
31st NC State
Undergraduate
Research
&
Creativity
Symposium

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UNDERGRADUATE RESEARCH

31ST ANNUAL NC STATE UNIVERSITY
SPRING UNDERGRADUATE RESEARCH & CREATIVITY SYMPOSIUM AGENDA

TUESDAY, APRIL 26

10:00 – 10:30 A.M.	Check-In/Welcome/Refreshments
10:30 – 11:30 A.M.	Oral Session 1
11:30 A.M. – 12:30 P.M.	Poster Session 1 *Engineering*
12:30 – 1:00 P.M.	BREAK
1:00 – 2:00 P.M.	Poster Session 2 *Business & Economics* *Education* *Environmental Sciences* *Humanities* *Mathematics & Quantitative Studies* *Physical Sciences and Astronomy* *Social and Behavioral Sciences*
2:15 – 3:15 P.M.	Poster Session 3 *Biological and Life Sciences* *Medical and Health Sciences* *Chemical Sciences* *CALS Honors*
3:15 – 3:30 P.M.	Closing Remarks

Wednesday, April 27

10:00 – 10:30 A.M.	Check-In/ Welcome/ Refreshments/ Michael Dickey Award
10:30 – 11:45 A.M.	Oral Session 2
11:45 A.M. – 12:30 P.M.	BREAK
12:30 P.M. – 1:30 P.M.	Poster Session 4 *Biological & Life Sciences*
1:30 P.M. – 1:45 P.M.	Closing Remarks

Presenter Index
(Alphabetically by First Name)

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
Aasim Hussain (College of Engineering)	PS1	20	Dr. Fisher		Biochemical analysis of ECM/Gelatin Solution for use in a Near Field Electrospinning System for Engineering Tendon
Abby Hodges (College of Sciences)	PS4	15	Dr. Halweg		Impact of Virtual Case Study on Student Understanding of Multi-Generational Pedigree Analysis
Abigail Cordiner (College of Engineering)	PS1	15	Dr. Dolatshahi		New Insights into IgG1 Transport Across Placenta Using Agent-Based Modeling
Adam Sumner (College of Agriculture & Life Sciences)	PS4	42	Dr. Shen		The Long Isoform of AT1G31540 NLR from Arabidopsis Accession Pla-1 Specifically Confers Resistance to Geminivirus Infection
Adrianne Caudill (College of Sciences)	PS2	4	Dr. Griffith	Anthony Wang, Helen Reed, Roland Graham, & Patrick O'Keefe	Predictive Ability of GRE Scores on Graduate Student Success
Adrianne Caudill (College of Agriculture & Life Sciences)	PS4	23	Dr. Johnston	Katie Yoon, Sydney Deloatch, & Catherine Sander	Fresh Pasta SSOP Revision
Ahmed Haija (College of Sciences)	PS4	26	Dr. Kakumanu		Effect of diet on growth parameters and endosymbiont concentration in the German cockroach
Aidan Kelly (College of Sciences)	PS2	44	Dr. Dougherty		Modeling Exciton Diffusion in Organic Solar Cells using Stochastic Partial Differential Equations
Alex Almaraz (College of Engineering)	PS1	43	Dr Thornton	Lynee Dale, Katarina McGarry, & Tal Dor-El	Syringe Analysis for Foam Sclerotherapy
Alex Swanson-Boyd (College of Agriculture & Life Sciences)	PS3	19	Dr. Trivedi	Morgan Weinberg, Chicaya McDaniel, & Maddi Swain	Turmeric Zone: Turmeric Honey Lollipop

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
Alexander Sprague (College of Engineering)	PS1	28	Dr. Kamper		Multi-User Virtual Reality to Enhance Neurorehabilitation
Alexandra Addison (College of Sciences)	PS2	3	Dr. Griffith	Dyllan Baranchak, Grace Hilpl, Livia Popa, & Abigail McManus	How Do Funding and Demographics Affect Graduate School Success?
Alexandra Early (College of Humanities & Social Sciences)	PS2	34	Dr. Neupert		Resilience Following Traumatic Loss: Daily Uplifts Buffer the Negative Consequences of Losing Loved Ones
Alexiah Thompson (College of Sciences)	PS2	16	Dr. Mckenney	Helena Jolly	NC Coastal Communities and their Response to Coastal Erosion
Alexxis Gutierrez (College of Sciences)	PS4	18	Dr. Heil		Exploring Saccharomyces in Dough Environments
Alienor Hedlund (College of Sciences)	PS4	32	Dr. Long		The effect of iron variation on phloem differentiation
Alina Jugan (College of Engineering)	PS1	8	Dr. Bourham		Computational Exploration of Single-Shot Deposition of Selected Metals on Solid Targets Using a Pulsed Electrothermal Plasma Source
Alyssa McInnis (College of Agriculture & Life Sciences)	PS4	27	Dr. Kathariou		A Hidden Defense: Prophage as a Phage Resistance Mechanism in Listeria monocytogenes
Amanda I. McIntyre (College of Humanities & Social Sciences)	PS2	36	Dr. Neupert		Childhood Trauma and Perceptions of Control Later in Life
Amber Detwiler (College of Engineering)	PS1	36	Dr. Piedrahita		Engineering Skin: Building the Follicle from the Niche
Anaya Ahuja (College of Agriculture & Life Sciences)	PS4	6	Dr. Chouljenko	Haoyi An, Beryl Shoemaker, & Taylor Lanier	Pickling as a Preservation Method For Shrimp: Quality and Safety Analysis
Andrea Casallas (College of Agriculture & Life Sciences)	PS2	10	Dr. Leggett		Land Owner Surveys on Hemp Growing
Andrew Balsbough (College of Engineering)	PS1	40	Dr. Spontak		Novel Semi-crystalline Thermoplastic Elastomer Gels

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Andrew Hoang (College of Engineering)	PS1	35	Dr. Papadopoulou		Simulating Doppler Audio Signals of Free Gas Bubbles Flowing in Vessels In Vitro
Angelica Luzzi (College of Agriculture and Life Sciences)	PS3	34	Dr. Thakur		Analyzing Phenotypic Resistance Profiles of ESBL E. coli and Salmonella Found in Backyard Poultry Farms
Anjali Singh (College of Humanities & Social Sciences)	PS2	40	Dr. Widman		The Correlation Between Self-Worth and Delinquent Activity in Adolescent Girls
Anna Behnke (College of Natural Resources)	PS2	11	Dr. McKenney	David Wagner	Overfishing
Anna Taylor (College of Sciences)	PS2	42	Dr. Blondin		The Effect of Wind Speed and Roche Lobe Geometries on the Wind Dynamics of Vela X-1
Annalise Hafner (College of Agriculture & Life Sciences)	PS4	20	Dr. Hoyo		Implications of Maternal Pre-Pregnancy BMI and Mediterranean Diet Adherence on Offspring DNA and Health
Anusha Chandra (College of Agriculture & Life Sciences)	PS3	23	Dr. Kim		Studying dietary supplementation effects of algae on nursery pigs
Ashley Kim (College of Agriculture & Life Sciences)	PS4	4	Dr. Ascencio-Ibanez	Trisha Natarajan, Emely Pacheco, Reshma Goud, & Whitney Pesce	Partial Characterization of infectious clones of Pepper Huasteco Yellow Vein and Pepper Golden Mosaic Viruses in Tomato Lanai
Ashley Kropf (College of Agriculture & Life Sciences)	PS3	39	Dr. Flowers		Demographics of Cases Presented to an Emergency Veterinary Hospital
Ashley Williams (College of Sciences)	OS1	3221 (10:55-11:20)	Dr. Lorenzen		Hunt for the Male-Determining Factor in Tribolium castaneum
Benjamin Harris (College of Humanities & Social Sciences)	OS2	3210 (10:55-11:20)	Dr. Cassidy		The Debate Over the Best Use of Public Lands Through the Hetch Hetchy Valley Controversy
Bevin Neill (College of Engineering)	PS1	9	Dr. Brudno		Computational Modeling and Testing of Drug Targeting in the Body

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Brianna Diaz (College of Agriculture & Life Sciences)	PS3	21	Dr. Crespo		Effect of Live IBD Vaccine on Early Protection Against Challenge
Caitlin Phipps (College of Natural Resources)	PS2	19	McKenney	Dylan Hawkins	The Effects of Biodiversity Loss
Caleb Keaveney (College of Sciences)	PS2	45	Lackmann		Modeling the Longevity of Jupiter's Great Red Spot with EPIC
Carl Tunehag (College of Humanities & Social Sciences)	PS2	29	Gruehn	Rebekah Knight & Daniel Gruehn	Examining the link between working memory and eating habits.
Caroline Dau (College of Engineering)	PS1	21	Freytes		Development of a Wound Healing Assay to Test New Porous Extracellular Matrix Patches In Vitro
Casey Wofford (College of Natural Resources)	OS2	3210 (11:20-11:45)	Jeffries		Demystifying Dendrology: An Online Preparation Course Develops a Growth Mindset and Successful Strategies for Learning Tree Identification
Catherine McMahan (College of Sciences)	PS4	25	Jones		An Interrupted Virtual Case Study to Address Student Understanding of Biochemical Pathways
Chase Jenquin (College of Engineering)	PS1	33	Narayanaswamy		Pressure Field Mapping of Shock Boundary Layer Interactions Using Pressure Sensitive Paint in an Axisymmetric Geometry
Chloe Hincher (College of Engineering)	PS1	19	Fisher		Estrogen Receptor Alpha Expression Loss from Anterior Cruciate Ligament Fibroblasts Throughout Monolayer Culturing
Claire Waters (College of Natural Resources)	PS4	7	Cove		Biodiversity benefits of ecosystem engineers are negated by invasive predators and anthropogenic disturbance
Daniel Friday (College of Engineering)	PS1	16	Ducoste		Analysis of Retention-Based Grease Interceptor Design Patterns to Maximize Fat, Oil, and Grease Particle Separation

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Darbi Adcox (College of Agriculture & Life Sciences)	PS4	9	Dr. Ferket	Sung Kim, Will Shumate, & Jacob Johnson	Determination of ROx Water's Influence on E. coli Cell Biomass Yield and Growth Rate
Deeqa Musa (College of Engineering)	PS1	11	Dr. Cole		Material Heterogeneity Affects Element Yielding in Finite Element Models of Vertebral Trabecular Bone at Clinical Imaging Resolution
Diana Leyva (College of Humanities & Social Sciences)	PS2	28	Dr. Gruehn	Rebekah Knight	Negative Effects of ACEs on Memory Performance
Dianna Miller (College of Agriculture & Life Sciences)	PS3	36	Dr. Sutton		Discovering Cultural Competence
Drew Dunphy (College of Design)	PS3	8	Dr. Bell		The Right to Play
Dylan Hawkins (College of Sciences)	PS4	36	Dr. Mckenney		The Effects of Biodiversity Loss
Eli Benbenek (College of Sciences)	PS3	10	Dr. Paciulli	Cooper Lamb, & Allie Monahan	Captive aye-aye (Daubentonia madagascariensis) Mother Vocalizations after Giving Birth
Elijah Kormanek (College of Natural Resources)	PS2	30	Dr. Lee	Logan Yokeley, & Agatha Mitchem	A Holistic Review of Pressing Issues, Coping Strategies, and Resources Available to Collegiate Athletes
Elizabeth Ampolini (College of Agriculture & Life Sciences)	PS4	1	Dr. Ascencio-Ibanez		Identifying the Composition of Secondary Endosymbionts in Different Bemisia Tabaci Populations and their Related Effects on Begomovirus Transmission
Elizabeth Ampolini (College of Agriculture & Life Sciences)	PS4	2	Dr. Ascencio-Ibanez		Developing the OpenFlexure Microscope for Low-Cost, In-Lab Brightfield and Fluorescent Imaging
Ella Harlacher (College of Natural Resources)	PS2	12	Dr. McKenney	Joel Beebe	Environmental and Social Justice

