16 from the mutated cell line genomes. In the future, these cell lines will be probed for differential RNA expression and m6A modification, as well as changes in cell proliferation rates. Overall, we anticipate removing METTL16 entirely from the cell will prove lethal, however deactivating one domain at a time will reveal differences in how the RNA targets are affected. These differences can provide insights into disease pathogenesis associated with aberrant METTL16 such as cancer.

Take a Breath: The Efficacy of A Prescribed Paced Breathing Intervention to Reduce Anxiety in College Students

Amelia Saul

Rehabilitation Counseling Administration

Mentor: Matthew Fish

According to the Association for University and College Counseling Center Directors Annual Survey, the most common concern among college students in the United States is anxiety.¹ Spielberger² defines anxiety as stimulation of the nervous system, which manifests feelings of tension, fear, nervousness, and worries.² For some individuals, excessive anxiety can adversely influence learning, performance,³⁻⁴ memory storage,⁵ and processing capacity for working memory.³ The purpose of this study is to determine the effectiveness of a prescribed paced breathing intervention used by college students, for 2-weeks, to reduce state anxiety. We conducted an exploratory study to investigate this hypothesis. The study was an experimental design that randomized participants to an experimental or control group and included a pretest and posttest methodology. The study included 35 participants (i.e., college students). The experimental group participants ($n = 17$) completed 2-weeks of prescribed paced breathing, and the control group ($n = 18$) continued with business as usual for the 2-weeks. At baseline, pre-randomization, state anxiety was approximately the same for the control and experimental groups (46.17 4.70 and 45.35 4.80, respectively) as evidenced by a non-significant independent t-test, $t(33) = 0.51, p = 0.76$. A Repeated Measures ANOVA revealed no significant interaction of group by time for state anxiety, $F(3, 96) = 2.564, p = 0.059$. When examining differences in mean scores for groups, no statistically significant differences were found, $F(1, 32) = 0.197, p = 0.660$. For time measures, no statistically significant differences in scores were discovered, $F(3, 96) = 1.843, p = 0.144$. Additionally, we conducted a Cohen's Delta analysis to measure effect size within and between groups. Cohen's delta analyses revealed small and medium effect sizes between and within groups. Furthermore, while there were no statistically significant differences between or within groups; conversely, from a clinical perspective, using $\alpha = 0.10$, and the small to medium effect sizes produced, our results demonstrate clinical significance. We believe a larger sample size is needed for future research and may produce statistically significant findings.

Investigating the Effect of Exercise Framing

Alexis Schroeder

Exercise Physiology

Mentor: Christine Habeeb

A large problem in society today is that people often do not exercise the amount they should. Approximately one in four men and one in three women do not meet the minimum recommendations for physical activity (Lancet, 2018). Exercising regularly is important for many reasons; reducing risks of cardiovascular disease, improving mood, lessening negative effects of mental illness, and generally helping to maintain a good physical condition (Vina et al., 2012). Unfortunately, people often do not feel motivated to exercise despite knowing the benefits of exercise. As such, more research is needed to understand how framing of exercise using motivational phrases impacts psychological outcomes related to exercisers' motivation. More directly, the purpose of this study is to examine how self-confidence, instructor-confidence (the confidence the exerciser has in their instructor's abilities), and anticipated affect is affected by different frames of exercise (fun vs hard-work). As part of a larger study, 60 male undergraduate students at ECU who are not studying within the Kinesiology field will participate. Participants will be asked to identify sex, age, major, race and physical activity levels. Male participants will view two online exercise videos (framed differently) and after each video answer questions regarding their self-confidence, instructor-confidence, and anticipated affect. The two videos are 2.5 minutes long and consist of simple exercises being performed by the exercise instructor (e.g., squats). Both videos will not be varied in any way except for the motivational phrases. The motivational cues will continuously frame exercise as hard work in one video and as fun in the other video. Self-confidence and instructor-confidence will be measured using Likert scales in which participants will be asked to imagine future participation in a class with the instructor and rate their own confidence and confidence in the instructor's ability to perform relative tasks from 1 (no confidence at all) to 5 (complete confidence). Participants will also be asked to rate how they would anticipate feeling certain moods (e.g., crummy and upbeat) after completing a HIIT class in the future with the instructor. A MANOVA will be conducted to test for mean differences between exercise framing and self-efficacy, other-efficacy, and affect. The information that will be found from this study will allow us to learn what framework of exercise results in more motivated exercisers.

Wildlife Tourists' Perceptions of Pro-Conservation Behavior Efficacy

Gwyneth Schuler

Recreation Sciences

Mentor: Jeffrey Skibins

Wildlife tourism, i.e., tourism that involves interactions with wildlife, is extremely popular and can occur in *in situ* (e.g., parks and protected areas) or *ex situ* (e.g., zoos and aquariums) settings. Annually, over 12 million trips are taken for wildlife tourism purposes across the globe, and over 4 million people visit wildlife tourism venues in Eastern North Carolina alone. Wildlife tourism has been justified on the grounds that it produces a net-positive impact on wildlife conservation by encouraging tourists to participate in pro-conservation behaviors (PCB). However, empirical data on the factors that influence wildlife tourists' perceived efficacy of PCB are lacking. This study explored (a) how engagement with interpretation, attitudes, and past participation in PCB influence tourists' perceived efficacy of PCB through the Diffusion of Innovations model, and (b) the role of social media as an emerging PCB. To investigate these objectives, 450 surveys were administered to tourists at seven wildlife tourism venues across North Carolina. Engagement with interpretation, attitudes, and past participation in PCB were found to have no influence on perceived efficacy of PCB. Posting on social media emerged as a unique PCB in this study, as past participation in this behavior significantly increased perceptions of its efficacy. Based on these results, tourists' perceived efficacy of PCB is influenced by factors not yet assessed. This study also highlights the role of social media as an emerging PCB, indicating that social media behaviors warrant further study in the future.

An Increase in Lower Extremity Injury as a Result of Cognitive and Psychological Deficits of Concussion

Caitlin Schult

Sport and Exercise Psychology

Mentor: Nicholas Murray

Sport-related concussions have become a prominent part of our society and much of the research has focused on the immediate impact of a concussion and factors that influence return to play; however, little research has focused on the long-term consequences. Sports-related concussions occur in approximately 21% of college athletes with implications for long-term cognitive impairments including working memory (Hudac et al., 2017). These long-term effects include a change in cognitive functions and motor performance, which includes reaction time, oculomotor performance, and self-efficacy. Impaired individuals are slower to respond to and are less accurate in tracking visual stimuli (DiCesare et al., 2017). With the ever-changing environmental demands associated with sport participation, altered visuomotor processing may also negatively impact task performance, modifying injury risk as well (Herman et al., 2016). Delays in these types of cognitive functions can lead to athletes facing risky or dangerous situations during their performance due to not being able to perform necessary motor movement tasks appropriately in times that are critical to performance or safe execution of a performance task. Recent research reports an increased risk for lower extremity injury during sport participation post concussion. The increased risk following concussion suggests that routine care does not fully capture persistent neuromuscular and neurocognitive deficits associated with lower muscular injury (Herman et al., 2017). To further investigate solutions for this problem research must be done to explain why this increase is occurring in concussed athletes and what factors increase the risk of lower extremity injuries in contact sports. The purpose of this research is that concussion effects have shown to cause negative symptoms on those inflicted that result in a higher risk of lower extremity injury. Mainly the research investigates reaction time, oculomotor performance, self-efficacy, and the presence of lower extremity injury. Direct assessment of neuromuscular and neurocognitive processing over time is needed to fully understand persistent deficits in reaction time, oculomotor performance, and self-efficacy and their effect on risk of lower extremity injury. Understanding these relationships could help change the way we treat those who receive concussions and help prevent lower extremity injury by creating specific protocols that detect long-term effects of concussion.

The Role of Rab10 in Cognitive Dysfunction Using Trace Eyeblink Classical Conditioning

Jocelyn Seabrook, Elizabeth Harris

Multidisciplinary Studies

Mentor: Tuan Tran

Purpose: We examined the role of Rab10 in cognitive dysfunction using trace eyeblink classical conditioning (TECC), a form of associative learning mediated by cortical-hippocampal-cerebellar interactions. Rab10 is a small GTPase that is involved in vesicular trafficking. It is a substrate of leucine-rich repeat kinase 2 (LRRK2), a serine/threonine protein kinase genetically associated with Parkinson's disease. Recently it was found that phosphorylation of Rab10 is prominently expressed in hippocampal tissues of patients with Alzheimer's disease (Yan et al., 2018). Thus, elevated expression of Rab10 may enhance AD progression and pathology, leading to cognitive impairments.

Methods: Adult male and female wild-type (WT) and Rab10⁺ mice were surgically prepared for TECC with electromyographic (EMG) recording electrodes implanted on the left eyelid muscle and a stimulating electrode implanted caudal to the same eye, using an established procedure for rodents (Tran et al., 2017). After five days of recovery, they received six consecutive days of TECC. Each day of TECC consisted of 90 paired trials (conditioned stimulus [CS] + unconditioned stimulus [US]) and 10 CS-alone trials. In each paired trial, an 80dB tone CS was first delivered for 380ms. This was followed by a period of no stimuli for 500ms (trace period). Then a mild shock US (1.6mA) was delivered for 100ms to elicit an eyeblink (unconditioned response, UR). In TECC, the key learning measure is the conditioned response (CR), an anticipatory eyeblink that is elicited by the tone CS and is emitted prior to shock US onset. On every 10th trial, only the tone CS was delivered to probe for learning (CR emittance) in the absence of the US. Due to the trace period, rodents are challenged to resolve the offset of the tone CS with the onset of the shock US, thus making this task relatively difficult to acquire. Over several days, they typically develop a learning curve expressed as a pattern of CRs. We compared whether the learning curves differed between WT and Rab10⁺ mice.

Results: Rab10⁺ mice exhibit impaired acquisition of trace CRs compared to WT mice, suggesting that elevated expression of Rab10 may disrupt learning performance.

Discussion: Further research is needed to elucidate the involvement of Rab10 overexpression, particularly in neurodegenerative diseases such as AD, in mediating learning impairments. Indeed, deletion of Rab10 may be a viable approach in mitigating progressive learning impairments.

Neuraminidases in *Bacteroides fragilis* represent a potential target for antimicrobial therapy

Nathaniel Seals

Microbiology and Immunology

Mentor: Edson Rocha

Bacteroides fragilis is a commensal organism of the large intestine that can cause extraintestinal infections, such as an infection of the peritoneal cavity, following intestinal perforation that culminates in the formation of an abscess; these abscesses typically require antibiotic therapy and surgical drainage, and often respond poorly to antibiotics due to an increase in multi-drug resistance in *B. fragilis* strains. To survive in the peritoneal cavity, *B. fragilis* has developed the ability to utilize host N-linked glycoproteins as a source of carbon and energy at extraintestinal sites. One of the many strategies *B. fragilis* employs to accomplish this is the encoding of four neuraminidase homologs: NanH1, 2, 3, and 4. The neuraminidase enzyme is responsible for the cleavage of terminal sialic acid residues from sialylated glycans and it represents a committed initial step in the degradation of N-glycans. To understand the role of NanH in *B. fragilis* pathophysiology, recombinant neuraminidases containing C-terminal His-tags were overexpressed in *E. coli* and purified by affinity chromatography. The neuraminidases, named rNanH1, 2, 3, and 4 displayed varying degrees of specific activity that were pH and calcium (Ca^{2+}) dependent. This was determined fluorometrically using 2'- α -(4-Methylumbelliferyl)-D-N-acetylneuraminic acid (MUNANA) as a substrate. Given the ubiquity of neuraminidases in the pathogenesis of diseases caused by both bacteria and viruses, neuraminidase inhibitors have been used as therapeutic treatments for such diseases. To determine if neuraminidase inhibitors would inhibit the *B. fragilis* rNanHs, a series of neuraminidase inhibitors were tested using the MUNANA based fluorometric assay. Influenza neuraminidase inhibitors such as oseltamivir, zanamivir, and peramivir showed little to no inhibition of rNanH at 500 μM where other sialic acid analogs such as siastatin B was effective in inhibiting over 50% of rNanH2 activity compared to control. 2-Deoxy-2,3-dehydro-n-acetyl-neuraminic acid (DANA) showed robust inhibition against rNanH1 (72%) and rNanH3 (57.7%). Interestingly, the plant derived polyphenolic compounds Eriodictyol and Curcumin also showed marked inhibition of *B. fragilis* rNanH activities. Taken together, these findings indicate that the utilization of narrow spectrum antibiotics to target the utilization of host-derived N-linked glycans could prove effective in treating *B. fragilis* infections that are often difficult to resolve.