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Emilie Norwood (College of Engineering)	PS3	4	Dr. Sombers		Optimizing the Fabrication of Carbon-Fiber Microbiosensors for Simultaneous Detection of Glucose and Dopamine in Live Brain Tissue
Emily Ostermann (College of Engineering)	PS1	44	Dr. Wei		Polymer Compatibility of Microneedle Patches for Nucleic Acid Extraction and Amplification of Tomato Leaf DNA
Emily Petersen (Wilson College of Textiles)	PS4	46	Dr. Fang		Assistive Knee Orthosis Powered by Miniature Fiber-Shaped Pneumatic Artificial Muscles
Emily Schoendorf (College of Sciences)	PS4	40	Dr. Perera		Do Arabidopsis sgr5 and frs2 Mutants Have Altered Tropic Responses?
Emily Ye (College of Sciences)	PS3	38	Dr. Xie		Characterization of Anti-SARS-CoV-2 Metabolite Profiles in Various End Products of Green Teas
Emma Knox (College of Agriculture & Life Sciences)	PS3	26	Dr. Leonard	Madison Manzo	Effects of particulate matter on health and performance of finishing swine
Emma Simpson (College of Agriculture & Life Sciences)	PS3	32	Dr. Sederoff		Bioinformatics Analysis of Lotus japonicus miRNA Gene Sequences
Erik Modesto Reyes (College of Engineering)	PS1	30	Dr. Lobaton		Improving the Design of a Robotic System for Microscopic Fossil Sorting
Ethan Frey (College of Engineering)	OS1	3210 (10:55-11:20)	Dr. Dickey		Precisely Controlling Stiffness in Double Network Hydrogels Using Metal Redox Reactions
Ethan Gates (College of Engineering)	PS4	3	Dr. Ascencio-Ibanez		Effects of Plasmid and Mutagenic Primer Concentrations on Transformation of a Mutated Geminivirus Infectious Clone
Evelyn Rowan (College of Natural Resources)	PS4	28	Dr. Katti		Bird Diversity Across a Socioeconomic Gradient in the North Carolina Triangle Area using Triangle Bird Count Data

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Garrett Baucom (College of Engineering)	PS1	2	Dr. Amassian		Multi-Component Exploration of PEDOT:PSS Ink Formulation by Optimization Campaign
Georgia Daniel (College of Agriculture & Life Sciences)	PS3	42	Dr. Trivedi	Linzi Long	Evaluating Depression, Anxiety, and Stress in Pre-veterinary Students using DASS-21
Grace Sigmon (College of Natural Resources)	PS2	15	Dr. McKenney	Claire Sholar	Human Effects on Shorebirds in North Carolina
Grace Thomas (College of Agriculture & Life Sciences)	PS1	24	Dr. Guertault		Experimental and Numerical Study of Long-Term Solute Transport and Fate in Soils
Grace Winesett (College of Agriculture & Life Sciences)	PS4	16	Dr. Hanley-Bowdoin		Correlation Between SEGS-1 Episomes and Cassava Mosaic Disease Progression in TME3 Cultivar Infected with EACMV
Graham Neve (Wilson College of Textiles)	PS3	1	Dr. Budhathoki-Uprety		Polymer-mediated Removal of Textile Dyes for Environmental Sustainability
Hang Nguyen (College of Sciences)	PS2	7	Dr. Banks		Analysis of Bactrocera dorsalis Count in Senegal and Environmental Factors Affecting Bactrocera dorsalis and Fopius arisanus Growth
Hayden Bland (College of Engineering)	PS1	6	Dr. Bataller		Microrheology of Molten Salts
Hayden Bland (College of Engineering)	PS1	7	Dr. Bataller	Matthew Field, Christopher Williams, & Miranda Moultrie	A Method for Bubble Detection in Molten Salts using an Acoustic Resonator
Hayden Reed (College of Humanities & Social Sciences)	PS3	9	Dr. Clarke		The Ontogeny of Feeding Behavior in the Endangered Ring-tailed Lemur (Lemur catta)
Helen Nocito (College of Agriculture & Life Sciences)	PS4	34	Dr. Mainello		Designing Lineage- and Species-Specific LAMP Assay to Detect P. ramorum and P. kernoviae In Rhododendron

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Holly Walsh (College of Natural Resources)	PS2	21	Dr. Nichols		Screening of Groundwater in Wake County for Private Well Users
Hongtu Yang (College of Humanities & Social Sciences)	PS2	18	Dr. McKenney	CJ Dierking	Climate Change
Hunter Coleman (College of Natural Resources)	OS1	3222 (10:55-11:20)	Dr. Lee		Racial Discrimination in NFL Coach Unemployment Length
Imani Bynum (College of Humanities & Social Sciences)	PS2	22	Dr. McLaughlin		How Augmented reality impacts Task Performance, Error Frequency, and Workload amongst nurses in the ICU
Isabella Hile (College of Natural Resources)	PS4	22	Dr. Jeffries		Invasive Fig Buttercup: A Community Approach to Stop the Spread
Jackson Beck (Poole College of Management)	PS2	1	Dr. Ajmani		The Use of Machine Learning to Manage Business Risk Within the Financial Industry
Jacqueline MacStudy (College of Sciences)	PS3	20	Dr. Tsuji		Intracellular Localization of a Cell Killing Protein
Jarica Edwards (College of Agriculture & Life Sciences)	PS3	22	Dr. Goshe	Nicolas Mastrovito, Carly Centanni, Alyssa Pope, Emma Hillburn, Bella Black, Alyceanna Campos, & Landon Privette	Recent Advancements in Tau and β-Amyloid Aggregation Research Related to the Pathology of Alzheimer's Disease
Jasmine Alleyne (College of Agriculture & Life Sciences)	PS4	44	Dr. Simpson		Examining the Knockdown Expression of RSK3 in relation to UGDH in Prostate Cancer Cells
Jeanette Pfeiffer (College of Agriculture & Life Sciences)	PS4	39	Dr. Perera		Regulation of a novel phosphate responsive transcript in Arabidopsis thaliana

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Jenna DeVito (College of Agriculture & Life Sciences)	PS3	29	Dr. Paciulli	Allie Monahan	Aye-Aye (Daubentonia madagascariensis) Infant Vocalizations during the First Two and a Half Weeks of Life
Jenny Iruela (College of Agriculture & Life Sciences)	PS3	40	Dr. Fogleman		Qualitative Analysis of Healthcare Experiences and Support among Women with Gestational Diabetes Mellitus
Jerush Christopher (College of Natural Resources)	PS1	18	Dr. Fedkiw		Predicting Polymer Morphologies using Machine Learning and Assessing Potential Applications in Energy Storage
Johnny Nguyen (Poole College of Management)	PS2	2	Dr. Byrnes		Best Strategies for Club Advertisement: Understanding Your Target Audience
Jonah Peckham (College of Sciences)	PS3	13	Dr. Paciulli		Trichromatic Color Vision in Female Coquerel's Sifakas (Propithecus coquereli) Demonstrated with Novel Objects
Jordan Page (College of Engineering)	PS1	34	Dr. Palmtag		Uranium Core Design for Versatile Test Reactor
Jordan Peeler (College of Agriculture & Life Sciences)	PS3	28	Dr. Leonard		Impact of Ammonia on the Production and Health of Finisher Pigs
Justin Ammann (College of Agriculture & Life Sciences)	PS3	31	Dr. Santos		Peanut Skins for Sustainable Packaging
Kailee Spake (College of Natural Resources)	PS2	20	Dr. Morais		Bigger is Not Always Better: Analysis of the Link Between Agritourism Micro Entrepreneurs and an Increased Adoption of Sustainable Agriculture Practices
Kaitlyn Keith (College of Agriculture & Life Sciences)	PS2	13	Dr. McKenney	James Patterson	Poaching and Pet Trade

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Kalynn Turner (College of Sciences)	PS3	6	Dr. Sombers		Real-time, Simultaneous Measurements of Hydrogen Peroxide and Dopamine Fluctuations in the Dorsal Striatum
Karl Hill (College of Sciences)	PS4	41	Dr. Planchart		CRISPR/Cas9-Mediated pycr1b Mutations in Zebrafish as a Model of Human Microcephaly
Katarina McGarry (College of Engineering)	PS4	11	Dr. Gluck		Cell Adhesion on Natural versus Synthetic Polymers
Katelyn Bohn (College of Humanities & Social Sciences)	OS2	3210 (10:30-10:55)	Dr. Murray		The Environmental and Economic Role of Historical Hemp Production in Rural France
Kathryn Benedict (College of Engineering)	PS1	10	Dr. Cole		Design Optimization, Fabrication, and Validation of a Bone-On-Chip Platform
Keanan Scarbro (College of Sciences)	PS2	41	Dr. Blondin		The Effect of Density Clumps on the Accretion Process in High Mass X-ray Binaries
Lailah Ligons (College of Engineering)	PS3	3	Dr. Sombers		Rapid Detection of Glucose and Lactate Fluctuations in Rat Dorsal Striatum
Laney Kimble (College of Agriculture & Life Sciences)	PS3	7	Dr. Sombers		Real-time, Simultaneous Detection of Dopamine and Glutamate in Rat Striatum Using an Enzyme-Modified Carbon-Fiber Microelectrode with Fast-Scan Cyclic Voltammetry
Lara Rabinowitz (Wilson College of Textiles)	OS2	3221 (10:30-10:55)	Dr. Nartker		Something on the Way to Becoming Something Else: The Agency of Objects in Textile Making and Memory Preservation
Lauren Reynolds (College of Engineering)	PS1	47	Dr. Zaharoff		Development of Dissolvable Microneedle Patch-based Vaccines
Lauren Rooney (College of Natural Resources)	PS4	37	Dr. McKenney	Justin Boehm	The Value of the Endangered Red Wolf (Canis Rufus)

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Leeman Smith (Wilson College of Textiles)	OS2	3221 (10:55-11:20)	Dr. Lamar		The Lovers
Lexi Ezzell (College of Agriculture & Life Sciences)	PS3	25	Dr. Leonard	Elizabeth Espino	The Negative Effects of Humidity on the Growth of Finisher Pigs
Lily Averette (College of Agriculture & Life Sciences)	PS1	26	Dr. Jones		Precision Agriculture for Sweetpotato Analytics for Produce Provenance and Scanning (Sweet-APPS)
Lily Mullins (College of Humanities & Social Sciences)	PS2	39	Dr. Widman	Carina Becker, & Megan Armstrong	Barriers To Child-Parent Sexual Communication: "My child is too young"
Lindsay Long (College of Agriculture & Life Sciences)	PS3	33	Dr. Sorenson		Investigating Food Preference in Madagascar Hissing Cockroaches(Gromphadorhina portentosa)
Lindsay Strickland (College of Sciences)	PS3	35	Dr. Ferzli		The Relationship Between Testing Anxiety and Learning Approaches in Undergraduate STEM Courses
Lindsey Britton (College of Agriculture & Life Sciences)	PS3	30	Dr. Pickworth		Ireland: Global Food Systems and Sustainable Agriculture Study Abroad
Lindsey Childs (College of Agriculture & Life Sciences)	PS3	14	Dr. Singletary		Group the Foods Course Curriculum
Lindsey Wilson (College of Sciences)	PS4	19	Dr. Heil		The Identification and Analysis of Wild Nectar Yeast Strains in the Research Triangle Area

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Lohan Ross (College of Sciences)	PS2	6	Dr. Griffth	Alyson Salinas, Yueqi Gu, & Grace Salo	Impact of COVID-19 in the Academic Performance of Master's Students
Lucas Laszacs (College of Sciences)	PS4	31	Dr. Laster		Angelica keiskei Derived Chalcones Inhibit Coronavirus Replication
Madhusudan Madhavan (College of Sciences)	PS2	24	Dr. Alexanderian		Computational Studies on Zermelo's Navigation Problem: Preliminary Results
Mai-Sophie Meng (College of Natural Resources)	OS1	3221 (10:30-10:55)	Dr. Hopkins		Quantifying How Forest Cover Affects Cave Climates
Maggie Kimmett (Wilson College of Textiles)	OS2	3221 (12:20-11:45)	Dr. Lamar		How Perspective is Everything: Microbial Ecosystems Meet Our Digital Age Portrayed Through Textile and Mixed Media Art
Malone Hanis (College of Agriculture & Life Sciences)	OS1	3210 (10:30-10:55)	Dr. Simpson		Characterization of a Biologically Relevant Model for COVID-19 and Subsequent Investigation of 4-Methylumbelliferone on the Model
Manav Patel (College of Sciences)	PS3	18	Dr. Tavierne		Title: Assessing Soil from Umstead State Park for the presence of bacteria that can produce novel antimicrobials
Maria Kanton (College of Engineering)	PS1	1	Dr. Adams		The Development of Microneedle Coating Formulations that Enable the Delivery of RNA Lipid Nanoparticle Vaccine Cargos
Mary Grace Ussary (College of Natural Resources)	PS2	17	Dr. Mckenney	Trey Kaufman	Invasive Species Effects and Management Proposals
Matthew Klassa (College of Engineering)	PS1	14	Dr. Dickey		Factors Affecting the Toughening of Stretchable Fibers with Metallic Core

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Megan Armstrong (College of Humanities & Social Sciences)	PS2	38	Dr. Widman		Father Communication About Sexual Risks and Protection Related to Sexual Health Outcomes in Adolescents
Megan Cislo (College of Sciences)	PS3	37	Dr. Cheng		Inhalation of LSC Exosomes to Treat Rodent Models of COPD
Meghan Broderick (College of Sciences)	PS3	2	Dr. Proulx		Development of a SNAr Reaction on Resin-bound Peptides for Scope Expansion in Ketoxime Ligations
Meghan McGuire (College of Agriculture & Life Sciences)	PS3	27	Dr. Leonard	Abigail Todd	Effects of heat stress on finishing pig productivity
Melina Kanelos (College of Agriculture & Life Sciences)	PS4	38	Dr. Nestor		Examination of Arcuate Kisspeptin Neurons Following Saporin-Mediated Ablation During Realimentation in Ovariectomized Female Lambs.
Michael Shea (College of Sciences)	PS2	27	Dr. Clarke		An investigation into the scent-marking behavior of captive blue-eyed black and crowned lemurs at the Duke Lemur Center
Mikayla Beeson (College of Sciences)	OS2	3222 (11:20-11:45)	Dr. Price		Habitat Use and Reproductive Ecology of Sand Tiger Sharks in the Graveyard of the Atlantic
Mike Ni (College of Humanities & Social Sciences)	PS2	23	Dr. Neupert		Daily Mindfulness and Memory Failures Depend on Depression
Mili Jimenez (College of Sciences)	PS3	15	Dr. Smukowski Heil		Thermosensitivity of Meiosis Within and Between Species
Mitchell Haselow (College of Engineering)	PS1	45	Dr. Westmoreland		Assessing the Use of LAMMPS with ReaxFF to Simulate Glucose Pyrolysis
Mohammad Riahi (College of Engineering)	PS1	5	Dr. Bandodkar		Developing wireless, battery-free, NFC-enabled electronics for wound monitoring.
Molly Carlson (College of Sciences)	PS2	8	Dr. Frank		Simulated Nitrogen Deposition and Drought Effects on Acer rubrum Tree Growth and Insect Herbivores

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Nadia Sheppard (College of Engineering)	PS1	29	Dr. Knappe		Hydrolysis of pesticides and identification of associated transformation products
Naomi Bouedo (College of Engineering)	PS1	39	Dr. Simon		Characterization of Stable Coamorphous Pharmaceuticals
Natalie Deans (College of Agriculture & Life Sciences)	OS2	3222 (10:30-10:55)	Dr. Fellner		Observing handedness between species and sex of Brown lemurs, Red-ruffed lemurs, and Ring-tailed lemurs
Natalie Hackman (College of Engineering)	PS1	42	Dr. Thangjitham		Geometric Optimization and 3D Printing Reinforcing Steel
Neha Suresh (College of Engineering)	PS1	41	Dr. Stancil	Ramachandran Sekanipuram Srikanthan, Rashani LNU, & Gabriel Franics	Forget Me Not: Early detection of Alzheimer's Disease
Nehemiah MacDonald (College of Engineering)	PS1	31	Dr. Mayorga		Identifying risk factors of human trafficking in illicit massage businesses through qualitative analysis of stakeholder interviews.
Nicole McAleese (College of Agriculture & Life Sciences)	PS3	16	Dr. Taveirne		Assessing Antimicrobial Properties of Bacteria Isolated from Soil
Olivia Clark (College of Agriculture & Life Sciences)	PS3	24	Dr. Leonard	Kylie Karabinos	Effects of Carbon Dioxide on the Growth and Well-being of Finishing Pigs
Owen Larson (College of Natural Resources)	OS1	3222 (10:30-10:55)	Dr. Lee		The Dark Side of Sports Betting
Paige Seibert (College of Agriculture & Life Sciences)	PS1	37	Dr. Sagues		Biological Conversion of Cotton Residues to Bioplastic & Proteins via Wild Fermentation

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Parker Dickinson (College of Engineering)	PS1	3	Dr. Avramova		Loading Pattern and Contingency Assembly Design for a Westinghouse Two-Loop Reactor
Peyton Williamson (College of Humanities & Social Sciences)	PS2	37	Dr. Neupert		Daily Physical Activities and Stressors Predicting Daily Physical Health
Rabiya Ansari (College of Agriculture & Life Sciences)	PS4	30	Dr. Landin		Coverage of Climate Change in Introductory Biology Textbooks, 1970-2019
Rachael Bieler (College of Sciences)	PS4	35	Dr. Marsden		Exposure to Environmental Cyanotoxins Alters Motor Function Consistent with Neurodegeneration in Zebrafish Larvae
Rachel Brookshire (College of Sciences)	PS4	24	Dr. Jones		Impact of an Interrupted Case Study with Immediate Personalized Feedback on Student Understanding of Complementation Genetics
Rahul Sharma (College of Sciences)	PS4	12	Dr. Goller	Gwen Dallmann	Campus Waste & Who Eats It
Rani Shah (College of Agriculture & Life Sciences)	PS4	29	Dr. Kennedy		Impact of Fructose Consumption on the Proliferation of Non-Alcoholic Fatty Liver Disease
Raven Yurtal (College of Sciences)	PS4	8	Dr. Estes		RNA Expression of an Uncoupling Protein after Cold Exposure in Drosophila
Rebecca Olson (College of Sciences)	PS3	12	Dr. Paciulli	Lauren Boyd, & Laurel Hey	Captive maternal aye-aye (Daubentonia madagascariensis) Anxiety Behavior Peripartum
Reshma Goud (College of Agriculture & Life Sciences)	PS3	41	Dr. Nestor	Kaylin McKeown, Lindsey Frye, Gracie Ford, Katherine Stalford, & Anna Thomas	Examining Research Techniques in Neuroscience: Stereotaxic Surgery, Central Drug Delivery, and Optogenetics

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
Rhianna Klewin (College of Natural Resources)	PS2	14	Dr. McKenney	Connor Pogue	The Damage to Biodiversity by Habitat Fragmentation
Robert Kobrin (College of Engineering)	PS1	46	Dr. Zaharoff		Novel Chitosan-Glycerol Injectable Gel for Intratumoral Delivery of Immunotherapeutics
Robert Wine (College of Agriculture & Life Sciences)	PS4	33	Dr. Machado	Raquel Brito, Ava Mojica, & Josie Vincitorio	Enzymes and Food Upcycling Applications
Rosemary Maloney (College of Engineering)	PS1	23	Dr. Guertault		Predicting bank erosion and retreat in the Canadian River, OK using the Bank Stability and Toe Erosion Model (BSTEM)
Roshni Panwala (College of Agriculture & Life Sciences)	PS4	21	Dr. Huerta		Rhize of Resistance: Comparison of Ralstonia solanacearum infested soil microbiomes in North Carolina tomato fields
Ross Petersen (College of Natural Resources)	PS2	9	Dr. Kelley		Can Biomaterials Outperform Certified Sustainable Products? A Life Cycle Comparison of Cladding Products
Ruby Shah (College of Sciences)	PS3	5	Dr. Sombers		A double-barrel microelectrode array for improved electrochemical investigation of neurotransmitter release from single cells in culture
Ryan Rumple (College of Engineering)	PS1	27	Dr. Jones	Cory Campbell, Davis Wood, & Zizhi Zhuang	Synthesis and Characterization of Novel Biodegradable Polyurethane Foams for Apparel Applications
Sabrina Pietrosemoli Salazar (College of Engineering)	PS1	12	Dr. Daniele		CHARACTERIZATION OF TISSUE INTEGRATING MATERIALS FOR THE INCORPORATION OF ELECTROCHEMICAL SENSORS
Sam Young (College of Sciences)	PS4	43	Dr. Sikes		Understanding the role of Upstream Stimulatory Factor (USF) on transcriptional regulation of p53, a universal tumor suppressor

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
Samantha Knapp (College of Engineering)	PS1	22	Dr. Freytes		Structural and Mechanical Characterization of Luteolin-ECM Hydrogel
Samhitha Gali (College of Engineering)	PS4	13	Dr. Guilluy		Analyzing the cellular response to confinement
Samuel Macy (College of Humanities & Social Sciences)	PS2	35	Dr. Neupert		Daily Physical Health and Control Beliefs Predict Subjective Age in Adults
Samuel Thornton (College of Sciences)	PS2	43	Dr. Clarke		Plasticizing Chitosan in Order to Melt Electrospin Chitosan-Based Fibers
Seo Young Yang (College of Sciences)	PS4	5	Dr. Caudill	Rachel Gooley, Alyssa Frostbutter, & Ayah Samara	Storage Stability of Liquid Media in Comparison to Rehydrated Powder Media
Shannon Ari (College of Sciences)	PS2	25	Dr. Boos		New Approach to 2 x 2 Tables
Shatorupa Ghosh (College of Engineering)	PS1	4	Dr. Bandodkar		Immobilization of Quantum Dots on Various Treated Substrates
Shelby Neal (College of Engineering)	PS1	25	Dr. Harrysson		Evaluating the Performance of Novel Patient-Specific 3D Printed Cutting Guides for Canine Caudal Maxillectomy
Sophia Gray (College of Sciences)	PS4	14	Dr. Hall		C/EBP Suppresses the Type-1 Interferon Response to Inhibit Caspase-8 Mediated Apoptosis in response to DNA Damage
Sophie Korenek (College of Agriculture & Life Sciences)	PS4	45	Dr. Simpson		Characterizing the Role of UGDH Phosphorylation by the AGC Kinase RPS6KA2
Sowmika Vaka (College of Humanities & Social Sciences)	PS2	33	Dr. Mulvey	Fiona Presetemon, & Ansley Jewell	Evaluation of the Endorsement of Gender Stereotypes in the Perception of Scientists in College Students

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
Spencer Watts (College of Sciences)	PS3	17	Dr. Taveirne		Identification of Soil Microbes that Produce Novel Antimicrobials Effective against Common ESKAPE Surrogate Pathogens
Sydney Jordan (College of Sciences)	PS2	26	Dr. Bush		The All or Nothing Effect
Tara Ferrell (College of Humanities & Social Sciences)	PS2	31	Dr. Mayhorn		How We Perceive and Trust Advice from Virtual Humans: The Influence of Voice Quality
Thuy Nguyen (College of Agriculture & Life Sciences)	PS4	10	Dr. Ferket	Yue Zuo, Dylan Diedwardo, & William Hernandez-Montalvo	Mining the BioOx Microbiome for Biological Applications
Tiffany Brocco (College of Sciences)	PS3	11	Dr. Paciulli	Catherine Edbrooke, & Ian Lewis	Infant Aye-Aye (Daubentonia madagascariensis) Activity Budget
Trevor Patten (College of Humanities & Social Sciences)	PS2	32	Dr. McLaughlin	Ebernoe Guzman-Bonilla	Planned Behavior Barriers and Motivations in Diabetic Retinopathy Eye Screening
Tyler Void (College of Engineering)	PS1	17	Dr. Ducoste		Developing a Coating Material to Reduce the Adhesion of FOG Deposits
Vega Sproul (College of Engineering)	PS1	38	Dr. Sciaudone		Visualizing Dune Volume Change Across the Pea Island National Wildlife Refuge
Veronica Heyl (College of Engineering)	PS1	13	Dr. Diaconeasa	Malek Abedrabouh, Noah Davis, & Jaylen Jones	Initiating Events Analysis to Support Preliminary Steps Toward a Full Scope Dynamic Probabilistic Risk Assessment Framework for the PULSTAR Research Reactor
Virginia Barnes (College of Agriculture & Life Sciences)	OS2	3222 (10:55-11:20)	Dr. Price	Maggie Hart	Conserving the Crystal Skipper: Vegetation Analyses and Steps to take to Conserve a North Carolina Endemic Species