Talk Move Implementation and Frequency in Preservice Science Concentrators

Camryn Sears

Elementary Education

Mentor: Tammy Lee

In the STEM field, it is vital that scientists communicate with one another and share their findings. It is the role of teachers to engage students in activities scientists do and educate them about science topics. This means that quality discourse is essential in science classrooms and should begin in Elementary school. In an effort to investigate the discourse training of preservice teachers, this study seeks to analyze frequency and effectiveness of talk move usage in engaging students in science talks. Preservice teachers in the Elementary Education program at East Carolina University (ECU) will be studied. Elementary Science Concentrators (ESCs) will be compared one another to learn more about how prior experience with science talks impacts preservice teacher performance. Data will be gathered from video recordings and transcripts of the students participating in science talks with peers and the software Mursion Prior training with science talks should mean that ESCs will more effectively engage students in science discourse by using talk moves.

Regenerative stormwater conveyance (RSC) for reducing nutrients in Greenville stormwater runoff

Olivia Sessoms

Environmental Engineering

Mentor: Natasha Bell

Greens Mill Run is a stream located in Greenville, North Carolina that flows through the campus of East Carolina University between College Hill and East 10th Street. The stream has been found to have nutrient-sensitive water exceeding NC Department of Environmental Quality criteria, and this is of concern as the stream empties into the Tar River and comes into close contact with citizens and university students. One particular water quality parameter of concern is fecal coliform bacteria. This group of bacteria includes *E. coli*, which is specific to fecal material from humans and other warm-blooded animals. The Environmental Protection Agency (EPA) recommends *E. coli* as the best indicator of health risk from water contact in recreational waters, however some states, including NC, still use overall fecal coliform bacteria as an indicator of health risk from freshwaters. Regenerative stormwater conveyance (RSC) is a growing green stormwater infrastructure and ecological treatment technology that can remediate pollutants using natural processes in a cost- and resource-effective manner. As RSC is a relatively new technology, there is little in the literature about the efficacy of various substrates in different applications, and there are no set design standards. Lab-scale RSC units will be designed and constructed to treat water from Greens Mill Run and test different substrate materials and amounts. The substrates will include silicate sand (low Fe, Ca, and Mg), wood chips, and leaf litter; the amounts include 1) pure sand, 2) sand with 20% wood chips by volume, and 3) sand with 20% leaf litter by volume. Water quality parameters of fecal coliform bacteria, temperature, pH, and dissolved oxygen (DO) will be measured before, during, and after RSC treatment. By testing the water quality of Greens Mill Run with this new technology, not only can the environmental health of a stream close to the heart of campus and a source of the Tar River be potentially remediated; but crucial findings about RSC systems can be also shared to improve their design and increase their implementation.

Improving Mental Health Literacy in Middle School Teachers through Emotional Poverty® Training: Signature Honors Project

Lihi Sharabi

Nursing

Mentor: Deborah Tyndall

Background: A community-engaged research project with a public middle school in Wilson, North Carolina has been ongoing since 2018. The project, supported by the Engagement and Outreach Scholars Academy (EOSA), was established to address the emotional and mental health needs of adolescents. Phase I of the EOSA project indicated that teachers had limited knowledge in how to manage behaviors in the classroom that manifest due to unmet emotional and mental health needs. This Signature Honors Project will support the design of Phase II which will evaluate the outcomes of Emotional Poverty® training on teachers' mental health literacy.

Objective: The purpose of this Signature Honors Project is to collect preliminary data on teacher response to Emotional Poverty® training.

Method: Teachers at a public middle school completed Emotional Poverty® training in January 2021. Training included the participation in book club discussions and attendance to a six-hour virtual workshop provided by aha! Process Inc. A Qualtrics survey will be designed in collaboration with the community partner to collect preliminary data on teacher response to the training. Responses will solicit how teachers are planning, developing, and implementing strategies within their virtual and/or in-person classrooms to address emotional and mental health needs.

Results: Teacher responses to the survey will be organized within a Microsoft Excel® spreadsheet for analysis. Data analysis from the surveys will be used to inform the design of the EOSA project's Phase II.

Discussion: Adolescents can experience depression, anxiety, and other emotional issues that manifest in classroom behaviors. Teachers are on the front line of this issue; however, many of them are not adequately trained to identify and manage students with emotional and mental health needs. Emotional Poverty® training has the potential to provide teachers with the knowledge to develop and implement strategies to support students emotional and mental health needs in the classroom.

YOUR CHILD IS OVERWEIGHT, NOW WHAT? UNDERSTANDING HOW HEAD START STAFF COMMUNICATE WITH LOW-INCOME FAMILIES ABOUT CHILDHOOD OBESITY

Dana Shefet

Public Health

Mentor: Virginia Stage

Children (3-5 years) enrolled in Head Start (HS) are at increased risk for obesity. In an effort to prevent childhood obesity, HS implemented a Body Mass Index screening program in 2012. This program provides opportunities for HS to engage families by communicating information about children's weight status; however, limited research is available to describe the barriers and facilitators HS staff face when communicating this information to families. The objective of this study was to explore common experiences of HS Health/Nutrition Managers when communicating information to families about their child's weight status. Researchers conducted 29 in-depth telephone interviews with Managers across North Carolina and Ohio. Phenomenology was used to guide study design and analysis. Interviews were recorded and transcribed verbatim. Researchers identified significant statements through open-coding and grouped them into themes focusing "what" and "how" participants experienced the phenomenon.

Researchers identified four themes: Family Background, Communication and Educational Opportunities for Families, Staff Support and Counseling Resources and Family Awareness, Reaction, and Engagement. Programs used different methods to communicate about children's weight (e.g. letters, meetings, no communication). Parent reactions to children's weight status often dictated communication methods chosen; negative reactions often resulted in limited communication. Managers perceived parents' backgrounds (socioeconomic status, education) and the "shame" associated with having an overweight/obese child as communication barriers. HS (e.g. consulting dietitian) and community-based (e.g. WIC) educational/counseling opportunities for families were identified as supportive of Manager efforts to communicate about children's weight status.

Participating HS programs acknowledged the importance of communicating with parents about their children's weight status. However, findings also indicated parents' personal feelings about their child's weight status may influence the type of communication they receive and their willingness to utilize other educational/counseling opportunities. More research is needed to explore parents' perceptions of HS communication methods, as well as effective strategies for supporting and educating parents about healthy weight in childhood.

Intracellular Mechanisms of α -klotho to Suppress Orexigenic Gene Expression in Hypothalamic Neurons

Daniel Shookster

Cellular and Molecular Bioengineering

Mentor: Hu Huang

Recent evidence demonstrates the central circulation of the anti-aging protein α -klotho in cerebrospinal fluid suppresses AgRP neuron activity and gene expression; however, the neuroendocrine interactions of central α -klotho and metabolic hormones are less explored. One particular hormone of interest is the potent orexigenic hormone ghrelin, which is released from the stomach in response to starvation and low energy status to promote food intake by activating AgRP neurons. Cell culture experiments were performed using hypothalamic GT1-7 cells treated with ghrelin and/or α -klotho, after which protein and gene expression were analyzed via western blot or real-time polymerase chain reaction (RT-qPCR), respectively. Consistent with previous findings, ghrelin significantly increased AgRP gene expression; however, co-treatment with α -klotho nullified these effects. Intracellularly, the principal ghrelin signaling mechanisms to increase AgRP gene expression via increased pAMPK^{Thr 172} and decreased phospho-p70 S6K^{Thr389} were inhibited by α -klotho, this effect may be due to α -klotho induced pAKT⁴⁷³, phospho-p70 S6K^{Thr389}, and reduced pCREB^{Ser133} signaling. Taken together, these results identify a novel neuroendocrine regulatory role of α -klotho in central control of metabolism that may be targeted to aid in the maintenance of energy and metabolic homeostasis.

Caregiver Oral Health Literacy Associated with Oral Health Status of Children: A Rapid Review

Breanne Smith

Biology

Mentor: Van McCarlie

Objectives: Oral health literacy (OHL) is the measure of how well an individual collects and comprehends oral health information, as well as his or her ability to subsequently make advisable oral health care decisions. Measures for OHL include a number of validated instruments from the literature, such as the Rapid Estimate of Adult Literacy in Medicine and Dentistry (REALMD). Oral health status (OHS) is the measure of one's current state of oral health, based upon clinical examination, evaluation of dental, medical and social histories, including results from and stability of previous treatment. In this rapid review, we examined literature in PubMed® to determine whether there is credible evidence of an association between caregiver oral health literacy and children oral health status.

Methods: We searched using applicable MeSH subject heading and keyword terms, and no filters were applied. Two blinded reviewers screened 85 articles. Only peer-reviewed articles were included. Additionally, we only examined literature pertaining to children up to 11 years old, that was published within the last 15 years. Ultimately, 6 articles met the inclusion criteria, which were established *a priori*. The credibility of the evidence of the included articles was determined using the appropriate Joanna Briggs Critical Appraisal Checklists.

Results: Associations between caregiver OHL and children OHS were demonstrated across 83% of articles.

Conclusions: There is credible evidence that caregiver OHL is associated with children OHS. This review supports that a caregiver's limited OHL may affect a child's OHS negatively. Language, socioeconomic status, education, occupation and other factors can all influence both OHL and OHS of caregivers and children.

Effects of a lateral line loss-of-function mutation on expression of *parathyroid hormone 2* in zebrafish

Cameron Smith

Biology

Mentor: Timothy Erickson

In larval zebrafish, *parathyroid hormone 2* (*pth2*) codes for a peptide hormone that is expressed exclusively in cells near the ventral part of the posterior tuberculum, an area of the forebrain involved in sensori-motor control and social behavior. We identified *pth2* in an RNA-seq experiment looking for genes regulated by voltage-gated calcium channel activity. Relative to wild type larvae, *pth2* was down-regulated in larvae where the L-type Cav1.3 channel was inactivated either genetically (*cav1.3a* mutants) or pharmacologically (the Ca²⁺ channel blocker isradipine). Using mRNA *in situ* hybridization on *cav1.3a* mutant larval zebrafish and larvae treated with isradipine, we confirmed that *pth2* expression in zebrafish requires Cav1.3a channel activity. Next, to characterize the regulatory region of the *pth2* gene, we cloned a 2 kbp fragment of the zebrafish genome immediately upstream of the *pth2* coding sequence. We cloned the GFP gene into a plasmid with the upstream region driving its expression and injected it into zebrafish embryos, resulting in GFP expression in cells of the posterior tuberculum and their axons.

Recently, a study investigating gene expression in zebrafish showed that social isolation led to decreased levels of *pth2* transcription. Expression of *pth2* was recovered after exposing previously isolated fish to conspecifics, and conversely, was decreased after isolating fish that were raised socially. Levels of *pth2* transcription were shown to be dependent on mechanical stimulation due to the movements of other zebrafish. The study also found that fish raised socially did not express *pth2* when the lateral line was ablated using neomycin or CuSO₄. These findings provided evidence that *pth2* is not expressed when hair cells of the lateral line are killed using drugs, but the study did not explore the effects on *pth2* expression when lateral line function is lost genetically. To test whether a loss-of-function mutation in the mechanoreceptors of the lateral line affects *pth2* expression, we will perform mRNA *in-situ* hybridization on lateral line mutant zebrafish raised in a social environment, mutants raised in isolated environments, and wildtype fish raised in social and isolated environments for comparison. We predict that there will be minimal, if any, *pth2* expression in lateral line mutants, regardless of whether they are raised socially or isolated. The results will serve to further elucidate the role of Pth2 in the social behavior of zebrafish.

Greening Beverage Industries in North Carolina

Haley Smith, Kenneth Weddle

Engineering

Mentor: Tarek Abdel-Salam

Currently the state of North Carolina, USA, ranks 10th in wine production and 8th in the number of breweries. The state has about 200 Wineries with around 7,600 workers and \$1.3 billion in economic impact of the industry. In addition to this, it has over 333 craft breweries and brewpubs and the 10,000 jobs and \$2,805 million in economic impact supported by beer making. However, the wine and beer industries are primarily dominated by small to mid-sized operations, many of whom lack particular expertise or access to knowledge on energy and water conservation and waste reduction. These circumstances provide an opportunity as well as a challenge to reduce pounds of pollution, conserve water and/or energy, reduce greenhouse gases, and save money through Economy, Energy and Environment (E3) by using Lean and Green initiatives. This paper presents results from a research grant fund by the USA Environmental Protection Agency. Energy and lean manufacturing recommendations will be presented and discussed in the presentation of this work.