STUDENT PRESENTERS	*POSTER/ EXHIBIT SESSION*	*NUMBER*	*MENTOR*	*TEAM MEMBERS*	*PROJECT TITLE*
William Fryer (College of Sciences))	PS2	5	Dr. Griffith	John Healy, Katelyn McInerney, Dihan Su, & Trey Capps	Assessing Graduate Student Graduation Rates by College of Study
Yueyue Jiang (College of Agriculture & Life Sciences)	PS4	17	Dr. Harris		Outta-the-Box
Zacharia Nyambega (College of Engineering)	PS1	32	Dr. Menegatti		Continuous Removal of Antibody Fragments

ABSTRACTS

ORAL SESSION 1 | 10:30 - 11:30

Characterization of Biologically Relevant Model for COVID-19 and Subsequent Investigation of 4-Methylumbelliferone on the Model

Author(s): **Malone Hanis**
Mentor(s): **Dr. Melanie Simpson**
Room: **3210**

During a SARS-CoV-2 infection, the production and clearance of hyaluronan in the lungs is defective. Hyaluronan normally protects tissues while recruiting immune cells to damaged or infected sites. 4-methylumbelliferone (4MU) is a scavenger of molecular precursors for hyaluronan and has been found to selectively reduce hyaluronan production. CD44 is a cell surface receptor that is linked to the clearance of hyaluronan and involved in the resolution of inflammation. We do not know if the inhibition of hyaluronan synthesis through 4MU treatment will alter the recruitment of immune cells to the lungs. This information will help determine whether 4MU could be a part of a preventive treatment for severe COVID-19, to alleviate lung damage. We are characterizing an in vitro system to mimic conditions of a COVID-19 infection and evaluate the subsequent effects of 4MU, specifically using the human lung epithelial cell lines A549 and BEAS-2B. The A549 cell line produces significantly more hyaluronan than the BEAS-2B line and is less responsive to the proliferation suppressive effects of 4-MU treatment. Both cell lines expressed significant levels of cell surface CD44. We have analyzed the response of CD44 and HA to 4MU in monoculture. After this, a differentiated macrophage cell line, which mimics immune cells found in COVID-19 lungs, was introduced into a co-culture with the characterized cell lines. Results have shown a decrease in immune signaling receptors with the treatment of 4MU. Further research should now be done to determine whether 4MU can reverse the negative pro-inflammatory effects of increased hyaluronan.

Precisely Controlling Stiffness In Double Network Hydrogels Using Metal Redox Reactions

Author(s): **Ethan Frey**
Mentor(s): **Dr. Michael Dickey**
Room: **3210**

Blending soft and rigid materials is crucial for numerous applications including synthetic tendons and flexible electronics. However, large gradients in stiffness can lead to rapid delamination under strain. Gradual stiffness gradients allow stress to be distributed evenly and adhesion with the rigid material maintained. Hydrogels, a popular soft material known for their biocompatibility and exceptional ductility,

consist of hydrophilic polymer networks that can absorb water and ions. Hydrogels containing both covalent and ionic crosslinks (double network) have previously been demonstrated to have enhanced mechanical properties. This work utilizes redox reactions in hydrogels to create locally tunable stiffness gradients. Double network polyacrylamide-alginate hydrogels containing bismuth particles were reacted with silver nitrate to form silver particles and bismuth ions, which crosslinked the carboxylic groups of the alginate. Digital image correlation (DIC) analysis showed that stiffness increased only at the locations of the bismuth particles. By controlling the viscosity of the precursor solution, curing time, and redox reaction time, stiffness gradients were created at desired locations. For example, allowing the particles to partially settle in the precursor solution created a hydrogel that actuated during the redox reaction due to a difference in elastic modulus. This system allows for stiffness to be tuned down to the size of individual bismuth particles, offering a solution for the fluid integration of rigid and soft materials.

Quantifying How Forest Cover Affects Cave Climates

Author(s): **Mai-Sophie Meng**
Mentor(s): **Dr. Skylar Hopkins**
Room: **3221**

The Tri-colored Bat (Perimyotis subflavus) had stable and increasing populations across the eastern United States before the white-nose syndrome (WNS) epizootic began. The fungal pathogen spread first across northeastern states, where Tri-colored Bat populations rapidly declined, and arrived later in southeastern states, where impacts on Tri-colored Bat populations have not yet been well-documented. In this study, we examined the potential impacts of WNS and forest cover on Tri-colored Bat presence and abundance in the karst-rich Tennessee, Alabama, Georgia (TAG) region. We analyzed a long-term dataset of 774 cave biosurveys that included summer and winter bat counts from 2004 to 2021, before and after the pathogen invaded the region in 2010–2012. We found that Tri-Colored Bat presence and abundance did not change between the pre- and post-WNS periods during the winter months when the bats hibernate in caves. In contrast, there were substantial declines in the proportion of caves that contained Tri-Colored Bats (57% to 26%) and Tri-Colored Bat abundance (mean of 0.14 to 0.034 bats/100m) during the summer months, when cave use is optional. As the first broad geographical analysis of trends in summer cave use, our results highlight a potentially important change in bat behavior. Additionally, in all periods, Tri-Colored Bats were more likely to be present and abundant in caves that were surrounded by dense forest cover, re-iterating the importance of forest conservation for bat conservation.

Hunt for the Male-Determining Factor in Tribolium castaneum

Author(s): **Ashley Williams**
Mentor(s): **Dr. Marce Lorenzen**
Room: **3221**

The Y chromosome of the red flour beetle, Tribolium castaneum, has been know to harbor a master regulator of sex-determination. This regulator, often referred to as a “maleness” gene, is required for initiating male development. The male-determination factor is currently only known for a handful of insect species. Discovering this gene for T. castaneum would allow the opportunity to create a “male-only strain” to further the efforts of Sterile Insect Technique, a reputable and environmentally-friendly pest control method. We sought to use CRISPR/Cas9 to mark and track a T. castaneum Y chromosome to compare the gene expression of future male and female embryos. We investigated how to alter a previously marked Y chromosome by building a Homology Directed Repair construct designed to replace a late-acting marker gene with one that can be detected during the earliest stages of development. Our work stemmed from a published construct that consists of right piggyBac arm (pBR), left piggyBac arm (pBL), and aTub-EGFP. Using a series of PCR, cloning, and ligation, we were able to create a new construct that is expected to swap the late-acting marker with aTub-EGFP once injected. Embryos that possess a Y chromosome are anticipated to carry the fluorescent marker gene and are presumed to express the male-determination factor during the earliest stage of embryonic development. RNA isolated from fluorescent embryos can be compared to that isolated from non-fluorescent embryos. This is expected to help narrow the list of candidate genes and ultimately determine the male-determination factor in Tribolium castaneum.

The Dark Side of Sports Betting

Author(s): **Owen Larson**
Mentor(s): **Dr. Marce Lorenzen**
Room: **3222**

The purpose of this paper is to analyze and critique the sports betting practices within the US. First, the paper illustrates the normalization of sports betting practices through the use of diction, TV advertisements, and free-play incentives. It also explains how normalization of sports betting can lead to problem gambling and adverse gambling patterns that negatively impact the lives of gamblers, their families, and the surrounding community. These patterns include significant financial loss, loss of trust between family and friends, and the exposure of other mental health disorders. Second, the paper explains what live betting is and the ways in which leading sport betting companies across the US are pushing live betting as

the “future” of betting despite it being more addictive and producing higher rates of problem gamblers. Third, the paper conducts a comparative analysis of the sports gambling legislation of the US and Denmark. Additionally, it illustrates preventative measures that these two governments have employed, while also analyzing the actions taken by other companies in an effort to reduce problem gambling. Finally, the paper will offer some recommendations for promoting safe and responsible sports betting such as passing specific legislation and what steps sports betting companies and sports bettors alike should take.

Racial Discrimination in NFL Coach Unemployment Length

Author(s): **Hunter Coleman**
Mentor(s): **Dr. KangJae Lee**
Room: **3222**

Previous studies have documented that upper-level managers and coaches in professional sports in the US have been predominantly White individuals. However, limited research has focused on the existence of racial and ethnic disparity in the employment and unemployment duration of high-level coaches. To fill this gap, this study investigated the difference between White and non-White National Football League (NFL) coaches in the length of first position employment and the length of between-job period from the first to the second coaching position. The data was collected from an online website containing all NFL coaches’ employment records from the 1979-80 to the 2020-21 season. Independent sample t-tests were performed to compare the statistical difference between White coaches and non-White coaches in (1) their length of the first position employment period and (2) the length of the first between-job period from the first to second position. Results showed no statistical difference in the length of first position at $p<.05$ level. Similarly, no statistical difference was found in the length of the first between-job period at $p<.05$ level. Although no statistical difference was identified from the analysis, the circumstances of certain coach hiring decisions are still questionable in light of racial justice and inclusiveness. For example, two highly qualified non-White coaches, Jim Caldwell and Eric Bieniemy, have not received employment opportunities equal to their qualifications, while multiple White coaches with less experience or similar backgrounds have received such opportunities. This study concludes with a few recommendations for future studies.

The Development of Microneedle Coating Formulations that Enable the Delivery of RNA Lipid Nanoparticle Vaccine Cargos

Author(s): **Maria Kanton**
Mentor(s): **Dr. Javon Adams**
Poster: **1**

Microneedle vaccines represent a promising future in vaccine administration and distribution. Not only do microneedle vaccines solve the many drawbacks of traditional intramuscular and subcutaneous injection methods, but they also boast improved vaccine immunogenicity and the possibility of dose sparing. Additionally, for RNA vaccines, microneedle-based dry formulations may offer thermostability and eliminate the need for a cold chain during distribution. Through the use of Continuous Liquid Interface Production (CLIP)-based 3D printing, a solid microneedle patch has been produced and formulated with protein subunit vaccines by surface coating. [1] Through the use of antibody ELISAs, it is known that microneedle vaccines induce an antigen-specific IgG response 50x higher than subcutaneous injection. Current work focuses on formulating coating solutions for RNA vaccines that can enable high-cargo payloads on the microneedle patches while simultaneously retaining RNA activity. Lipid-based RNA nanoparticles have been shown to be highly efficient in transfecting cells in vitro and in vivo. Using RiboGreen assays, we have shown that sucrose is an effective coating excipient that helps maintain RNA encapsulation in LNPs during the drying process at room temperature or by lyophilization. Through the use of Micro BCA assays measuring ovalbumin, it has been identified that hydroxypropyl methylcellulose, polyvinyl alcohol, and polyvinylpyrrolidone work well as viscosity enhancers. However, both hydroxypropyl methylcellulose and polyvinyl alcohol show trace amounts of aldehydes when using fluorometric quantitation assays and may require further purification for RNA vaccine delivery, as aldehyde can inactivate RNA by way of nucleophilic addition.

Multi-Component Exploration of PEDOT:PSS Ink Formulation by Optimization Campaign

Author(s): **Garrett Baucom**
Mentor(s): **Dr. Aram Amassian**
Poster: **2**

Solution-based processing for electronic materials has gained significant popularity due to the flexibility and ease of use that the method can potentially provide. Optimization of these solution processed inks is crucial, as there are often many different components that can go into the production of a single ink. Our lab's RoboMapper platform allows for the precise formulation of multi-component inks,

and subsequent deposition for later characterization. By utilizing this platform, an ink system with multiple components can be efficiently explored and optimized, either by a parameter space mapping approach, or by a mathematically guided optimization campaign approach. This work explores the processing of a PEDOT:PSS materials system with the optimization of the resulting electrical conductivity, exploring a combinatorial parameter space that may not have otherwise been explored by manual mixing of solutions and casting of films.

Loading Pattern and Contingency Assembly Design for a Westinghouse Two-Loop Reactor

Author(s): **Parker Dickinson**
Mentor(s): **Dr. Maria Avramova**
Poster: **3**

This senior design project, in cooperation with Westinghouse, consisted of two distinct components. The first project goal involved developing the 33rd operational loading pattern of the Boundary Waters two-loop pressurized water reactor. Several safety constraints had to be considered. Namely, the designed core had to satisfy limits on the enthalpy rise peaking factor, moderator temperature coefficient, doppler power coefficient, shutdown margin, and peak pin burnup. Also, the ejected rod accident scenario, a worst-case accident, could not result in a violation of additional safety constraints. Our final goal was to reach a cycle length of 690 effective full power days (EFPD). In the final design, all safety factors were met, while the cycle length was found to be 687.9 EFPD.

The second task involved creating two contingency assemblies to assist in rapid emergency core redesign. When shuffling fuel, damage may render a spent assembly unusable. Core designers must then quickly find a suitable replacement from the spent fuel pool or an alternative source and perform a redesign. The goal of this portion of the project was to create spare assemblies that could be placed practically anywhere in the core and act as the replacement assembly in the event of a redesign-demanding accident scenario. It was found that contingency assemblies designed to be placed on the core periphery always met design criteria and could even improve cycle length, but that interior contingency assemblies always violated safety constraints.

Immobilization of Quantum Dots on Various Treated Substrates

Author(s): **Shartorupa Ghosh**
Mentor(s): **Dr. Amay Bandodkar**
Poster: **4**

Beyond the economic impacts, COVID-19 exposed the vulnerabilities of the US public health infrastructures. For instance, a staggering 38.7% of the population seeking medical treatment were unable to receive care due to the pandemic between June and July of 2020. Remote monitoring and surveillance became necessary for treatment and understanding of the virus itself. Wearable sensors offer one plausible solution to assist with remote health monitoring. In terms of monitoring an inflammatory response, c-reactive protein (CRP) measurements could provide knowledge about the consequential inflammatory response to COVID-19. CRP is often measured invasively through blood samples, but recent research has proved that it can be measured using saliva samples. Presently, the standardized testing for CRP measurements consists of the enzyme-linked immunosorbent assay (ELISA) protocol, a complicated, time-consuming and detailed procedure. One of the sensing techniques common in wearable biosensors is optical sensing. Optical sensors often involve the transduction of a color change, which would prove to be a more useful, convenient and efficient method of measuring analytes. Quantum dots could provide a ready solution to easy, observable fluorescent color changes upon interaction with certain chemicals. This work aims to develop a novel device that allows for real-time remote monitoring of CRP concentration within salivary samples. Our preliminary studies reveal various substrates interacting in different ways with the quantum dots with varying subsequent fluorescence. Immobilization was monitored and observed for three different substrate types. Future studies will focus on the interaction between CRP-specific aptamers and CRP on these substrates.

Developing wireless, battery-free, NFC-Enabled electronics for wound monitoring

Author(s): **Mohammad Riahi**
Mentor(s): **Dr. Amay Bandodkar**
Poster: **5**

Wound healing measurements play a significant role in evaluating the healing process and predicting the treatment outcomes. Existing wound monitoring techniques can track healing visually or through individual pH, oxygen, moisture measures, and physiological analyses that require clinical trips and lab tests over days. However, there is still no state of art technology to indicate the healing process in real-time through direct biochemical measurements providing an assessment of tissue recovery. This study aims to introduce a way to achieve real-time wound

healing measurement with a custom NFC board transmitting lactate concentration in the wound exudate. Lactate is a biomarker with an established correlation with wound healing. Unlike the traditional electrochemical biosensors, the sensor attached to the NFC board is of a two-lead sensing platform that omits the need for a potentiostat and contains Lactate Oxidase (LOX). To achieve the objective of the project, a custom NFC board was designed, programmed, and connected to a customized tuned antenna.

Microrheology of Molten Salts

Author(s): **Hayden Bland**
Mentor(s): **Dr. Alexander Bataller**
Poster: **6**

Well-established methods of measuring viscosity in molten salts require the creation of well-defined fluid flow. An alternative “flow-free” method that we are developing utilizes Brownian motion of microspheres, whose mean square displacements (MSD) are related to the liquid’s viscosity via the Stokes-Einstein relationship. By creating a "flow-free" environment using microscope slides and rubber gaskets we have been able to obtain the viscosity and diffusion coefficients of water. Improvements underway for this experiment is the introduction of laser video holography. In this experiment a laser light replaces the white light used in previous experiments, and the Mie Scattering of this laser light off the microparticle creates interference patterns in the form of concentric rings around the microparticle. These frames are placed into an open-source code that inputs these fringe patterns and output the particles radius and its position in 3-dimensions, all within a 5x faster framerate than with white light.

A Method of Bubble Detection in Molten Salts using an Acoustic Resonator

Author(s): **Hayden Bland, Matthew Field, Christopher Williams, & Miranda Moultrie**
Mentor(s): **Dr. Alexander Bataller**
Poster: **7**

Well-established methods of measuring viscosity in molten salts require the creation of well-defined fluid flow. An alternative “flow-free” method that we are developing utilizes Brownian motion of microspheres, whose mean square displacements (MSD) are related to the liquid’s viscosity via the Stokes-Einstein relationship. By creating a "flow-free" environment using microscope slides and rubber gaskets we have been able to obtain the viscosity and diffusion coefficients of water. Improvements underway for this experiment is the introduction of laser video holography. In this experiment a laser light replaces the white light used in previous experiments, and the Mie Scattering of this laser light off the microparticle creates interference patterns in the form of concentric rings around the microparticle. These frames are

placed into an open-source code that inputs these fringe patterns and output the particles radius and its position in 3-dimensions, all within a 5x faster framerate than with white light.

Computational Exploration of Single-Shot Deposition of Selected Metals on Solid Targets Using a Pulsed Electrothermal Plasma Source

Author(s): **Alina Jugan**
Mentor(s): **Dr. Mohamed Bourham**
Poster: **8**

Through the ETFLOW computational program that simulates the electrothermal (ET) plasma source behavior, the code has been used to predict the deposition of various metals onto a solid surface at a specified distance from the source exit channel. ETFLOW was developed in conjecture to past experiments as a way to supplement and offer opportunities for further material analysis. ETFLOW is a 1-D and 2-D time-dependent heat and current transport simulation code that runs a sub-program used to measure ablated mass and deposition onto a target surface. The program incorporates a comprehensive library of materials and properties and allows for customization of material and dimensional input. ET sources allow for the understanding of material behaviors and better engineering of new products by observing the ejection of different plasmas. Deposition from the ET source offers uniform coating of surfaces, therein, understanding deposition dependency allows for more accurate production. Metals researched were chosen based on current relevance as coating materials and application in industry. The strongest findings show that metal deposition decreases exponentially with respect to heat of melting, increases quadratically as sleeve length increases, and decreases exponentially as target distance increases. Additionally, there is a strong correlation between atomic mass along various periodic table trends. Results and ETFLOW code offer knowledge to develop accurate production models for the deposition of metals for highly technical and precise applications.

Computational Modeling and Testing of Drug Targeting in the Body

Author(s): **Bevin Neill**
Mentor(s): **Dr. Yevgeny Brudno**
Poster: **9**

Achieving sustained, controlled, and local drug presentation at disease sites is a major challenge in drug delivery. While many devices have been developed that release drugs over time, these deplete their drug stores quickly and cannot be modified or refilled after implantation. To overcome these limitations, our lab has developed refillable drug-eluting depots. These depots have click chemicals at a disease site that capture protodrugs injected into the blood. The protodrugs are

inactive in the blood and only release drug at the disease site, allowing for repeated, targeted, and long-term drug delivery. Herein, we report a physiologically based pharmacokinetic (PBPK) model of the refillable depot system that can predict drug concentrations in organs and at a disease site such as a tumor. Using published physiological parameters, the PBPK model predicts the behavior of a common chemotherapeutic doxorubicin protodrug after systemic administration. This model recapitulates doxorubicin concentration-time profiles published in literature. After this, the click-mediated protodrug capture and subsequent drug release was added to the model. This was achieved by adding a tumor compartment containing a depot that captures circulating protodrug to release active drug. Currently, we are validating this model by studying the in vivo behavior of fluorophore-labeled click chemicals to offer real-time monitoring of the click reaction. This data will offer insight into the click reaction kinetics, and this information will be used to modify the PBPK model to improve its predictive ability.

Design Optimization, Fabrication, and Validation of a Bone-On-Chip Platform

Author(s): **Kathryn Benedict**
Mentor(s): **Dr. Jacque Cole**
Poster: **10**

Ischemic stroke is the main cause of long-term disability and leads to increased bone loss. From previous research, specific factors contributing to bone loss following stroke are not known. An organ-on-chip device is a microfluidic in vitro platform that mimics the bone microenvironment with greater control than previous models. This platform enables us to better understand cell-cell interactions and explore causes of stroke-related bone loss. We optimized a bone-on-chip platform design that contains microdevice-compatible mineralized bone scaffolds using SolidWorks® (structural analysis) and COMSOL Multiphysics® (blood flow analysis). The microdevice consisted of a top chamber containing the scaffold to support osteoblast cells and a bottom chamber containing endothelial cells separated by a semi-permeable membrane. Computational simulations were performed using flow rates of 100-1200 µL/min and top chamber heights of 1, 1.5, and 2 mm to determine velocity, convective transport, and wall shear stress. After 15 minutes, the top chamber was 42-100% filled at 25 mol/m^3, where higher percentages resulted from higher flow rates and smaller chamber heights. Targeted wall shear stress (8-15 dynes/cm^2) was obtained using flow rates of 100-300 µL/min, suggesting this range is optimal for endothelial cell support. A more complex computational model incorporating an endothelial cell layer showed lower filling concentrations of 5-15 mol/m^3 consistent with endothelial cell barrier function. Fabrication molds for the microdevice pieces were designed in AutoCAD®, printed, and used to practice fabrication through soft lithography. Next steps will be using this microdevice to

study osteoblast-endothelial cell interactions in simulated stroke microenvironments.

Material Heterogeneity Affects Element Yielding in Finite Element Models of Vertebral Trabecular Bone at Clinical Imaging Resolution

Author(s): **Deeqa Musa**
Mentor(s): **Dr. Jacque Cole**
Poster: **11**

Trabecular bone is a heterogeneous tissue composed of plate- and rod-like bone struts with different mechanical roles. Plates function as load-bearing structures, whereas rods preferentially accrue microdamage to protect plates. Trabecular bending stiffness for both plates and rods is affected by tissue material heterogeneity created through bone remodeling, in which surface tissue is continually eroded and replaced to repair microdamage. Since newly deposited bone is not fully mineralized, stiffness is lowest at the trabecular surface and increases toward the interior, facilitating bending. Trabecular plates and rods can be identified in micro-computed tomography (micro-CT) images using Individual Trabecular Segmentation (ITS), and finite element analysis (FEA) used in conjunction enables investigation of their mechanical roles while accounting for material heterogeneity. A previous study used high-resolution FE models (17 μm voxels) of vertebral trabecular bone, with and without heterogeneity, to show that preferential microdamage accumulation in rods is enhanced by heterogeneity. The current study extends this work with coarsened models that mimic clinical imaging limitations. We hypothesized that these models would produce similar patterns of microdamage accumulation when tested under the same conditions as high-resolution models. Downsampled models were created by combining groups of 64 neighboring voxels into one. Microdamage was identified using element principal strains, and ITS was used to identify plates and rods. As in high-resolution models, downsampled models displayed microdamage accumulation in rods that was enhanced by heterogeneity, showing that noninvasively evaluating bone structural integrity through the lens of plate-rod microdamage distribution may be feasible in a clinical context.