Computational Modeling of Arteriovenous Fistula Hemodynamics in Pulmonary Hypertension Patients

Kaitlin Southern

Engineering

Stephanie George

In the United States, approximately 37 million people suffer from chronic kidney disease, which over time progresses to end-stage renal disease (ESRD). Care for these patients is typically managed by dialysis with the surgical creation of an arteriovenous fistula. Even though fistula formation is a common and an effective treatment it has been suggested as a risk factor for developing pulmonary hypertension (PH). The objective of this research is to develop a protocol for creating subject-specific computational fluid dynamics (CFD) models of fistulas in patients with PH. Using previously collected magnetic resonance images (MRI) from a single patient, a model of the fistula will be created using Mimics software. Flow measurements from MRI will be used as boundary conditions for the CFD model. The model will then be meshed, and the 3D velocity field will be solved using ANSYS. Fistula data, geometric and hemodynamic, will be compared with formerly processed hemodynamic data from the pulmonary artery (CFD and clinical), amongst the same patient. This project presents a unique opportunity to study both the pulmonary artery and fistula within the same patient, simultaneously. Modeling of fistula hemodynamics may provide insight to the link between fistulas and pulmonary hypertension; thus, identifying key monitoring parameters. Improved monitoring will allow physicians to intervene (such as fistula banding); thereby, preventing the development of pulmonary hypertension.

Thinking about Vocabulary Inside the Box - A Study of the Frayer Model Vocabulary Strategy in Secondary Science

Amanda Starnes

Science Education MAED

Mentor: Tammy Lee

Secondary science students face the challenge of understanding not just content knowledge, but also how to fluently speak the language of the science. The vocabulary load of high school biology students is tremendous and teachers are tasked with finding ways to mitigate the circumstances that prevent student understanding. A modified Frayer model vocabulary strategy is implemented in this study as one way to mitigate those circumstances and is shown to help students develop a more meaningful understanding of vocabulary and also develop the student's ability to discuss and relate the vocabulary within the context of the scientific principle. Through inquiry-based introduction to the vocabulary, multiple exposures, contextual relevance, and drawings, students use the Frayer model to create their own understanding, more than a mere definition. A foundation of science learning based in genuine, contextual, and comprehensive vocabulary mastery is a critical component in helping students develop scientific literacy and to foster their engagement and interest.

Spectrum: An evaluation of common experiences

Savannah Stewart

Psychology

Mentor: Angela Wells

Through the medium of digital photography, I am evaluating my personal experiences as an undergraduate senior in light of the common experiences of many in similar positions. No matter what stage of life one finds themselves in, the good and the bad coexist. Sometimes it feels like there is more light, while other times a person may feel like they are drowning in darkness. My goal is to portray this through the photographs representing my own positive and negative experiences with the understanding that everyone goes through both good and bad times. My photographs range from the ominous and eerie elements of student life during a trying time to the more joyous and light-filled areas of the student experience. In completion, the photographs will be arranged in the Health Science Center gallery to express a full spectrum of experiences in a bi-directional setting that highlights the ups and downs of life. While these photographs can be specific to my experiences, I hope the emotion within them can spark conversations about the variety of life. That a viewer can see their positive and negative experiences within my own and, through that, relate to them on a human level.

Calibration and Correction of the SPS30 Low Cost Optical Particle Counter as Part of the GeoAir 2 Platform for Measuring Personal Exposure

Dillon Steuber

Environmental Health, Research Option

Mentor: Sinan Sousan

There has been increasing demand for low cost particulate matter sensors in the market and to meet this demand, new devices are being developed and released to the public. Low-cost sensors in particular open routes to citizen science and community air quality monitoring, something that can prove a great boon to both public health and public health education. Optical particle counters in particular are of interest in this regard. However, these lower cost sensors are generally expected to lack the quality paid for in higher cost sensors, thus leaving the question as to their efficacy especially at different concentrations and humidities. This study focused on the SPS30, an optical particle counter built into the GeoAir 2 monitoring platform. This platform was designed to measure particulate matter, CO₂, and VOC personal exposure while providing GPS location for geospatial monitoring and recording of time, temperature, and humidity data. In order to test its correlation with related sensors in detecting PM_{2.5}, a commercial spectrometer (MiniWRAS by GRIMM Aerosol) and another common low-cost optical particle counter (OPC-N3 by Alphasense) were used. First, we tested the devices with two different aerosols, salt and Arizona road dust, with steady states measured by a medium-cost pDR-1500 aerosol sensor. The filter used in the pDR-1500 provided gravimetric analysis for mass correction. The mass concentrations for salt aerosol measured by the SPS30 ($r=0.99$) and OPC-N3 ($r=0.99$) were highly correlated with the MiniWRAS reference instrument. Measurements of Arizona road dust between the SPS30 ($r=0.99$) and the OPC-N3 ($r=0.99$) were similarly correlated to the MiniWRAS reference device. Second, the effect of humidity on the SPS 30 sensor was tested against the aforementioned devices at 30, 50, 70, 80, and 90 percent relative humidity. In the humidity test, the SPS30 was positively correlated with both the OPC-N3 ($r=0.99$) and the MiniWRAS ($r=0.99$). However, while the slope between the SPS30 and the OPC-N3 increased with higher humidities (30% RH=0.64, 90% RH=1.09), the slope between the SPS30 and the MiniWRAS declined (30% RH=0.89, 90% RH=0.39). The findings of this study suggest that the SPS30 built into the GeoAir 2 monitoring platform is a competitive option compared to similar low-cost optical particle counters in dry conditions though may yield unpredictable results as relative humidity increases.

1,4-Dioxane Removal from Drinking Water Using Nano-ECM

Collins Suarez

Environmental Health, Research Option

Mentor: Lok Pokhrel

1,4-Dioxane is a contaminant of emerging concerns (CECs) and has been linked with increased cancer risk, and liver and kidney damage. Because of the inability and high costs of traditional treatment methods (e.g., advanced oxidation) to remove 1,4-Dioxane from drinking water, there is a need for novel methods that are economical. We developed several low-cost nano-modified electrically conducting membranes (Nano-ECMs) and assessed their 1,4-Dioxane removal efficacy using a simple vacuum filtration system. Upon surface modifying commercially available 150 nm pore size PVDF membrane using nanoparticles of silver (NH_2 AgNPs, Taxol- NH_2 AgNPs, Citrate AgNPs) or cerium oxide (CeO_2 NPs), we tested their 1,4-Dioxane removal efficacy as a function of NP concentrations (100-400 mg/L), frequency of surface modified layers on the PVDF membrane (2-4 layers), electric potential (voltage: 0-25V), and Ultra Violet ($\text{UV}_{254\text{nm}}$) irradiation (present or absent). Two glass slides surface-coated with same NPs or indium tin oxide (ITO) served as electrodes to supply potential difference to the Nano-ECM being held in place by a magnetic seal. 1,4-Dioxane was quantified using the USEPA Method 8260C-SIM. The UV+15V+NanoECM₁ (membrane/slides coated thrice with [400 mg/L CeO_2 NP+400 mg/L NH_2 AgNP+100 mg/L Citrate AgNP]), UV+15V+NanoECM₂ (membrane/slides coated twice with [CeO_2 NP+ NH_2 AgNP+Citrate AgNP]), UV+15V+NanoECM₃ (membrane/slides coated twice with [Taxol- NH_2 AgNP+ NH_2 AgNP+Citrate AgNP]), and the UV+15V+NanoECM₄ (membrane/slides coated twice with 200 mg/L CeO_2 NP]) were found most effective with average removal rates 90.4%, 84.1%, 82.9%, and 78.4%, respectively, for 1,4-Dioxane removal from the spiked water samples. These results demonstrate the potential of Nano-ECM to adequately remove 1,4-Dioxane from drinking water and could be adapted in developing a low-cost, solar-powered filter module for the removal of CECs (e.g., 1,4-Dioxane, PFASs) from public water systems and protect public health.

The Effects of Triangulation: the Game of Divide and Conquer

Lindsay Swan

Ceramics

Mentor: James Tisnado

My work describes a comparison between the family roles and the power dynamics in a household of a narcissistic parent with the divisive manipulative controls used in recent politics. I am introducing the different roles that a narcissist will place on family members, colleagues, and friends. My work shows how and why these rolls are interchangeable. It explains how a narcissist is able to pit people or groups against each other to obtain narcissistic supply or fuel. I am addressing the different kinds of consequences a person should expect if they do not go along with or confront a narcissist. The purpose behind my work is to understand the mental manipulations used to control through triangulation, a divide and conquer strategy. This occurs when an outside person or people intervene or are drawn into a conflict for an abusive purpose. The narcissist will play off insecurities of all parties involved against each other, while acting as the go between in order to manipulate and control multiple people simultaneously. I have sculpted a hand-built ceramic series in the form of a Matryoshka or nesting doll. On each vessel I am painting aspects of family roles relating to recent political issues, and the effects of triangulation, while experimenting in form, function, and glaze applications.

The Prevalence of Vaping and Vaping Addiction Among a Sample of College Students

Kathryn Swinson

Public Health

Mentor: Ryan Martin

Nicotine and e-cigarette use has been on the rise over the past decade. Young adults are rapidly getting involved in the trend and the rising incidence of involvement is alarming as there are long-term health impacts which have not been sufficiently researched. Additionally, there is more research done to explore vape addiction among high school students, but less data is available on those entering universities. The primary goals of the study were to measure prevalence of vaping among a sample of college students and to examine differences in vaping addiction of two demographic groups: first-semester university status and gender. The study involves a secondary analysis of survey data collected by professors in the ECU Department of Health Promotion and Education. The online Qualtrics survey, conducted during the Fall 2019 semester, administered to HLTH 1000 students ($n=1377$) and completed anonymously, assessed health behaviors among participants. Using SPSS, frequencies were reported for demographic variables (e.g., gender, first-semester university status) and the following vaping-related variables of interest: those who have ever vaped, current vape users, and those who met the threshold for vape addiction/dependence. Next, a series of chi-square tests were computed to examine differences in the vaping-related variables of interest by two demographic factors (gender, first-semester university status). The majority of the sample was female (65.9%), white (75.5%), and in their first semester of college (88.1%). Prevalence rates for the vaping behaviors of interest are as follows: Ever vaped (57.2%), currently vape (34.3%), and met the threshold for vaping addiction (3.2%). Chi-square results indicated that there were no statistically significant differences in the vaping related behaviors based on gender or first-semester university status. However, males were more likely to currently vape ($X^2 = 2.957$, $p = 0.085$) and meet the threshold for vaping addiction ($X^2 = 2.101$, $p = 0.147$). Since differences in demographic factors were not found, the results of the study may encourage universities to include more information on the health impacts of regularly vaping to all students in required health courses. This would result in students being able to make more educated health decisions on whether they choose to use vape products and could reduce vaping behavior in the future.

The Influence of Cleft Lip and Palate on Breastfeeding Among Infants in the NICU

Neda Tahmasebifard

Rehabilitation Sciences

Mentor: Jamie Perry

Objective: The objective of this study was to determine the odds of breastfeeding at discharge in infants admitted to a neonatal intensive care unit (NICU) with cleft lip and palate (CLP).

Method: Data from the 2018 National Vital Statistics System were used for this project. The sample consisted of infants admitted to NICU with CLP and those without CLP. For baseline comparisons, Chi-square tests of independence were used to compare categorical variables, and independent sample *t* tests were used for continuous variables. The logistic regression models were performed to determine the odds of breastfeeding at discharge in infants admitted to NICU with CLP.

Results: The sample included 345,429 infants admitted to NICU of which 660 had CLP. Baseline comparisons indicated significant differences between the two groups related to: mother's race, mother's education, maternal smoking, delivery method of birth, maternal pre-pregnancy, five-minute (appearance, pulse, grimace, activity, and respiration) APGAR, multiparity, gestational age, and gestational weight. The logistic model results indicated differences between the two study groups. Infants admitted to the NICU with CLP had a lower probability to breastfed at discharge compared to infants admitted to the NICU without CLP (OR = .543; 95% CI .455, .648) after controlling for significant covariates.

Conclusion: Results from the current project suggest a lower odds of breastfeeding at discharge among infants admitted to NICU with CLP compared to those without CLP. These findings indicate that nutrition through breastfeeding in infants admitted to NICU with CLP may be reduced compared to infants without CLP.

Folktales Across Cultures: An Interactive Website

Maria Tallant

Psychology

Mentor: Elena Murenina

All around the world, folktales capture the wonderment and imagination of all ages.