Characterization of Tissue Integrating Materials for the Incorporation of Electrochemical Sensors

Author(s): **Sabrina Pietrosemoli Salazar**
Mentor(s): **Dr. Michael Daniele**
Poster: **12**

Sensors are needed to further develop the diagnostic process in the medical field. Different types of sensing techniques can be used depending on the analyte of interest and where it is present in the body. Subcutaneous sensors target analytes present in the tissue or structures underneath the skin, and these incorporate technologies related to sensing and tissue engineering. Tissue engineering models can be used to provide a testing platform in the development and characterization of these biosensors. In this project, a combination of biomaterials synthesis, characterization, 3D tissue culture, and electrochemical sensing was implemented to engineer a physiological model to serve as a testing platform for different tissue integrating sensors. Functionalization of pH measuring sensors was performed through electrodeposition of polyaniline and open circuit potential was used to detect pH levels ranging from 4 to 8. The sensors developed were able to replicate the expected pH measuring capabilities in comparison with consulted studies. A three-dimensional tissue culture was developed containing human dermal fibroblasts to provide an environment that is more physiologically-relevant. Fluorescent imaging was used to verify the proliferation of the cells and to later compare the integrity of the culture after the sensors were inserted. Finally, these tissue constructs were then embedded with the sensors for continuous measurement of pH levels. The analysis of this project relied on the pH measurement of the tissue environment, as well as the assessment of the cells' response to the integration of the measuring devices.

Initiating Events Analysis to Support Preliminary Steps Toward a Full Scope Dynamic Probabilistic Risk Assessment Framework for the PULSTAR Research Reactor

Author(s): **Veronica Heyl, Malek Abedrabouh, Noah Davis, & Jaylen Jones**
Mentor(s): **Dr. Mihai Diaconeasa**
Poster: **13**

Probabilistic Risk Assessment (PRA) is used to estimate risk through computation of realistic probabilities to determine what can go wrong and what the subsequent consequences are. Our project sets up the foundation for developing a full scope dynamic PRA framework, which currently does not exist. The traditional PRA model needs to be developed first while building the deterministic and probabilistic computational capabilities. Experience from achieving the traditional PRA will inform the design of the full scope dynamic PRA framework capable of evaluating both the

frequencies and consequences. The PULSTAR research reactor is an ideal design to begin to develop this framework. The following three methods were selected to identify initiating events for the PULSTAR in line with the current PRA standards: a master logic diagram analysis, a heat balance fault tree analysis, and a failure modes and effects analysis. Completeness was ensured throughout the set by cross-referencing the three models and comparison with the list of initiating events from the PULSTAR final safety analysis report and other pool-type research reactor PRA literature. Each initiating event identified was used to build its own event tree in order to model each accident scenario. The event trees in the event sequence analysis will eventually be quantified, using frequencies from reliability databases.

Factors Affecting the Toughening of Stretchable Fibers with Metallic Core

Author(s): **Matthew Klassa**
Mentor(s): **Dr. Michael Dickey**
Poster: **14**

Fiber-like structures in nature (e.g. titin or collagen) maintain their structural integrity while undergoing significant elongation and deformation. Mimicking this behavior in artificial fibers is integral in emerging applications such as flexible electronics and soft robotics. This paper reports the application conditions and assembly methods that affect the mechanical properties of gallium as it is injected into styrene-ethylene-butylene-styrene (SEBS) fibers. These gallium and shell structures combine the flexible behavior of SEBS, an elastomeric polymer, with the rigid behavior of the gallium metal. As stress is applied, the shell experiences localized strain centers resulting in the repeated localized fracture of the metal core dissipating energy during extension. The objectives of this paper are to develop correlations between various application conditions and assembly methods and the resulting toughness behavior in gallium core and shell systems. The temperature and length are shown to be inversely related to toughness while the elongation rate is shown to be positively related to the toughness. Additionally, assembling the structure in a water bath and pre-straining the SEBS shells form structures that are 35% and 19% more resistant to repeated strain respectively. This paper shows that the toughness behavior of gallium core and shell systems is controllable for different emerging applications.

New Insights into IgG1 Transport Across Placenta Using Agent-Based Modeling

Author(s): **Abigail Cordiner**
Mentor(s): **Dr. Sepideh Dolatshahi**
Poster: **15**

Neonates are born without a fully developed humoral immune response, and are protected in their first month by antibodies transferred transplacentally. Immunoglobulin G1 (IgG1) crosses from the maternal blood through the syncytiotrophoblast (SYN) layer, the fetal stroma, and the fetal endothelium to the fetal capillaries. To cross the SYN, IgG1 must be endocytosed into the SYN multinucleated layer and then bind to the Neonatal Fc receptor (FcRn) within an endosome. Specifics of this mechanism and its rate-limiting factors remain unknown due to obstacles studying this system in vivo. An agent-based model (ABM) was developed to investigate possible transfer rate-limiting factors: maternal IgG1 concentration, FcRn binding chance (pFcRnbinding), and FcRn expression/endosome formation (pFcRnEndosome). The ABM of the maternal-fetal interface was constructed in Netlogo. Parameters undefined in the literature were optimized to fit experimental data with 95% confidence interval using t distribution. ABM data matches in vivo data when pFcRnbinding and pFcRnendosome were tuned using a physiologically based value of maternal IgG concentration. This concentration has a minimal effect on F:M ratio. Increasing both pFcRnbinding and pFcRnendosome resulted in an increased F:M ratio; however, the effect diminishes at higher pFcRnEndsome values. Results indicate that the concentration of maternal IgG1 does not significantly impact transplacental IgG1 transfer but IgG1-FcRn interactions within the placenta play a larger
role in modulating transfer. This framework lays the foundation towards a more complex, physiologically-based model to gain insight into the process of IgG transfer across the placenta which could inform pregnancy treatment strategies.

Analysis of Retention-Based Grease Interceptor Design patterns to maximize Fat, Oil, and Grease Particle Separation

Author(s): **Daniel Friday**
Mentor(s): **Dr. Joel Ducoste**
Poster: **16**

The lack of regulations and protocols surrounding retention based grease interceptors (RGI) has contributed greatly to the amount of fat, oil, and grease (FOG) particles present in the United States wastewater system. Previous studies demonstrate limits to the effectiveness of flow-based grease interceptors given various hydraulic factors and that retention-based designs are instrumental in maximizing the separation of harmful FOG particles before they reach the water supply. Testing of flow based grease interceptors has been historically performed

under favorable conditions, providing inaccurate results that are not transferable to retention based grease interceptors. This study assessed the performances of various RGI designs in the separation of FOG particles by altering each model's overall size, inflow pipe, outflow pipe, and baffle wall geometry through the use of Sketchup's 3D modeling software. These various designs were assessed using CHAM Phoenics computational fluid dynamics software to simulate the flow of a distribution of FOG particle sizes throughout the interceptor for a 30 minute hydraulic residence time. The ultimate goal of this study was to evaluate RGI design patterns that yielded a greater separation of FOG particles while also taking into account coalescence of FOG particles in a non-idealized testing environment. Through the analysis of various designs, simulation results show that certain RGI design characteristics perform separation of smaller diameter FOG particles than other designs due to the specific geometric properties of their inlet and outlet conditions and baffle wall.

Developing a Coating Material to Reduce the Adhesion of FOG Deposits

Author(s): **Tyler Void**
Mentor(s): **Dr. Joel Ducoste**
Poster: **17**

Fat, oil, and grease (FOGs) deposits in sewer pipes reduces their efficiency in transporting wastewater and results in Sanitary Sewer Overflows (SSOs). Previous research has shown that reducing the leaching potential of calcium ions from concrete used in sewer infrastructure can also reduce the formation of FOG deposit accumulation in pipe networks. Studies on concrete structures have shown that sodium acetate, when applied as a coating or intermixed, can effectively form crystals inside the concrete pores and make the concrete structures water resistant. Therefore, in this study, we aim to explore alternative coating materials (such as Sodium Acetate) that can reduce the calcium leaching potential of concrete materials, and eventually reduce the FOG deposit formation. Sample wastewater will be prepared by mixing deionized (DI) water, canola oil, and oleic acid as the source of long chain free fatty acids (LCFFAs). FOG deposit tests on coated concrete samples will be conducted for 14 days. Fourier Transform Infrared Spectroscopy (FTIR) analyses will be performed on the FOG deposit samples to determine the composition and extent of the FOG deposit formation. We hypothesize that by waterproofing concrete materials with sodium acetate based coating material, water penetration inside concrete pores will be reduced, consequently leading to a reduction in FOG deposit formation on concrete surfaces. This study is the first known research to explore water-proof coating's impact on FOG deposits.

Predicting Polymer Morphologies using Machine Learning and Assessing Potential Applications in Energy Storage

Author(s): **Jerush Christopher**
Mentor(s): **Dr. Peter Fedkiw**
Poster: **18**

Nanofabrication has shown promise in developing high-performance materials for energy storage by allowing higher specific capacities and cycling stability to be achieved. This project used a nanofabrication process that injects a polymer solution into a turbulent anti-solvent flow and precipitates a polymer in the process. By varying the concentration of the polymer solution and anti-solvent, a variety of polymer morphologies form ranging from nanoparticles to fiber-like structures. Predicting morphologies from this nanofabrication process is a multidimensional problem that cannot be solved using first-principles approaches. This has motivated developing a machine learning algorithm that provides insight into the interactions between the polymer, solvent, and anti-solvent. Classification algorithms were used to create a model that predicts polymer morphology by implementing Linear Discriminant Analysis (LDA) and Support Vector Classifier (SVC). While non-solvent systems of ethanol and water produced an accuracy of 70% using LDA, separating the data to contain water non-solvent systems produced accuracies of 82% and 78% for LDA and SVC, respectively. Validation of the model was done by forming polyacrylonitrile (PAN) soft dendritic colloids (SDCs) using processing suggested by the CatBoost regression model. We investigated the use of PAN SDCs for anode material in lithium-ion batteries. Membranes were formed from the PAN SDCs and carbonized to form free-standing electrodes. These electrodes were assembled into half-cells where cyclic voltammetry and charge-discharge cycling were done. Future plans entail improving the machine learning model, becoming a predictive tool for fabricating other materials, and to continue exploring their applications in electrochemical devices.

Estrogen Receptor Alpha Expression Loss from Anterior Cruciate Ligament Fibroblasts Throughout Monolayer Culturing

Author(s): **Chloe Hincher**
Mentor(s): **Dr. Matthew Fisher**
Poster: **19**

Anterior cruciate ligament (ACL) injuries are common, having an annual incidence of 200,000 injuries in the United States. Furthermore, the risk of ACL injuries in adolescent females is substantially higher when compared to males, which is

thought to be because of sex hormone differences. Some of these conclusions are driven by 2D cell culture experiments, yet monolayer culture is known to poorly match the native tissue environment. Thus, the objective of this work was to determine the impact of 2D cell passage number on primary ACL fibroblast behavior and sex hormone receptor expression. ACL tissues were obtained from 2-week old female pigs, and primary cells were isolated through either enzymatic digestion or through the explant migration method. Over 2 passages, estrogen receptor alpha and collagen-1 expression was determined through immunocytochemistry. Immunohistochemistry was performed on the tissue as a control. From these experiments, cells in the tissue controls were much smaller and tightly packed in a crimped alignment, while cells in culture were more sparsely distributed with noticeably larger nuclei. ERa was verified to be present in the tissue control, but the expression of ERa was lost between initial plating and passage 2 in both the explant migration and digested groups. Collagen I expression was significantly higher in the cells isolated through primary explant techniques than in the cells isolated through enzymatic digestion. Understanding the changes in hormone and ECM expression in culture is important when making conclusions from hormone exposure experiments in primary ACL fibroblasts.