Folktales are passed on from generation to generation, from culture to culture, from Disney to Hollywood, in order to keep the stories alive. Beginning in the 19th century, European scholars began to collect and study folktales. In his pioneering study "*Morphology of Folktales*"(1928), the Russian formalist Vladimir Propp (1895-1970) famously introduced thirty-one functions to analyze the typology of motifs and heroes in folktales across cultures.

This Digital Humanities project will create an interactive website that enhances students' knowledge of folktales cross-culturally with a focus on the Russian folktales collected in 1855-1867 by the Russian ethnographer Aleksandr Afanas'ev (1826-1871). As a Psychology major with a Russian Studies minor and training in pedagogy, I will integrate my interdisciplinary knowledge with digital media to create a digital tool for studying and assessing folktales in the humanities classroom. Beyond the textual access to folktales, I will provide users with a glossary of Russian terms and a cultural guide so that English-speaking students can better comprehend Russian folktales. Students will analyze a variety of primary and secondary sources as they define the methods of folklore based on Vladimir Propp's thirty-one functions of *dramatic personae*. This interactive website will enrich the students' cognitive abilities and promote multimodal literacy while fostering their language, interpretive, and creative skills. It will also allow the students to evaluate similar types of folktales originating in different cultures by using the comparative methods introduced by Propp. International film adaptations, animations, and book illustrations will enrich the user's experience. As the world is moving to online classrooms, such a website will benefit elementary to college level curricula as an innovative educational tool for the 21st century, with an interactive method to study Russian and international folktales.

Black critical limb ischemia patients possess a unique limb muscle transcriptional program

Zoe Terwilliger

Physiology

Mentor: Joseph McClung

Critical limb ischemia (CLI) is the most severe manifestation of peripheral artery disease (PAD) and is characterized by high rates of morbidity and mortality. As with most severe cardiovascular disease manifestations, Black individuals disproportionately present with CLI. Accordingly, there remains a clear need to better understand the reasons for this discrepancy and to facilitate personalized therapeutic options specific for this population. Gastrocnemius muscle was obtained from White and Black healthy adult patients and patients with CLI for whole transcriptome shotgun sequencing (WTSS) and enrichment analysis to identify alterations in specific reactome pathways. When compared to their race-matched healthy control patients, both White and Black patients with CLI demonstrated similar reductions in nuclear and mitochondrial encoded genes and mitochondrial oxygen consumption across multiple substrates, indicating a common bioenergetic paradigm associated with amputation outcomes regardless of race. Direct comparisons between tissues of White and Black patients with CLI revealed hemostasis, extracellular matrix organization, platelet regulation, and vascular wall interactions to be uniquely altered in limb muscles of Black individuals. Among traditional vascular growth factor signaling targets, WTSS revealed only Tie1 to be significantly altered in limb muscle tissues of Black patients when compared to White. qRT-PCR validation of select identified targets verified WTSS directional changes and supports reductions in MMP9 and increases in NUDT4P1 and GRIK2 as unique to limb muscle of Black patients with CLI. This represents a critical first step in better understanding the similarities and differences in the transcriptional programs between Black and White patients in the setting of amputations related to CLI and provides a promising start for therapeutic development in this population.

Will the implementation of science talks support my fourth grade students in effectively reaching mastery in science concepts through vocabulary?

Nicole Thompson

Science Education MAED

Mentor: Tammy Lee

Many students acquire their vocabulary knowledge through practical use, which often consists of tier 1 words. Tier one words are words that commonly appear in spoken language, and rarely require explicit instruction. Tier three consists of words whose practical use and frequency is low (Sprenger,2013). However, these tier three words are central to building knowledge of instructional content (Sprenger, 2013). These tier three words are a challenge for students to understand, and when students can't use content specific language in a science lesson they cannot understand the content being taught in the classroom. In my research study, my students will be learning about magnetism and forms of energy. The vocabulary terms used to reach mastery of these standards are extremely challenging and abstract since magnetism cannot be easily seen. The implementation of science talks will allow students to practice using tier three vocabulary terms in the classroom, and apply these words in context in order to reach mastery.

Evaluating how the habitat complexity of North Carolina seagrass meadows affects the faunal community composition

Stacy Trackenberg

Biology

Mentor: Rachel Gitman

Research has demonstrated that habitat complexity can greatly affect community composition and structure across ecosystems. However, habitat complexity can vary as a function of the species making up that habitat (foundation species). Thus, species-specific variation in complexity within a habitat likely influences how organisms within a community use that habitat. To investigate how complexity affects community composition, we compared seagrass habitat complexity and community composition across mono- and polyculture beds of three foundational seagrass species, *Zostera marina*, *Halodule wrightii*, and *Ruppia maritima*, in the shallow sounds of North Carolina. To quantify seagrass complexity, we measured multiple complexity metrics across three different scales: landscape (bed area, habitat fragmentation), bed (seagrass species richness, canopy height, percent cover, shoot density), and quadrat (leaf width, shoot and leaf length, and leaf and branch number). To assess community composition, we quantified the density (ind./m²) of sessile fauna using quadrats and cores and mobile fauna using replicate otter trawl tows within the surveyed beds. We hypothesize beds with greater complexity, measured across multiple metrics, and greater complexity at larger scales (landscape and bed), will support a higher diversity and abundance of faunal species. Climate change has the potential to affect the future distribution of seagrasses in North Carolina, with the less heat tolerant *Z. marina* being replaced by *H. wrightii* and *R. maritima*, changing the composition and complexity of these habitats. Understanding how changes in seagrass bed composition affects the ecosystem services of fish communities utilizing seagrass meadows is critical for future management.

Cannabidiol (CBD) improved vocal recovery is associated with anti-inflammatory and antioxidant efficacy

Mark Tripson

Biomedical Sciences

Mentor: Kenneth Sonderstom

The non-euphorogenic phytocannabinoid CBD has been used successfully to treat childhood epilepsy. Some evidence suggests concomitant resolution of developmental delays, including improved vocal communication. Translational to human speech, zebra finch song is a complex behavior learned during a sensitive period of vocal development, and therefore is a promising model to understand mechanisms responsible for potential CBD-related improvement of delayed speech. Like language, adult zebra finch song quality is maintained through continuous sensorimotor refinement involving dual circuits controlling vocal learning and production. Song syntax and phonology slowly degrade following deafening (that interferes with sensorimotor maintenance) and are rapidly, but transiently disrupted following partial lesions of a vocal motor cortical region called HVC (proper name). We found previously that CBD both reduces the magnitude of lesion-related disruptions, and speeds vocal recovery. Because in other systems CBD has anti-inflammatory and antioxidative effects, we hypothesized that similar processes may be important to vocal recovery. We therefore tested the hypothesis that expression of inflammatory (IL-1 β , IL-6, TNF α), and anti-inflammatory mediators (IL-10), as well as oxidative stress (SOD2) were altered following lesions in a manner opposed by CBD treatments. Measuring gene and protein expression of these markers, after six pre-lesion treatments (10 mg/kg/day CBD, IM) followed by two post-lesion treatments, we found a robust decrease in inflammatory markers and increased anti-inflammatory activity. Through microdissection techniques, we have isolated inflammation to key areas within both motor and learning pathways, suggesting specific targets for drug activity. Identification of associated physiological changes within these regions promises to reveal neuroplastic changes necessary for vocal learning and recovery, and the substrates underlying CBD efficacy to improve these processes.

Utilization of the EHR to Improve Family and Support Person Engagement in Health Care

Emily Tucker

Medical Family Therapy

Mentor: Jennifer Hodgson

Innovations to electronic healthcare record (EHR) systems are inviting new methods of patient and support person engagement. The aim of the current study was to explore the experiences of patients, their support persons, and healthcare team members as they interact within the patient's EHR using a patient portal function. A total of 21 patient, support person, and healthcare providers were interviewed at three separate points over a 6-month time period. Data from interviews and focus groups were analyzed using Colaizzi's seven step phenomenological data analysis method. Themes identified from all three participants groups revealed that utilizing the EHR portal with a team-centered approach invites improvements in care and dispels myths that increased proxy engagement through the EHR will overwhelm the system with patient and proxy requests for healthcare team response. Themes across all groups include: (a) pro-proxy characteristics, (b) ways proxy access improves patient care, and (c) strategies to maximize the proxies' role as part of the healthcare team. The portal functions of EHR systems are underutilized and understudied. Given recent advancements in telehealth and requirements for safer care pandemic protocols, this study highlights strategies and dispels myths that are essential to advancing care to those most in need.

Physical Activity and Sleep Study in Preschool Aged Children

Diana Turner

Exercise Physiology

Mentor: Katrina DuBose

Introduction: Physical activity (PA) participation and sleep benefit preschool aged children's mental and physical health. Unfortunately, childhood obesity and hypertension are becoming more prevalent in this age group. While achieving the recommended amount of PA and sleep at the preschool age may decrease children's risk for these illnesses, limited research has examined their associations with health outcomes in this population. The purpose of this study is to examine the relationships between PA, sleep, and health outcomes in preschool aged children.

Methods: This study included eight parent-children dyads with children aged 3-5 years. Parents completed a demographic survey and sleep diary for eight days to measure the children's total sleep at night and during nap times. Anthropometric measurements and blood pressure (BP) measurements were obtained for all the children. Anthropometric measurements were used to calculate the children's body mass index (BMI), BMI z-score, and BMI percentile. BP was used to calculate participants BP percentile and BP z-score. PA participation was measured using accelerometers for eight days. The accelerometers were used to calculate the amount of time spent in light, moderate, vigorous, MVPA, and total PA.

Results: Of the eight children who participated, four were female and four were male. The mean age of the children was 4.0 ± 0.76 years. On average, the children met PA guidelines by participating in 388.91 ± 63.74 minutes/day of total PA. The mean amount of sleep per night was $9.42 \pm .85$ hours/night and only four of the children took naps during the day. Approximately 37.50% of the children met sleep guidelines while 62.50% did not. The mean BMI z-score of the children was $-.01 \pm .48$ and the mean BMI percentile was 49.75 ± 17.81 . The mean systolic BP z-score was $-.37 \pm .92$ and the mean diastolic BP z-score was $.73 \pm .79$. Of the children, 25% had an elevated blood pressure and 75% had a normal blood pressure.

Conclusion: Among preschoolers it is easier for them to meet PA guidelines than sleep guidelines. Nap time seems to play an important role in helping preschool aged children meet sleep guidelines. This research may help confirm that typically developing preschool aged children are not getting enough sleep. While it appears that the lack of sleep does not impact health indicators, further research is necessary to investigate the relationship between sleep, PA, and health indicators in typically developing preschool aged children.

CONNECTING DURING COVID: MEETING SOCIAL AND EMOTIONAL NEEDS OF AT-RISK ELEMENTARY STUDENTS DURING A PANDEMIC

Jamie Tyler

Educational Leadership

Mentor: Travis Lewis

The COVID-19 pandemic necessitated school buildings to close in March of 2020 across the United States. Since then, despite a lessening of quarantine restrictions, many students remain in virtual learning environments, unwilling or unable to step onto campus. The inability to access the supports provided from the physical school environment can provide additional challenges for certain populations of students, especially those who are considered at-risk academically or described as *vulnerable* due to conditions within the home environment. While teachers provide opportunities for these students to interact virtually, remote learning environments can be isolating and may not support the academic or social and emotional needs of these students. In light of the current educational circumstances, one approach to mitigate the isolating impacts of the COVID-19 pandemic is mentoring. Mentoring provides strategic and structured opportunities for students to interact with peers while building relationships with trusted adults within the school building. This study evaluates the effects of an online mentoring program for vulnerable, at-risk students and aims to identify effective interventions that can help to mitigate the educational inequities that result from the isolated, remote learning environments. This mixed methods, action research study, is framed around the theoretical foundations of Maslow's Hierarchy of Needs and the Science of Learning and Development model. Following implementation of an online mentoring program, data is currently being collected to measure the impact on levels of student engagement and connectedness. Teachers met with small groups of students online for six weeks, implementing lessons that focused on CASEL's social and emotional learning competencies. Both qualitative and quantitative data from surveys and focus groups were gathered to examine the effects of these lessons. The findings from this study may be helpful to schools that need to provide social and emotional support for students isolated in remote learning environments as a result of school buildings closing in response to the global pandemic.