Biochemical analysis of ECM/Gelatin Solution for use in a Near Field Electrospinning System for Engineering Tendon

Author(s):**Aasim Hussain**
Mentor(s): **Dr. Matthew Fisher**
Poster: **20**

Tendon injuries are one of the most pervasive injuries and a leading cause of mobility issues with tendons involved with ~50% of musculoskeletal injuries. Yet, the full complexity of the injury and subsequent healing is not well understood, including cell-matrix interactions in these processes. Investigation into cell-matrix interactions will build on an overall understanding of the healing process and why there is a loss of function and overall disorganization post healing. Direct-write, near field electrospinning (DWNFE) is a computer-guided, single fiber deposition method for creating 3-dimensional structures on a collagen-fiber scale. DWNFE, though more widely known for its use of synthetic polymers, more recently has shown promise with natural polymers such as collagen and gelatin. Here, we aim to qualify the capacity of using native extracellular matrix (ECM) in DWNFE systems, which has been shown in other bioprinting systems, to gain the beneficial bioactive nature of ECM. To do this, n=3 equine superficial digital flexor tendon (SDFT) were obtained. ECM was prepared for use by taking native SDFT through a decellularization and digestion/neutralization process with quantification of DNA, sGAGs, and collagen content at each step. Gelatin was then used as a carrier for decellularized tendon ECM. 15w% ECM was mixed with gelatin for a total 625mg/ml ECM/gelatin solute

concentration in 70v/v% acetic acid at 40°C for 2 days. ECM/gelatin fibers were successfully produced and a similar biochemical analysis was then run. Further testing is needed to quantify the viability of the fibers for use in engineered tendon applications.

Development of a Wound healing Assay to Test New Porous Extracellular Matrix Patches In Vitro

Author(s):**Caroline Dau**
Mentor(s): **Dr. Donald Freytes**
Poster: **21**

Introduction:
Extracellular matrix-based (ECM) materials have been used to restore function of tissues by promoting tissue remodeling and modulation of inflammatory and fibrotic responses. However, conventional ECM hydrogels do not form or maintain the uniform porosity and shape for applications that require cell reperfusion in motile injuries. Hence, a custom shaped, robust, uniform ECM scaffold for motile wound healing is needed. In addition, in vitro platforms to test the cell recruiting capacity are needed to better assess the potential of the new ECM-material. This project looks at a new fabrication method of creating a porous ECM scaffold for tissue restoration and the development of an appropriate skin-mimicking assay.
Methods/Results:
A process was developed to take any organ-specific tissue and isolate its ECM for patch production by processing native porcine tissue via decellularization and formed into a lyophilized hydrogel. For the wound healing assay, human dermal fibroblasts were seeded on a collagen matrix. A biopsy punch was used to remove a portion of the collagen and then replaced with the porous ECM patch. Cell migration was evaluated via MTT assay at specific timepoints. Current results suggest the patch promoted the greatest amount of cell migration during the first 24 hours post-treatment.
Discussion/Conclusion:
The proposed work is the first step towards creating a new porous ECM material tested in a modified skin surrogate model. The use of this scaffold will expedite tissue reconstruction and encourage uniform distribution of cells and biologically active properties at the wound site.

Structural and Mechanical Characterization of Luteolin-ECM Hydrogel

Author(s): **Samantha Knapp**
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Poster: **22**

The development of decellularized extracellular matrix (ECM) scaffolds are critical within tissue engineering applications as they present a more physiologically relevant environment for cells in vitro than tissue culture plastic, or even other hydrogel formulations, like collagen hydrogels (Collagen-H). It has been found that porcine ECM as a substrate for cell growth promotes the wound healing environment, ranging from a chemotactic effect on progenitor cells, the release of growth factors during degradation, to the shift of macrophages from the proinflammatory phenotype to the pro-healing phenotype. Many phytochemical compounds, including the flavonoid luteolin, have been shown to exhibit antioxidant, antibacterial, and anti-inflammatory properties, making this class of molecules an ideal substrate for wound healing. The combination of luteolin and ECM scaffold creates a novel biomaterial that can provide immunomodulation in dermatological applications. Our goal was to measure the effects of the combination of luteolin with a dermal ECM (dECM) hydrogel. Structural and mechanical effects of luteolin were characterized over a series of concentrations ranging from 40 μM to 160 μM luteolin by measuring rheological properties such as complex viscosity, storage modulus, and loss modulus. Gelation kinetics were measured over the same concentration ranges. Visualization of the scaffolds' macromolecular structure with respect to luteolin concentration was accomplished by performing scanning electron cryomicroscopy (cryoSEM). This work presents a representative physical analysis of the novel luteolin-dECM hydrogel scaffold for further use in both in vitro and in vivo applications.

Predicting bank erosion and retreat in the Canadian River, OK using the Bank Stability and Toe Erosion Model (BSTEM)

Author(s): **Rosemary Maloney**
Mentor(s): **Dr. Lucie Guertault**
Poster: **23**

The Canadian River is a braided, alluvial river in Oklahoma. In the 1960s, many dams were built, decreasing the frequency of large floods. The reduced flow allowed vegetation encroachment, leading to a narrower, less complex channel and to the modification of in-stream habitats. Because of the significant changes to the natural flow and sediment regimes of the river, the Arkansas River Shiner, which had adapted to the braided river structure and the large annual floods to reproduce, became endangered. (Fox et al., 2020)

This study investigated how BSTEM (Bank Stability and Toe Erosion Model), a mechanistic model that includes fluvial erosion, toe erosion, and mass wasting processes, could be used to predict bank retreat and help inform management strategies to restore the river to more natural conditions. The initial bank geometry was determined from Lidar data. Data from past field reconnaissance studies were used to determine the bank material, median diameter (d50), and grain size distribution of the layers of the bank (Paxton, 2000; Pollack, 1961; Simms, 2001; Smith, 2002). Flow data measured at two stream gauges along the study reach were used to determine the water level and energy grade slope. The BSTEM model parameters for the Canadian River were inverse-calibrated using remotely sensed bank retreat between 2010 and 2017. A correction factor was introduced to account for the impact of meandering and vegetation on bank erosion. The calibrated model accurately predicted erosion and will be used to predict the effects of future floods and inform management strategies.

Experimental and Numerical Study of Long-Term Solute Transport and Fate in Soils

Author(s):**Grace Thomas**
Mentor(s): **Dr. Lucie Guertault**
Poster: **24**

Agricultural solute spraying, such as pesticide and nutrient application, can infiltrate into the soil or be transported through runoff to surface water, causing detrimental health impacts to wildlife and humans. The long-term fate of pesticides is controlled by multiple physical and biogeochemical processes, thus creating a need for long-term experimental data to better understand controlling factors and verify numerical models. These numerical models are used in long-term pesticide fate predictions for environmental exposure assessment and designing best management practices to reduce the impact of agricultural pollution.

In this study, two laboratory experiments were conducted to track the long-term transport and fate of solute tracers in soil. A sloping soil box was filled with sand and WT Rhodamine (10.6 grams) was sprayed at the surface. A steady runoff inflow with a 40 minute duration was applied at one end of the box twice a week for four consecutive weeks. Runoff outflow rate and concentration, bottom drainage outflow rate and concentration, and soil moisture and soil pore water concentration were monitored during and in-between tests. The second set of experiments used a sandy clay loam soil with sodium chloride as the tracer sprayed at a mass of 15 grams. In the sand, the tracer was transported both laterally and vertically. Approximately 0.1% of the initial mass remained in the soil after four weeks. In the sandy clay loam, the tracer was transported with a mostly vertical movement. Approximately 2.67% of the initial mass remained in the soil after four weeks.

Evaluating the Performance of Novel Patient-Specific 3D Printed Cutting Guides for Canine Caudal Maxillectomy

Author(s): **Shelby Neal**
Mentor(s): **Dr. Ola Harrysson**
Poster: **25**

Advancements in medical imaging and stereolithographic 3D printing have allowed patient-specific cutting guides to become more prevalent in biomedical engineering applications. Cutting guides are commonly used by surgeons for the removal of a variety of anatomical deficiencies. These devices assist surgeons to increase the accuracy of planned cuts thereby improving clinical outcomes and increasing the performance of novice surgeons. This technology can be used for oncologic cases where there is a need to surgically remove a large anatomic segment, such as in this particular application, canine maxillary bone tumors. In the prototyping phase, different versions of caudal maxillary cutting guides were developed through the use of computer-aided design (CAD) software, 3D printed and tested on canine cadaveric heads in order to achieve an optimal design. Important design considerations were the fit and placement of the guide on the skull, and surgeon usability. The main objective of the study was to compare the performance of 20 3D printed caudal maxillectomy cutting guides, performed by both experienced and novice surgeons, to 10 freehand caudal maxillectomies performed solely by the experienced surgeon. Accuracy was quantified and analyzed by comparing the originally planned cuts in CAD to intraoperative and postoperative CT scans of the skulls. Additionally, this project highlights the exceptionally collaborative nature of the use of advanced engineering technology in medical clinical practice and reinforces the importance of communication and process streamlining between both engineers and surgeons throughout the design phase.

Precision Agriculture for Sweet Potato Analytics for Produce Provenance and Scanning (Sweet-APPS)

Author(s): **Lily Averette**
Mentor(s): **Dr. Whitney Jones**
Poster: **26**

Sweet potato growers continuously seek to produce the most desirable product to attract sales and increase their profitability. In doing this, they seek to achieve a standard of shape and size in their product that is concurrent with USDA's highest root grading standards, which is seen as most desirable in the consumer's eyes. The Sweet-APPS team is seeking to further their research in sweet potato growth by implementing research techniques and data analysis on existing data while collecting new data in current growing seasons. In doing this, we will be able to draw

conclusions about factors that affect sweet potato growth to create predictions on size and shape as well as yield from specific growing areas. Our overarching goal is for growers to be able to access and easily use this compiled data on sweet potato growth factors so that they can produce more of the highest root grade sweet potatoes and therefore increase profitability. For my role in the Sweet-APPS team, I have been collecting data from Scott Farms using soil moisture sensors, rain gauges, temperature probes, and data loggers under the guidance of Dr. Jones and BAE graduate student Shelly Hunt as part of my Summer 2021 REU. In Fall 2021 and Spring 2022, I have continued to collect field data and assist in the harvest season yield data collection at the farm while also learning how to use SAS and ArcGIS where we will begin data analysis and organization.

Synthesis and Characterization of Novel Biodegradable Polyurethane Foams for Apparel Applications

Author(s): **Ryan Rumple, Cory Campbell, Davis Wood, & Zizhi Zhuang**
Mentor(s): **Dr. Whitney Jones**
Poster: **27**

HanesBrands is a global, vertically integrated company, responsible for making more than 70% of their own clothing in facilities they either own or operate. With global eyes turning to sustainability, Hanes is addressing the typical non degradable polymer materials in their bras and footwear, and is aiming to make them biodegradable. In order to reduce the tremendous amount of plastic waste buildup from discarded foams in apparel, biodegradable foams were engineered to degrade, by anaerobic mechanisms, in landfill conditions. By introducing biodegradable additives and formulating biodegradable polyols, polyurethane foams were produced via the one shot process that exhibit improved biodegradable behavior as compared to traditional polyurethanes. Polymer samples were fabricated and subjected to anaerobic microbial degradation conditions, physical properties of the polymers such as density and hardness were quantified, and characterization of the porosity and microstructural features of the foams were performed by X-ray computed tomography. The ultimate goal of the project being to identify the correct ratio of and most effective biodegradable additives and the effectiveness of biodegradable polyols in the production of a biodegradable polymer with physical properties that align with those of current polyurethane foams used in HanesBrands manufacturing processes and to make a recommendation for steps going forward to integrate biodegradable polyurethanes into the contemporary apparel industry.