A SENSE OF BELONGING: EXAMINING THE IMPACT OF A SOCIAL EMOTIONAL FRAMEWORK ON STUDENT CONNECTEDNESS WITH SIXTH GRADE MALES

Krystal Tyndall

Education Leadership

Mentor: Travis Lewis

Swansboro, a township part of Onslow County Schools, is a community of schools comprising three elementary schools, one middle school, and one high school. Based on data collected from an at-risk referral database, Swansboro Middle School has experienced a sharp increase in student mental health referrals. The community has also endured three student suicides over the last three years. Several parents of students have also committed suicide in the last year, resulting in increased advocacy and support for their children in response. Separately, sixth grade males have consistently demonstrated a higher number of discipline referrals than any other grade level in the school, as indicated by a three-year trend in the school's discipline report. Being connected serves as a promotive function during adolescence, reducing risks and improving positive outcomes in social, emotional, and academic domains. Student connectedness has an impact on student's well-being and participation in youth risk behavior. Given the concerning trends with disciplinary incidences, mental health referrals, and suicidality, the purpose of this action research study is to monitor the effects of implementation of the Responsive Classroom social emotional learning framework on student connectedness and a sense of belonging. It is intended that such implementation will have a positive effect on student success as indicated by a decrease in student discipline incidents and a decrease in at-risk behaviors as indicated by at-risk and mental health referrals. A mixed method, action research approach has been employed. Quantitative data is being collected by analyzing data points from discipline incidents, mental health referrals, and the administration of the Youth Risk Behavior Survey (YRBS). A pre-implementation survey has been disseminated to 186 sixth grade students. Through the use of action research, the collaborative inquiry partners and the scholarly practitioner are applying incremental changes as appropriate based on data collected throughout the study. The findings of this study will be shared with the school's strategic leadership team to determine if continued use of this SEL framework will occur. This presentation will share the pre-survey results and progress thus far with implementation of the SEL framework at Swansboro Middle School on the number of disciplinary and at-risk behaviors.

Potential for nanobodies as therapeutic agents against SARS-CoV-2

Chukwudi Ubah

Environmental and Occupational Health

Mentor: Lok Pokhrel

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a new strain of β -coronavirus responsible for the Coronavirus Disease 2019 (COVID-19) pandemic. Although, SARS-CoV and MERS-CoV also emerged as a pandemic before, their spread and death toll were more limited compared to COVID-19. As of February 8th, 2021, there have been over 106 million cases of COVID-19, 59.2 million recovered, and 2.3 million deaths, globally. The lack of an effective therapeutic agent against these viruses has prompted the need for the development of effective and safer antiviral agents necessary for curbing both the ongoing pandemic and future viral outbreaks. Although remarkable success has been made in the development of vaccines against COVID-19, their efficacy on the multiple new variants of SARS-CoV-2 has remained unclear. To circumvent this challenge, nanobodies have emerged as potential antiviral therapeutics. Nanobodies are nano-sized entities derived from conventional antibodies with potential to neutralize virus and/or inhibit virus propagation. Nanobodies can also serve as a nano-size carrier platform with potential to deliver antiviral drugs with high specificity to the target sites, increasing drug bioavailability and thus effectiveness against viruses, including MERS-CoV and SARS-CoV-2. Because of their variable antigen binding domains and high specificity and affinity to intended antigen binding, nanobodies elicit little to no toxicity and immunogenicity on the host, their prolate shape exposes a convex paratope and enable easy access to receptor clefts, which are inaccessible to conventional antibodies. This poster critically summarizes the current information on the molecular biology of SARS-CoV-2, the mechanism of virus cell entry using the human receptor Angiotensin Converting Enzyme 2 (ACE2), and the potential usefulness of novel nanobodies as a therapeutic or preventative option against COVID-19. Our results show that nanobodies could be significantly surface modified as desired to target different stages of viral replication including viral attachment, viral uncoating, viral uptake, viral nuclear translocation, and viral release from host cells. These potentials can be harnessed through a nanobody platform making it an effective therapeutic agent against the coronaviruses such as MERS-CoV, SARS-CoV and SARS-CoV-2.

Word Count:319. Key words: Virus particle, Spike protein, Nanobodies, Molecular biology, ACE2 receptor, SARS-CoV-2, MERS-CoV.

Campus Voter Initiative

Alex Urban

Community Engagement

Mentor: Timothy Christensen

Based on information collected from the US Census Bureau, young Americans are the least likely demographic to vote. According to *Common Cause, North Carolina*, not only were students at ECU less likely to vote, ECU ranked nineteenth in voter turnout of all schools in North Carolina. Because of this, our honors group concluded that this was an issue that needed to be addressed. After the group found that classic get-out-to vote drives often yielded the best results for campaigns, our research group concluded that in order to increase voter participation among ECU's students, we would use grassroots techniques to spur them to vote. This included as much face-to-face interaction as possible, centered around tabling events, registration drives, and bringing candidates on campus to interact directly with students. In order to achieve this, we founded the Campus Voter Initiative. The group held tabling events and meet and greets, as well as a debate, on ECU's campus during the Fall of 2019 and Spring of 2020. However due to the COVID-19 pandemic, unforeseen hurdles were created. Thusly, the Campus Voter Initiative, in an effort to make some sort of impact on the 2020 election, partnered with the Association of Mexicans in North Carolina, and recruited the help of other campus organizations to run a Safe Site at the Willis Building, where we disseminated PPE, water, and voter guides.

Using Cryo-Electron Microscopy to Determine the 3-Dimensional Structure of Fibrinogen

Elizabeth Viverette

Physics

Mentor: Nathan Hudson

Fibrinogen is a large protein that is the soluble protein precursor to fibrin, which forms fibers that hold blood cells together to create blood clots. Research into the properties of fibrinogen is necessary because of its role in many thrombotic ailments, including strokes and heart attacks. The structure of fibrinogen has been studied through various methods, though certain regions of fibrinogen have not yet had their structures conclusively determined. These regions all have apparent flexibility and mobility of the region that is lost in sample preparation of other imaging methods such as the formation of crystal structures for x-ray crystallography.

Cryogenic Electron Microscopy (cryo-EM) is a technique for imaging proteins and other macromolecules at resolutions of 1-3 Å while preserving native structures such as flexibility. Cryo-EM involves freezing samples in a layer of amorphous ice to remove interference from frozen crystal structures. Because of this sample preparation procedure, fibrinogen can be imaged in its natural state. CryoSPARC and other Cryo-EM analysis software works by identifying isolated molecules and grouping them into relative angle orientations that are then condensed and averaged into 2-D structures. The initial process of 2-D angle classification and data refinement can be automated to some degree with neural networks, such as Topaz, developed and trained specifically to assist with Cryo-EM analysis. Once 2-D structures have been optimized, a complete three-dimensional render of the protein can be reconstructed using Gaussian best-fit algorithms.

A data set of over 500 GB has been collected using the Cryo-EM microscope at the National Institute of Environmental Health Sciences. This data set includes samples collected via negative staining. Multiple software packages for Cryo-EM analysis will be used to choose appropriate particles for use in the final structure and render initial and final structures, including EMAN2, CryoSPARC, and a neural network specifically trained to process fibrinogen data. The particles to be used to image 2-D and 3-D maps of fibrinogen will be both manually and automatically selected and sorted into angle templates. This is complicated by the numerous possible flexibility states of fibrinogen. These templates will be refined and averaged over multiple iterations to create an optimal data set for the construction of a high-resolution structure map of fibrinogen in its natural, flexible form.

Collaboration and research in Fashion and culture from a constructivist point of view

Jillian Waddell

Family and Consumer Science Education

Mentor: Tiffany Blanchflower

For this research I am working with a Professor to redesign a domestic diversity course, MRCH 2239, Fashion Culture, offered by the Merchandising and Consumer Studies Program. The aim of this course is to increase students' awareness of the cultural diversity and richness that exist within the United States for the sociological and fashion lens. Via a grant by the Lapis Library this course is currently being revised to be textless using a combination of academic, industry, and cultural resource events to craft a course that will not only expand students' perspectives and enhance their ability to appreciate and be more receptive to various domestic cultures. The redesign of this course takes a social constructivist approach, wherein learning takes place with real world examples and in a social manner. For instance, students are presented with current cultural topics of events in the Weekly Powerpoint, quiz, and discussion boards. Once students have reviewed the PowerPoints and taken the quiz they complete a discussion board, wherein they use the Socratic method, asking other students questions about the topic at hand. Next, the students are required to engage and respond to one another. We are currently in the initial phases of course development and plan to collect data to see if this approach improves student awareness, understanding, and acceptance of domestic cultures.

Comparing Common Comorbidities of ADHD, Depression, Anxiety, and Stress, in Undergraduate Students with and without ADHD

Carmen Walker

Psychology

Mentor: Christyn Dolbier

The transition to college is difficult for all students, but a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) can escalate those challenges as a result of the new environment and rigor of school work. There is minimal research done regarding the experience of individuals with ADHD throughout this period of emerging adulthood, but this is arguably the greatest period of change so far in these undergraduate's lives. Increased levels of depression, anxiety and stress can make preexisting symptoms of hyperactivity and impulsiveness more difficult to deal with. This presentation will look at three common comorbidities of ADHD, depression, anxiety, and stress, in terms of how strongly they affect undergraduate students with ADHD compared to students without ADHD.

I predict that compared to students without ADHD, students with ADHD will have higher levels of depression, anxiety, and stress as a result of the increased pressure to adapt to a new environment while learning how to navigate ADHD symptoms on their own for the first time.

Students (N=454) were recruited from two primary sources including introductory psychology classes and from Disability Support Services (DSS) across the Fall semester of 2020. The average age of participants was 19.02, with the majority being female (69.38%), Caucasian (75.33%), and freshman (75.55%). Participants were asked to virtually complete a survey consisting of items from the Patient Health Questionnaire-8, the Generalized Anxiety Disorder-7, the Perceived Stress Scale-10, and the Adult ADHD Self-Report Scale Version 1.1.

By the time of the presentation there will be results to report, but at this time I am interested in seeing which of the three common comorbidities, depression, anxiety, and stress, are most prevalent in the study's sample and comparing the prevalence of those comorbidities in students with ADHD to those without ADHD.

If it is discovered that students with ADHD suffer from higher rates of these comorbidities, it is imperative that universities make strides to support this at risk group of students through increasing the accessibility of services from DSS and ensuring students have the tools they need to be successful in higher education.

Application of 1,8-ANS Fluorescent Probes to Identify Hydrophobic Patches on the Surface of EF-Hand Protein, Human Cardiac Troponin C (hcTnC)

Olivia Warfel

Chemistry

Mentor: Anne Spuches

The role that heavy metals play in cellular toxicity remains a highly relevant area of research due to negative health repercussions observed following toxic metal exposure seen in areas such as Flint, Michigan. This project contributes to the underlying goal of Spuches' lab, which is to understand how proteins and peptides interact with toxic metals from a fundamental thermodynamic, structural, and kinetic perspective. So far, we know toxic heavy metals, like cadmium and lead, can interact with calcium binding proteins as a structural impersonator but not a thermodynamic mimic. In order to understand toxicity from a molecular level, this study conducts a deeper investigation into the structural changes that occur with metal binding by applying 1,8-ANS fluorescent probes to identify hydrophobic patches on the surface of human cardiac troponin C (hcTnC), a model for these EF-Hand proteins. Our central hypothesis is that the hydrophobic patch will exhibit the least exposure in the apo state, and the counts for calcium and cadmium may show key differences that could help Spuches' lab in the quest to underline the mechanism of metal toxicity.

UterUS Abstract

Leah Warren

Engineering

Mentor: Bhibha Das

UterUs is a group of women dedicated to bringing sustainable and accessible reusable menstrual hygiene products to both the Pitt County and ECU communities. We believe advocating for reusable menstrual products can empower menstruators explore alternative options and change how future generations think about menstrual hygiene.

We have partnered with DotCup, a reusable menstrual cup company, to bring menstrual cups to Pitt County and ECU. They offer a 'buy-one-give-one' promotion, meaning for every cup purchased, one cup is donated to a community in need. DotCup's CEO, Betsy Drach, has promised us that they would give us the cups to donate to local shelters and organizations who might need them. We believe that menstrual cups could be cost effective in the long-run, ensure that students have the coverage they need, and change the mentality of alternative menstrual products in the future.

We have collected names of students who would be willing to try a cup if given the opportunity to gauge how much money we need based on ECU's interest. This will be our first round of free Dot Cups to students and a local shelter and we will be following it up with a virtual orientation to provide our group with instructions on their new menstrual cup from health care professionals at the ECU Student Health Center. We will also provide them with other great menstruation and empowerment resources from other groups at ECU like the Women and Gender Office for example. We are going to continue to search for funding and people willing to try a menstrual cup in our community to allow us to keep donating cups, holding orientations, and creating a community of period positive individuals for years to come!

Given Pitt County's 24.5% poverty rate compared to North Carolina's 16.8%, we believe that the community could have a great need for these cups. We have reached out to local shelters, and we are making a lot of progress! We are considering reaching out to high school's next. We have also considered the Purple Pantry or the Student Health Center as distribution centers for students in need. We know this project has the potential to aid so many in our community and we thank you for your consideration!

Tellus: a Business Driving the World's Transition to Sustainable Products

Rachel Watkins

Biochemistry

Mentor: Timothy Christensen

Project Description: According to historical data, "it can be expected that around 75% of the used masks, as well as other pandemic-related waste, will end up in landfills, or floating in the seas"[1]. Furthermore, surgical masks contribute to microplastics in the environment [2], and cloth masks release harmful dyes, chemicals, and methane when sitting in the landfill [3]. This waste is a problem because it is being created at an exponential rate due to the mask mandates imposed by the current COVID-19 pandemic, and it is going to substantially harm the environment. Therefore, it is hypothesized that if biodegradable facemasks are introduced into the mask market, then the environmental harm caused by facemasks will be significantly reduced. So, our business, Tellus, which was established in HNRS 2000/3000, will begin its impact by introducing biodegradable, disposable face coverings called Tellus Masks into the mask industry. Tellus Masks will be made from high quality wood pulp, and their three-ply construction has a bacterial filtration rate of at least 95%. Tellus plans to market its masks to personal consumers and high-traffic areas such as schools and businesses. Additionally, since our masks are biodegradable and disposable, our customers will need to continually replenish their stock of Tellus Masks, which will generate a steady cash flow into the business. In contrast, while conducting preliminary research, we found that "the UN trade body, UNCTAD, estimates that global sales will total some \$166 billion this year, up from around \$800 million in 2019"[1]. This fact means we should be able to introduce our Tellus Masks into the market relatively easily. Furthermore, Dr. Perkins, a physician at the Georgetown University Student Health Center, said that "There's still a lot that we're learning about the vaccine. Experts aren't sure what percentage of the population has to get the vaccine before herd immunity is established. And so for that reason, we want to continue to wear a mask" [4]. Moreover, Dr. Fauci recently promoted the use of double masking because "it just makes common sense that it would likely be more effective" [5]. These statements show that masks will be present in the foreseeable future, and their use may even become greater as the different strains of the virus circulate. Therefore, the need for masks from the pandemic as well as the daily need in many medical and industrial sectors will provide Tellus with a sustainable future.

Is Service Convenience in Healthcare Related to Sustained Competitive Advantage?

Abigail Webster

Management

Mentor: Oghale Asagbra

Telehealth services have become a vital technological tool that has proven to be especially important in the era of the COVID-19 pandemic. Telehealth services allow healthcare organizations to meet the convenience, safety, and quality expectations of their patients. By adopting a unique design and strategic application of this technology, healthcare organizations could improve their competitive advantage. This conceptual paper presents a framework illustrating how healthcare organizations can enhance their competitive advantage by providing telehealth services to meet the convenience needs and quality expectations of their patients. The pathway presented here builds on the combination of a service convenience framework and the resource-based view (RBV). It is anticipated that further research to test the propositions highlighted in this paper will contribute to the body of knowledge. Furthermore, it will allow healthcare organizations and policy makers to assess the value associated with the provision and utilization of telehealth services in accordance with their internal and external characteristics.

Analysis of a Direct-Heating Solar-Assisted Recompression Supercritical Co₂ Brayton Power Cycle

Kenneth Weddle

Mechanical Engineering

Mentor: Tarek Adbel-Salam

Power cycles based on supercritical carbon dioxide (sCO₂) have the potential to yield higher thermal efficiencies at lower capital cost than state-of-the-art steam-based power cycles. It has become clear that as the U.S. power sector evolves, power-generating technologies must be flexible, efficient, and highly responsive to grid needs. sCO₂ power cycles integrated with solar and thermal energy storage have shown significant potential to meet the needs of the current and future grid. Due to the importance of this research, three DOE offices are working together to reduce the technical hurdles and support foundational research and development of sCO₂ power cycles.

In this study, energy and exergy analysis will be performed to develop a model to optimize a direct-heating solar-assisted recompression sCO₂ Brayton power cycle. The research hypothesis is that the optimized cycle will have higher efficiency and lower cost with enhanced capability due the integration of a renewable energy source. Pressurized water is used as a working fluid in the solar collector loop. The equations of the components of the cycle will be solved using Engineering Equation Solver (EES). Optimization and simulations will be carried out using MatLab, Simulink.

Investigating Mentoring Experiences for Populations Interested in Pursuing a Career in Medicine

Varina Wekam

Biology

Heather Vance-Chalcraft

Mentoring plays a key role in STEMM (Science, Technology, Engineering, Mathematics and Medicine) because it helps retain students and increases the likelihood that students persist in a program. Mentoring typically happens in a dyadic form where a senior mentor advises a mentee who is not as experienced. Facilitated peer mentoring is one of the other forms of mentoring where a mentor or multiple mentors work with several mentees.

I investigate the prior mentoring experiences of students in medical school by surveying 75 medical students from three different schools of medicine (ECU's Brody, Wake Forest, and UNC Chapel Hill) and holding one-on-one interviews with ten of the survey respondents. Survey items asked about students' experiences with both formal and informal mentors as well as their exposure to different mentoring configurations. On average, students had been exposed to both formal and informal mentoring before entering medical school. Most students identified being mentored in a dyadic setting, and students mentored in a group setting mostly identified one mentor who mentored them and another peer together. Most students strongly benefitted from their mentoring experiences; however, based on the interviews, some students built better connections with their informal mentors. Both male and female students reported seeking career guidance from their mentors, but most female interviewees wished they had sought psychological guidance from their mentors as well. Female students reported that being able to relate with their mentors (work-life balance, being a woman and/or woman in color in science and medicine) positively impacted their mentoring experience. This study provides a deeper understanding of the prior mentoring experiences of these students and advances the ongoing research about effective mentoring in higher education.

Evaluating the impact of non-native SAV on native nekton

Emory Wellman

Biology

Mentor: Rachel Gittman

Species of submerged aquatic vegetation (SAV, seaweeds and seagrasses) are critical foundation species in marine systems. However, SAV habitats worldwide are being invaded by non-native SAV species, and attempts to control or eradicate these invaders are often expensive and ineffective. A key necessity in invasive SAV management is objective assessment of the impacts of invasive SAV on native organisms, and identification of different settings in which non-native SAV may be negative, neutral, or beneficial. As foundation species, non-native SAV may facilitate communities associated with degraded native SAV by reducing local stressors and improving environmental conditions for SAV-dependent fauna, like nekton. Broadly, nekton are animals that move independently of water currents, and, for the purposes of this study, are defined as the shrimp, fish, or decapod crustaceans that use SAV habitats. SAV provides habitat structure that many species of nekton use for refuge, reproduction, and foraging. To inform management decisions and advance understanding of SAV community ecology, we use quantitative meta-analysis to assess the impacts of non-native SAV on native nekton. We extracted data on non-trophic facilitation of native nekton by native versus non-native SAV from 36 studies. We compared nekton survival, reproduction, growth, size, abundance, and species richness in co-occurring native and non-native SAV habitats. We also evaluated whether potential benefits or detriments of non-native SAV were mediated by the identities of the native and invading SAV (i.e., seagrasses or macroalgae). Interestingly, we found no record of seagrasses invading macroalgae. Analysis of response metrics indicated that in all cases, native SAV had more positive effects on native nekton than non-native SAV, with the exception of habitat preference. The positive effects of native SAV held across all study regions. Study design (i.e. observational versus manipulative approaches) impacted only the outcome of assessments of nekton reproduction. Our results indicate that the interactions between native nekton and non-native SAV are complex and context-specific. We highlight several areas where additional research is needed to foster a holistic assessment of the ecological impacts of non-native species, and, therefore, a more informed approach to future SAV management.

Use of Teams versus WebEx for Group and Individual Writing Interventions for 7-12 Year Old Students

Taylor Whaley, Sarah Woodlief

Occupational Therapy

Mentor: Denise Donica

Handwriting is a fundamental skill used daily by children. Success with handwriting requires many underlying cognitive and motor skills. Occupational therapists are qualified to assess these skills and provide interventions to improve them. There is existing evidence supporting occupational therapy's role in improving handwriting skills; however, there is limited evidence regarding the delivery of handwriting intervention virtually through telehealth.

The COVID-19 pandemic has altered the way both therapy and school have been conducted, as in-person gatherings have been limited. This study reviewed the use of a virtual interprofessional writing program for children ages 7-12 that addressed both handwriting (occupational therapy) and spelling (speech language pathology) skills. This program was trialed in Spring 2020 in person until it was halted due to the pandemic. It was restructured to a virtual format for Fall 2020 to allow a broader audience of students to participate. This opportunity included students who may have otherwise had barriers to participating including living out of town and time of day of sessions.

This study examined the feasibility of two virtual platforms for providing telehealth services. The interprofessional program included 8 weekly sessions with a pre and post-test as well as another follow up 3-months later. For the sessions, we used both Microsoft Teams (first 4 sessions) and WebEx (last 4 sessions). This provided a unique opportunity to explore the features of conducting telehealth to students in both group and individual formats through two different platforms. The information gained from this research study provides beneficial knowledge for OT practitioners as well as other health care providers as it explores the features associated with two commonly used virtual platforms. The information can help guide practitioners in making informed decisions regarding their choice of virtual platform when conducting therapy services through telehealth. This study increases the knowledge base regarding features associated with virtual platform as well as information regarding the efficacy of virtual handwriting interventions.

This poster will detail various features of Microsoft Teams and WebEx that were used to provide both group and individual interventions. Features that contributed to the ease of use and challenges that arose from the therapists' perspective will be discussed.

Mechanical Failure of Human Fetal Membrane Tissues in Premature Birth

Mackenzie Wheeler

Biolmedical Engineering

Mentor: Michelle Oyen

More than 1 in 10 babies in the U.S. were born premature in 2017, resulting in approximately 4,000 preterm deaths. The goal of this project is to determine the force it takes for a baby's amniotic sac to rupture, leading to the onset of labor. The amniotic sac is the protective layer that surrounds the fetus and amniotic fluid during gestation. This project aims to discover a gel-like substance that can be used to patch up the baby's amniotic sac after a leak or rupture, allowing the baby more time inside their mother, as this is essential for the baby's life. Current testing methods include the mechanical testing of tissue paper. The elastic modulus and failure strength of the tissue paper and is comparable to the mechanical properties of fetal membranes. Next, fetal membranes are being obtained from full-term placentas as the IRB application has been approved for acquisition of tissue samples in collaboration with the obstetricians at Brody School of Medicine and Vidant Health. The mechanical properties of the chorioamnion membrane in the placenta, and the chorion and amnion layers are being assessed with biaxial puncture testing. Specimens are gripped between two 3D printed holders that we designed and printed in the lab, that have open centers to allow ample room for puncture testing to occur. Peak force is recorded with the ElectroForce machine, and the rupture sites are examined. The membrane and component puncture force data are used to calculate biaxial failure strength.

Branding & Social Media Engagement: A Study of Small Business Advertising

Alita White

Communication

Mentor: Erika Johnson

In 2017, Alita White founded Awe Media as a wedding videography business. Since then, she has had mediocre success with social media engagement and advertising online to consumers. This project seeks to understand whether specific branding of a business and a specific strategy to social media posts will increase online engagement. The first part of the project focused on building an informational, user-friendly, and aesthetic website for the business. This included developing a new logo, new color scheme, and changing the business name to Ali White Media. The second part of the project will involve developing a specific social media strategy and evaluating success through surveys and the study of social media analytics. Creating a social media strategy involves deciding what photos, videos, graphics, and text will be in social media posts over the course of several months. Messaging must be intentional and focused on specific goals of the business. It also involves creating a calendar in which to schedule posts. Overall, this project will determine whether intentional online marketing increases engagement and further improves the small business.

Risk assessment of inhaled diacetyl from electronic cigarette use among teens and adults

Avian White, David Wambui

Environmental and Occupational Health

Mentor: Lok Pokhrel

Diacetyl (C₄H₆O₂) is a toxicant commonly found in electronic cigarettes (e-Cigs) as a flavoring component and an enhancer of e-juices. Lung injury in current and former workers in popcorn manufacturing suggests a possible association with diacetyl inhalation exposure. Although the number of e-Cig users continues to rise steadily among the teens and adults, the potential risk of pulmonary disease has not been characterized. A systematic review of the open literature identified bronchiolitis obliterans—a pathological inflammation resulting in fibrosis of the bronchioles leading to an irreversible limitation to airflow in lungs—as the primary outcome of diacetyl exposures. Following the deterministic United States National Research Council/Environmental Protection Agency's risk assessment framework, that consists of four key steps: hazard identification, dose-response assessment, exposure assessment and risk characterization, we estimated noncarcinogenic (systemic) risks using a Hazard Quotient (HQ) approach upon exposure to diacetyl among teens and adults who use e-Cigs. Based on the NIOSH Benchmark Dose (BMD; 0.0175 mg/kg-day) and modelled Average Daily Doses (ADDs; range 0.11-5.2 mg/kg-day), we estimated 12 different HQ values—a measure of non-carcinogenic risk for diacetyl inhalation exposures—all of which were greater than 1 (range 6.2875–297.1429), suggesting a significantly higher non-carcinogenic risk from diacetyl exposures among teens and adults who use e-Cigs. These results underscore the need to regulate e-Cig use among teens and adults to protect them from diacetyl exposures and risk of developing lung injuries including bronchiolitis obliterans.

Comparison of Online Versus Face-To-Face Physical Activity Interventions on Undergraduates' Autonomy and Physical Activity Levels

Timothy White

Sport and Exercise Psychology

Mentor: Bhibha Das

Approximately 33% of undergraduate students do not adhere to the physical activity (PA) guidelines put forth by US Department of Health and Human Services and do not experience the benefits associated with regular PA. Because the college years are some of the most influential years of ones' life, promoting PA and its benefits during this period is a promising strategy to reduce the risk of the future development of chronic diseases in this population. PA interventions grounded in Self-Determination Theory (SDT) effectively improve levels of PA by increasing autonomously motivated behaviors. Yet, it is unknown how SDT may impact students' PA autonomy via an online versus a face-to-face (F2F) PA intervention. **METHODS:** The purpose of this study is to compare the effectiveness of a F2F course-based PA intervention and its ability to increase undergraduate students' PA and autonomy levels to that of online course-based PA intervention. It is hypothesized that a F2F course-based intervention will be more effective in increasing autonomy levels and PA in undergraduate students compared to the online intervention. The intervention will occur over a 15-week semester. Participants will complete demographics, IPAQ 7-day recall, Exercise Self-Regulation Questionnaire, and the Relative Autonomy Index. The F2F intervention will include an in-class lecture and activity. The online intervention will include the same educational material as the F2F intervention but will not incorporate any in-class lectures or activities. Statistical analyses will include frequencies and ANOVA. **ANTICIPATED RESULTS:** It is expected that both the online course-based PA intervention and the F2F course-based PA intervention will be effective in the promotion of autonomy and PA. However, it is expected that the F2F course-based PA intervention will be more effective in increasing autonomy and PA levels of undergraduates. The results of this study could further the understanding of how online course-based PA interventions may promote autonomously motivated behavior and regular PA. Future public health implications may include an increase in PA amongst young adults Adherence to the PA& guidelines by young adults, and later on life, could potentially assisting in alleviating public health burdens associated with physical inactivity and chronic diseases.

WORKPLACE TELEPRESSURE AND WORKAHOLISM: ICT BOUNDARY CREATION AS A POTENTIAL MODERATOR

Emily Wilder

Industrial-Organizational Psychology

Mentor: Shahnaz Aziz

In the current study, we investigated the relationships between workplace telepressure, workaholism, and information and communication technology (ICT) boundary creation. Workplace telepressure is defined as the urge to stay connected and respond to work-related messages via ICTs (Barber et al., 2019). In addition, workaholism is the need to work incessantly (Oates, 1971). Both workplace telepressure and workaholism have been found to negatively impact employees on interpersonal, organizational, and organizational levels (Clark et al., 2016). For that reason, we examined not just the workaholism and workplace telepressure relationship but also the potential moderating influence of ICT boundary creation. ICT boundary creation could allow employees to better divided their time at work and at home thus minimizing the negative consequences of workaholism and workplace telepressure. The final sample included 401 full-time staff and faculty at a large southeastern university. The results showed that workplace telepressure was positively related to workaholism and negatively related to ICT boundary creation. Furthermore, workaholism was negatively related to ICT boundary creation. In addition, ICT boundary creation did moderate the relationship between workplace telepressure and workaholism, such that as ICT boundary creation increased, the relationship between workplace telepressure and workaholism got weaker. Future potential studies, implications, and study limitations are addressed.

Examining the Use of Internet-Based Interventions among Racial/Ethnic Minority Cancer Survivors: A Systematic Review

Samantha Willard

Nursing

Mentor: Heather Kindi

Background: One growing area of research is the use of the Internet-based interventions among cancer survivors. Cancer survivors have a need for lifelong follow-up care and are more likely than the general population to seek information online. Internet-based interventions have also been proven to be helpful in providing support to cancer survivor. Historically, there was an under-representation of racial/ethnic minorities in research concerning Internet-based interventions. However, there is emerging research that is closing the gap. Thus, the purpose of this study is to examine the use of Internet-based interventions among minority cancer survivors.

Methods: The databases searched on November 12, 2020 were PubMed, Scopus, and ProQuest Search. No date limit was placed on this search. Inclusion criteria were studies concerning: racial and/or ethnic minorities, foci of support and/or education through Web-based or Internet or technology sources, and cancer survivors. Exclusion criteria were: studies aimed only on LGBTQ+ populations that focus on sexual minority and not racial minority, and studies focused on hospice care, palliative care, end of life, and mental health conditions.

Preliminary Findings: The search produced a total of 1,170 records. After duplicates (n=320) were removed, 850 records remained. Two independent reviewers screened the titles and abstracts of 850 records. During that phase, 775 records were determined as irrelevant based on inclusion and exclusion criteria. 62 records fit the criteria and 39 were questionable, where a third reviewer determined the discrepancies. A total of 75 records are under full text review. This is preliminary data. Two faculty screened the selected articles using Covidence, an online platform for conducting systematic reviews.

Approximately 16 records will be included and extracted for the systematic review. Preliminary themes among the records include information, support, and telehealth.

Viral Regulation of Immunity and Bioinformatics Analysis

William Willis

Biology

Mentor: Rachel Roper

Smallpox, eradicated in 1980, remains a historic milestone in medical science as well as a testament to the power of vaccines. However, its vaccine has remained relatively unchanged and continues to be one of the more risk-associated vaccines in modern medicine. The risk of smallpox vaccination (ACAM2000 Vaccine) lies in the fact that it uses the live vaccinia virus, a less virulent relative of smallpox that retains a degree of virulence in humans. Our lab uses bioinformatics to analyze sequences and study particular genes of vaccinia virus and how they contribute to virulence. We are studying the differences between A35-knockout, O1L-knockout and wild type vaccinia virus in terms of virulence and immune responses. Our lab hypothesized and demonstrated that the deletion of virulence gene sequence A35 in vaccinia virus resulted in dampening of viral pathogenesis. Immune responses of mice vaccinated with A35-knockout were significantly higher than the immune responses of wild-type vaccinated mice. The functions of the A35 and O1L genes are currently unknown, but we are using bioinformatics to explore homologous sequences in databases to develop hypotheses for these gene functions. In addition, we will explore sequence motifs within A35 and O1L that might give clues to their biochemical functions. These data will aid in understanding poxvirus virulence/pathogenesis. The improved immune response to A35 Deletion shows that this version of the virus could prove fruitful for not only a safer smallpox vaccine, but it could also be used as a recombinant vaccine against many other infectious diseases and cancer.

TELL ME MORE: PARENT-CHILD SEXUAL TALK AND YOUNG ADULT SEXUAL COMMUNICATION SATISFACTION WITH ROMANTIC PARTNERS

Kelsi Wilson

Marriage and Family Therapy

Mentor: Jakob Jensen

Young adults (18-30) tend to show insufficient levels of communication about sex with their romantic partners (Faulkner & Lannutti, 2010), despite the many benefits of sexual communication to relationships for this age group (Chatterjee, 2008; Denes, 2020; Jones, 2016; Landor & Winter, 2010). Often, learned sexual shame and guilt play a role in inhibiting sexual communication with partners (Faulkner & Lannutti, 2010; Lim, 2019). Early messages about sex from parents that stem from narrow cultural boundaries of communication may play a role in fostering sexual shame and guilt from a young age and may influence sexual communication patterns with partners later on (Arnett, 1995; Ballard & Senn, 2019; Day, 2019; Powers, 2017). This study seeks to identify whether a significant relationship exists between participants' past parent-child sexual communication growing up and sexual communication satisfaction, relational satisfaction, and sexual satisfaction with current partners.

The researchers of this study will use frequencies and ANOVA procedures to examine whether there is a relationship between the main source of sexual information for young adults and sexual communication satisfaction with current partners. Furthermore, bivariate correlations, regression analyses, and path modeling will be used to view the relationship between parent-child communication about sex and later satisfaction of sexual communication, sexual satisfaction and relational satisfaction in young adults in romantic relationships. Finally, the researchers will conduct mediational analyses within the path models to inspect whether sex guilt plays a mediational role between parent-child sex communication in childhood/adolescence and sexual communication satisfaction with romantic partner. ANOVA analyses will be used to identify whether patterns of parent-child sex communication or sex guilt differ by gender, race/ethnicity, sexual orientation, or religiosity of participant.

Exploring the dynamic relationship between temperature and elevation in the lower atmospheric boundary layer.

Nia Wilson

Mechanical Engineering

Mentor: Teresa Ryan

This work is a continuation of an ongoing project comparing numerical sound propagation predictions based on temperature profile assumptions with predictions made using experimental measurements of the temperature profiles in the lower atmospheric boundary layer. Prior work measured the temperature data within a vertical range of 25 meters above ground level with the use of iMet-XQ2 sensors mounted on an unmanned aerial vehicle (UAV). The data was processed to create temperature profiles for each individual flight cycle from the flight sessions. A flight cycle consists of one vertical round trip from 5 meters to a predetermined flight ceiling and back down to 5 meters. The temperature profiles were then used to generate sound propagation predictions. The predicted sound pressure levels were compared for the measured or assumed temperature profiles. One aim of the new work is to better understand the experimental relationship between temperature and elevation, and how that relationship changes with time on the scale of minutes or hours. A new preprogrammed path with faster flight cycles and a 100 m flight ceiling will provide a richer data set for each flight session.

Chest X-ray After Thoracostomy Tube Removal in Lobectomy Patients is Associated with Increased Costs But Not Improved Re-Intervention or Readmission Rates

Nicolas Wingard

Biology

Mentor: James Speicher

Traditionally a chest x-ray is obtained several hours after thoracostomy tube removal in post-lobectomy patients, in order to assess for pneumothorax or other complications of tube removal. The value of this practice to detect a problem requiring intervention is compared to drawbacks in length of stay (LOS) and associated costs. An IRB approved, retrospective institutional database study was conducted on all lobectomy patients at a single institution over a three year period. Patients were separated into groups by whether or not they received a chest x-ray after removal of the thoracostomy tube that was placed during their initial procedure. Groups were compared based on demographics, symptoms after tube removal, need for re-intervention/readmission, LOS, and associated costs. 308 patients underwent lobectomy during the study period, and 183 (59.4%) of those had a chest x-ray (CXR) after thoracostomy tube removal while 125 (40.6%) did not (NCXR). Demographic data were similar between the groups. Outcomes data is shown in Table 1. There was no difference in the rate of re-intervention including new thoracostomy tube placement between groups. 37 CXR patients (20.6%) had notable findings on x-ray. Two of these (1.1%) required thoracostomy tube replacement and 16 (8.7%) received an additional x-ray. Three CXR patients (1.6%) had tube replacement for reasons other than the x-ray findings. The CXR group had increased, but statistically insignificant rates of emergency department visits and readmission. There was no difference in overall LOS and LOS after tube removal. Cost per patient was significantly increased in the CXR group, associated with additional radiographs and re-interventions. The use of chest x-ray after thoracostomy tube removal was not associated with re-intervention or readmission rates in lobectomy patients, however it significantly increased costs. This study suggests symptomatic assessment to determine the need for re-intervention is appropriate and adequate, and routine use of post-pull chest x-rays may be unnecessary.

Dredging impacts on ichthyoplankton and zooplankton in Beaufort, North Carolina: Initial results

Ceilia Wood

Biology

Mentor: Rebecca Asch

Dredging impacts marine life in many ways, including distorting vision and breathing. In Beaufort North Carolina, dredging is typically done in the wintertime. This past summer the Beaufort inlet was dredged to make way for ships to enter. This occurred during the typical time when juvenile fish use estuarine nursery habitat in this area. Not much research has been done in the Beaufort inlet, a few studies show that there isn't a large enough impact on larval fishes to potentially affect their population size. However, this work relied heavily on modeling potential impacts based on mean abundance of larvae and flows into the estuary rather than on data gathered in situ at the time of dredging. Based on results from studies in other regions, an increase in mortality among the larval fish could occur when there had been dredging in the area. To see the impact, samples were taken offshore of the inlet in varying distances. Each location is marked as a station, each station was sampled once a week. To examine potential impact, samples were taken in Beaufort inlet, near the Newport river estuary, and offshore of the inlet along three transects extending offshore. Once sorted out by size they are put in a jar filled with 70% ethanol. A station located near Pivers island was also sampled once a week. These samples were then brought back to the lab to be sorted by size to see how much sediment from dredging was in the sample and to identify mesozooplankton taxonomic groups. Each sample was sifted through three sieves with mesh sizes of 4.75mm, 850 μ m, 200 μ m. The findings concluded that there was an effect of the dredging on zooplankton volume in the vicinity closest to dredging, but more research is needed on which species of mesozooplankton and ichthyoplankton were most affected. In areas where the dredging created more debris there was less zooplankton. North and south of the inlet also saw a lower amount of zooplankton during and after dredging.

A Role of Dopamine and Adenosine Receptor Modulators on Spinal Reflex Excitability in an Iron-Deficient Model of Restless Legs Syndrome

Sydney Woods

Biomedical Science

Mentor: Stefan Clemens

Restless Legs Syndrome (RLS) is a sensorimotor disorder characterized by a strong urge to move the legs. RLS patients present regularly with brain iron deficiency (BID), and BID has been associated with altered dopamine (DA) and adenosine (ADE) neurotransmission. To assess the role of BID on sensorimotor reflexes as a measure of altered spinal cord excitability, we recorded pain withdrawal reflex latencies in a diet-induced brain iron-deficient animal model, as well as the model's responsiveness to DA and ADE receptor modulators.

Following a previously established protocol, C57Bl/6 mice were grouped into control iron diet (CTRL, ~48 ppm Fe, 8 males and 8 females) and iron-deficient (ID) diet cohorts (ID, 2-6 ppm Fe, 10 males and 10 females). The ID diet did not induce an anemic phenotype. To assess spinal cord excitability, we used the Hargreaves IITC Plantar Analgesia Meter to measure thermal pain reflex withdrawal latencies (TPRWLs), starting at one week after diet exposure. We found a significant decrease in TPRWLs after 3 weeks in female ID animals and after 5 weeks in male ID animals, compared to their respective CTRL cohorts, and these differences remained stable over time. We then administered a DA D3 receptor (D3R) agonist (pramipexole, PPX, 0.5 mg/kg, i.p.) to all cohorts. PPX led to the rescue of hyperexcitability in male and female ID animals within range of their respective controls, but was accompanied in these animals by strongly increased locomotor and rearing activities. We next tested the effects of the DA D1 receptor (D1R) antagonist ecopipam (SCH39166, 0.5 mg/kg, i.p.). SCH39166 rescued the ID-induced hyperexcitability in male IDs but not female IDs. Lastly, we tested the non-specific ADE receptor antagonist caffeine (50 mg/kg, i.p.) in CTRL cohorts and the ADE A1 receptor (A1R) agonist N6-cyclpentyladenosine (CPA, 1 mg/kg, i.p.) in ID cohorts. Caffeine did not have significant effects in CTRL animals, but CPA led in both male and female cohorts led to the rescue of hyperexcitability in both males and females; it did not induce unwanted locomotor side effects as observed after PPX treatment.

Together we show that diet-induced ID leads to increased hyperexcitability in the spinal cord reflex circuitry that remains stable over time. Our data also show that spinal cord excitability can be modulated by DA and ADE receptor modulators in a BID animal model, which may provide a novel approach for the treatment of RLS symptoms.

Variation in Timing of Male Breeding Plumage Growth in Ruff Sandpipers

Anna Works

Biology

Mentor: Susan McRae

Ruff Sandpipers (*Philomachus pugnax*) are migratory shorebirds that display unusual sexual dimorphism with most males molting into ornamental neck and head plumage. The species is unique among birds for a polymorphism in male mating strategy determined by a pair of chromosomal inversions in chromosome 11. Most males are "Independents" that grow dark ornamental plumage (ruff) and exhibit aggressive behavior while displaying and defending courts on a lek. Males carrying variants of the inversion have different plumage and behavioral patterns, both less aggressive: "Satellites" grow white ruffs and move among courts co-displaying with Independent males, and "Faeders" (or cryptic males) do not grow ornamental head or neck plumage or display, but resemble females and behave as sneakers. The courtship activity of males must synchronize with the breeding condition and laying behavior of females in order to successfully breed in captivity. At Sylvan Heights Waterfowl Park in Scotland Neck, NC, a small population of ruffs has been maintained in two separate enclosures. One winter, the males were inadvertently exposed to an altered light regime which simulated longer days. These males molted into breeding plumage and initiated courtship behavior ~2 months before females (that had been housed separately) were in mating condition. Few fertile eggs were produced as a result that year. A small cohort of birds arrived in late 2020 from Canada, where the winter light regime is also different than in North Carolina. My study examines the effects of these changes in light regime on molt schedule in relation to experience, age and morph type. Standard photos of males will be taken weekly to observe the development and timing of ornamental plumage growth on each bird. Knowing the timeline of molt under different light regimes will provide insights into the mechanisms controlling molt physiology and inform successful breeding of this species in captivity.

An analysis of the availability of Health Education Materials and resources in migrant farm workers and their families

Michael Wright

Public Health

Mentor: Joseph Lee

BACKGROUND: In the United States, there are more than 3 million migrant or seasonal farm workers each year. The lack of legal protections, low pay, and often-dangerous work conditions lead to serious health inequities for farmworkers and their families. This in conjunction with the lack of adequate health care opportunities makes a huge deficit for migrant farmworkers health. This project sought out to identify health education barriers within the farmworker community and map the availability of health education materials across four databases: Migrant Clinicians Network, National Center for Farmworker Health, National Agricultural Safety Database and MedlinePlus.

METHODS: We identified 15 key topics within health education. We established inter-coder reliability and conducted coding for patient education materials by topic. We also coded if the material was designed specifically for farmworkers.

RESULTS: The availability of materials ranged from on the low end, accessing clinic services, having one health education material total across all four databases, to Alcohol, Tobacco and other drugs having 50 materials across the 4 databases. Databases ranged from 1% of materials targeted towards farmworkers (MedlinePlus), to 27% materials targeted (Migrant Clinicians Network).

DISCUSSION: These data points were captured in hopes of bridging the gap in publicly available information for migrant and seasonal farm workers. Key databases for patient education materials for migrant farmworker populations have gaps that may hinder health promotion efforts.

Tissue-specific transcriptomics reveal functional differences in maize floral development

Hailong Yang

Interdisciplinary Biological Science

Mentor: Beth Thompson

Flowers are produced by floral meristems, groups of stem cells that give rise to floral organs. Grass flowers (called florets) are contained in spikelets, which contain one to many florets depending on the species. Like other members of the Andropogoneae tribe, maize spikelets contain two florets, which are the product of the upper and lower floral meristems (FM). Upper and lower florets are usually dimorphic in the Andropogoneae, with the lower floret greatly reduced relative to the upper floret. In maize, early floral development appears identical in both FM, although development of the LFM is delayed relatively to the UFM. Both the tassel and ear initiate bisexual flowers and sex determination occurs relatively late in development via carpel abortion in the tassel and stamen arrest in the ear. In the tassel, both florets fully develop resulting in spikelets with two male florets that are indistinguishable at maturity. In the ear, however, the lower floret aborts resulting in spikelets with a single female floret. To gain insight into the functional differences between the UFM and LFM, we globally examined gene expression in maize ears using laser capture microdissection (LCM) coupled with RNA-seq. We found that approximately 700 genes differentially expressed between the upper and lower FM, including genes related to hormone regulation, the cell wall, sugar and energy homeostasis. Furthermore, we found that cell wall modifications and sugar accumulation differed between the upper and lower florets. Finally, we identified a novel boundary domain between the upper and lower floret, which we hypothesize is important for floral meristem activity. We propose a model in which growth is repressed in the lower floret by limiting sugar availability and upregulating genes involved in growth repression and senescence.

Tweet Negativity-Baiting & Anti-China Sentiment

Anna Yerges

Communication

Mentor: Sachiyo Shearman

Coronavirus has caused mass fear, wide-spread panic, and fueled inaccurate or incomplete information nationwide in the United States (especially in the early part of 2020). The COVID-19 pandemic has Tweeter's freely expressing opinions using microblogging and text messaging. Unfortunately, the fear and uncertainty increased severity of racial discrimination targeting Asian ethnicities as well as anti-China sentiment (Chen et al., 2020; DOJ, 2021). Samuel et al. (2020) reported fear-sentiment and its progression among tweets during this pandemic. In the United States, the Asian Pacific Policy and Planning Council (2020) reported more than 1,000 anti-Asian discriminatory events. The Department of Justice Community Relations Service (CRS) coined "America's Peacemaker" responded to racial tensions by providing virtual mental and educational services in all 50 states (DOJ, 2021). The purpose of this study is to determine Tweet sentiment, transitions of sentiment, and polarity associations toward China and Asian ethnicities. Sentiment analysis was used to analyze Tweets containing keywords #Coronavirus and #China. Tweet Binder was used to gather data on three data points, Jan 27-28 (n = 4801, Apr 19-20 (n = 2440), and Jul 8-9 (n = 455). Tweet Binder's software identifies levels of positivity and negativity of Tweeter's opinions along with key indicators such as the number of re-tweets, likes, and economic value. Tweet Binder's unique measurement of impact of Tweets made by influencers is coined, *economic value*. The tweet contents were re-grouped into two groups by medium split by the number of re-tweets and likes. The top 100 most frequently used terms were investigated with Word Cloud. The number of tweets #Coronavirus and #China were most frequent in January, followed by April and July. Even though the number of tweets overall declined, the ratio of negative tweets reported by Tweet binders increased steadily from January, April and then to July. Initial data indicates shifts in positivity, negativity, neutrality, and number of tweets regarding coronavirus and china shifted over time. January data shows users show most frequently mentioned @who. April data indicates a shift towards a political theme with @realdonaldtrump being the most mentioned and a 2.7% increase in negative tweets. Word frequency lists contain between 71% - 75% identical matching words or hashtags.

Keywords: Coronavirus, COVID, China, sentiment analysis, #China, #Coronavirus

A Digital Transition: Visitor Engagement with Virtual Museum Tours During the COVID-19 Pandemic

Elizabeth Young

Anthropology

Mentor: Megan Perry

The North Carolina Museum of Natural Sciences has drastically modified how they engage with museum visitors in the wake of the COVID-19 pandemic. The forced closure of the museum allowed for the development of virtual 360° experiences based on their physical exhibits. These virtual experiences allow individuals to enjoy the permanent exhibits offered by the museum from their own homes. However, because virtual exhibits are new territory for the NC Museum of Natural Sciences, it is unclear how visitors engage or interact with the exhibit and the elements provided within it. Exhibit evaluation staff traditionally uses surveys to understand how visitors interact with exhibits in-person, allowing users to fill out surveys with volunteers or on iPad kiosks. This distribution method isn't available with virtual exhibits. Surveys based on three virtual exhibits were placed directly inside the exhibits for visitors to fill out and share what features of the exhibit they utilized and what information and visual aspects appealed to them. Responses will aid the museum in understanding how their audience engages with their virtual exhibits, allowing for staff to modify virtual exhibits to further engage their audience.

Structural and Thermodynamic Investigation of Pb^{2+} Binding to Human Cardiac Troponin C

Raazia Zia

Biochemistry

Mentor: Anne Spuches

Toxic metal exposure is linked to a variety of health issues including cardiovascular disease and diabetes. It is known that toxic metals are capable of mimicking essential metals for binding sites in proteins. It is also known that both divalent cadmium (Cd^{2+}) and lead (Pb^{2+}) can disrupt Ca^{2+} signaling pathways. However, little else is known about how this happens at the molecular level. Research in the Spuches Lab is geared towards understanding metal toxicity from a structural and thermodynamic perspective. In this project, I will investigate Pb^{2+} binding to human cardiac troponin C (hcTnC), a Ca^{2+} binding protein that is responsible for heart muscle contraction. Isothermal titration calorimetry (ITC) studies of Pb^{2+} binding to wild-type and C35A/C84A N-domain hcTnC will be conducted to determine the stoichiometry of metal binding as well as δG , δH , and $T\delta S$ of the reaction. Circular dichroism (CD) experiments will also be used to probe the structural changes that occur upon Pb^{2+} binding to wild-type and C35A/C84A N-domain of hcTnC. My results will be compared to data obtained for Cd^{2+} in the Spuches lab in an effort to understand lead toxicity at the molecular level.