Multi-User Virtual Reality to Enhance Neurorehabilitation

Author(s): **Alexander Sprague**
Mentor(s): **Dr. Derek Kamper**
Poster: **28**

Stroke is the leading cause of long-term disability in the U.S., with one-third to two-thirds of all stroke patients losing hand function post-stroke. Virtual-reality-based hand therapy is a promising, new approach to physical/occupational therapy that allows patients to interact with others during therapy sessions in-person or virtually. Additionally, it allows data to be stored for clinicians to use. This project aimed to incorporate new, wireless 9-DoF inertial measurement units (IMUs) into a virtual reality-based rehabilitation program in Unity, a virtual-reality platform. The IMUs are wireless and can be connected to send quaternions describing hand kinematics to a local computer via a Bluetooth-based hub. The linear accelerometer and Euler angle measurements from the sensor fusion mode were tested for accuracy and drift. A fourth-order bandpass Butterworth filter was used to filter the linear acceleration data. Both the filtered linear acceleration and Euler angle data were shown to be resistant to error accumulation and drift. Euler angles were used to accurately render an animated model of the metacarpophalangeal joint flexing. Future work includes interfacing the IMUs with Unity, testing the virtual reality therapeutic in the UNC Inpatient Rehab Clinic, and feasibility studies for in-clinic and at-home therapy.

Hydrolysis of pesticides and identification of associated transformation products

Author(s): **Nadia Sheppard**
Mentor(s): **Dr. Detlef Knappe**
Poster: **29**

The widespread use of pesticides has resulted in contamination of the environment and exposure of humans and animals. Chronic exposure to pesticides has been linked to health problems in humans and poses significant risks to nontarget organisms. To understand pesticide occurrence in the environment, targeted analytical methods are typically used. However, these methods target only a limited number of pesticides and do not keep up with the rapid development of new pesticide formulations and active ingredients. Furthermore, many pesticides that occur in the environment may be transformed via processes such as metabolism, hydrolysis, or photolysis. The resulting pesticide transformation products are not well understood and are rarely included in standard analytical methods used for environmental monitoring. It has been shown that pesticide transformation products that are included in environmental monitoring studies are sometimes detected more frequently and at higher concentrations than their parent compounds. Therefore, pesticide occurrence in water and the associated human

health risks could be substantially underestimated if pesticide transformation products are not considered. This project seeks to address this knowledge gap by 1) determining hydrolysis rate constants of pesticides and 2) identifying associated transformation products. Fluorinated pesticides are of particular interest because they may be considered per- and polyfluoroalkyl substances (PFAS) based on a definition proposed by the OECD (2021).

Improving the Design of a Robotic System for Microscopic Fossil Sorting

Author(s): **Erik Modesto Reyes**
Mentor(s): **Dr. Edgar Lobaton**
Poster: **30**

Forams are microscopic fossils found around coastal regions that can tell us about Earth's history. Forams are fossils that can help determine the Earth's historical past because they can survive in extreme environments. For example, different types of foram species thrive in various ocean environments, and chemical measurements can tell scientists everything from the ocean's chemistry to its temperature when the shell was formed. Current undergraduate workers are often employed to hand-pick several thousands of specimens from ocean sediments for each study. By automating the bulk of the identification process, user expertise can be focused on verifying and identifying subtle differences.

This research involves optimizing a robotic tool called the ForaBot to automate the analysis of these fossils. ForaBot will be able to automatically identify and separate individual forams and then provide visual images for the user using a microscopic camera. Currently, I am assembling a new prototype of the Forabot that can replace an existing camera system to make the platform more self-contained without a separate laptop. The importance of this innovation is that it will allow researchers to quickly and efficiently a large number of forams as part of broader research.

Identifying risk factors of human trafficking in illicit massage businesses through qualitative analysis of stakeholder interviews

Author(s): **Nehemiah MacDonald**
Mentor(s): **Dr. Maria Mayorga**
Poster: **31**

There are approximately 11,000 illicit massage businesses (IMBs) across the United States, many of which exploit victim workers through a hybrid of human and sex trafficking. However, there is currently no way to systematically determine which

massage businesses are likely to be illicit. This study seeks to identify common risk factors of human trafficking through qualitative analysis of law enforcement interviews. Natural Language Processing (NLP) techniques are used to analyze these interviews and extract common themes identified from responses given by members of law enforcement. Topics discussed with stakeholders relate to the IMBs management structure and role in criminal networks, physical characteristics, and the transportation of victims between businesses. Pinpointing these risk factors is the first step in creating a system that will help to more efficiently recognize if a massage business is illicit.

Continuous Removal of Antibody Fragments

Author(s): **Zacharia Nyambega**
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Poster: **32**

Therapeutic antibodies have increased in demand drastically in the past decade due to their success in treating many acute and chronic diseases. Antibody therapeutics require an arduous manufacturing train; after biological expression, they must be purified of process and product-related impurities that affect the safety and efficacy of the treatment. The current chromatography methods used to purify antibodies are expensive and time-intensive.

The goal of this research was to develop a rapid, single-use chromatography process to remove antibody fragments quicker and more cost-effectively than current industrial technologies. This novel method utilizes a combination of size-based filtration and adsorption principles to purify samples. The chromatography column was created from microporous silica and silanol ligands, which are less expensive than current industrial technologies. The following parameters were analyzed to determine the optimum operating conditions and design for the column to operate under: particle pore size, residence time, ligand chemistry, and the pH of the mobile phase.

Preliminary results at optimum operating conditions with a pore diameter of 100 Å, multimodal ligand, the residence time of 6 minutes, and a mobile phase pH of 7.0 showed the removal of 50% of antibody fragments while achieving a product recovery of 80%; this 80% recovery is a minimum threshold for maintaining an economically viable process. Further exploration and eventual implementation of this technology can reduce the cost and time to market required to distribute critical antibody therapies to people in need.

Pressure Field Mapping of Shock Boundary Layer Interactions Using Pressure Sensitive Paint in an Axisymmetric Geometry

Author(s): **Chase Jenquin**
Mentor(s): **Dr. Venkat Narayanaswamy**
Poster: **33**

Shock boundary layer interactions (SBLI) have a common occurrence on the bodies of supersonic and hypersonic vehicles. If sufficiently strong, they can result in large scale flow separation. In designing the inlet of high speed air-breathing vehicles, an axisymmetric geometry is often favored due to its superior total pressure recovery and relative lack of 3D effects, making this geometry the most relevant for this study. I endeavored to establish as complete of an experimental description as possible for an uncontrolled compression ramp SBLI in an axisymmetric duct. The main body of the axisymmetric model has an outer diameter of 100 mm, which tapers inwards to a sharp leading edge from the outside, forming an interior measurement domain with a diameter of 75 mm. A boundary layer forms along the inner surface of the model and undergoes a natural transition to turbulence. The boundary layer interacts with an axisymmetric oblique shock wave generated by a 20 degree compression ramp located 380 mm downstream of the leading edge. Fast-response pressure sensitive paint (PSP) was used on the model in the supersonic wind tunnel at Mach 2.5 to provide insights into the near-wall pressure fields and the RMS of these fields. From this PSP data, the power spectral densities could be computed, showing the low frequency unsteady shock motions that the separation bubble exhibited. Finally, the intermittent region conditional average pressure fluctuation maps and two point cross correlation analysis both gave insight into the driving mechanism of separation bubble pressure fluctuations.

Uranium Core Design for Cersatile Test Reactor

Author(s): **Jordan Page**
Mentor(s): **Dr. Scott Palmtag**
Poster: **34**

With advanced nuclear fuels and reactor designs being pursued in the United States, adequate infrastructure for experimentation, testing, design evolution, and component qualification is required. One solution to this challenge is the Versatile Test Reactor (VTR). Its purpose is to develop an understanding of the behavior of materials under a fast neutron flux; and thus is designed to optimize fast neutron production. In its current form, the VTR is designed to be operated using plutonium fuel, however, this type of fuel may be difficult to obtain in the future because of the lack of reactor-grade plutonium the United States has stored. Our project, therefore, is to design a core for the VTR which can operate using High Assay Low-Enrichment

Uranium (HALEU) fuel as an alternative while still achieving the intended fast flux of 4*1015 n/cm2s under the constraint of maintaining the core size specified by INL. Experimentation with fuels such as uranium carbide, uranium nitride, and uranium zirconium, was performed. In addition, certain assembly types and dimensions present in the original design were changed: leading to significantly better results. While the results seem promising, further research into alternative fuels and loading patterns may be required.

Simulating Doppler Audio Signals of Free Gas Bubbles Flowing in Vessels In Vitro

Author(s): **Andrew Hoang**
Mentor(s): **Dr. Virginie Papadopoulou**
Poster: **35**

Introduction
Decompression sickness (DCS) can result from the growth of bubbles in tissues and blood during rapid reduction in ambient pressure [1]. Doppler ultrasound (DU) is often used to detect venous gas emboli (VGE) after scuba dives [2,3] as a marker of decompression stress. These audio recordings are manually graded using the Kisman-Masurel (KM) scale which is associated with DCS risk. Our overall aim is to use deep-learning to automate KM grading of DU post-dive recordings, which needs both a large database of labeled synthetic data from laboratory experiments, and heart rate estimation (HRE) in real post-dive recordings.

Methods
In-vitro, air bubbles were injected using a 1 mL syringe in flowing water (at fixed rates of 800-1200 mL/min) through a wall-less channel in a gelatin phantom, and DU used to record bubble motion. For HRE, an algorithm based on short-term autocorrelation was developed in MATLAB and evaluated on 21 previously acquired and graded precordial DU recordings.

Results
Artificial bubble signals in recordings were isolated and saved as individual files (1,855 in total).

A window-size of at least 2 seconds was necessary for accurate instantaneous (HRE) with a mean error of 1.56±7.10 bpm. We found that our algorithm provides good results for low KM grade Doppler recordings with and without motion, and high KM grades without movement.

Conclusion
The generation of synthetic data based on laboratory experiments proved integral in localizing VGE events in real Doppler recordings. We have developed a fully automated algorithm for HRE in post-dive precordial DU recordings.

Engineering Skin: Building the Follicle for the Niche

Author(s): **Amber Detwiler**
Mentor(s): **Dr. Jorge Piedrahita**
Poster: **36**

Severely damaged adult skin cannot heal to its original state and instead forms scar tissue without skin appendages. While bioactive materials are promising substitutes for skin grafts, they lack hair follicles, a skin appendage that plays a major role in the physical appearance and function of skin. Prior research has used dermal fibroblasts in a collagen hydrogel to study cellular behavior in a 3D culture environment, but this model does not recapitulate the complex interactions between different cell types and skin extracellular (ECM) matrix that are key factors of the hair follicle niche. The goal of this project was to recreate the hair follicle niche in vitro using decellularized skin hydrogels—which maintain biological components of the native skin tissue—layered with multiple niche cell types. Dermal fibroblasts, dermal papilla, and epidermal keratinocytes were isolated from porcine skin and seeded in a decellularized skin ECM hydrogel that was patterned with artificial “pore” structures using a polylactic acid (PLA) 3D printed stamp. Outcomes of the skin construct were assessed by: pore formation, construct contraction via surface area, and cell distribution and recruitment to the follicle structure using immunofluorescent staining. In addition, skin structure formation was determined using hematoxylin and eosin staining. This research is a first step towards developing a construct that mimics important features of skin such as hair follicles, with future implications in folliculogenesis in biomaterial skin grafts.

Biological Conversion of Cotton Residues to Bioplastic & Proteins via Wild Fermentation

Author(s): **Paige Seibert**
Mentor(s): **Dr. William (Joe) Sagues**
Poster: **37**

A newly developed thermophilic bioprocess for the simultaneous enzymatic hydrolysis and fermentation of cotton residues produces valuable bioproducts of lactic acid and microbial protein. The process is facilitated by Bacillus coagulans, a microorganism capable of withstanding extreme environments that resides in cotton residues. Combined with cellulase enzymes, the B. coagulans can produce the aforementioned bioproducts at relatively low costs. Producing lactic acid, a common bioplastic precursor, is key to fulfilling the expected 216% increase in the demand for bioplastics from 2020 to 2026 (European Bioplastics 2021). Microbial protein is similarly in high demand, as alternative protein consumption is expected to grow to 97 million metric tonnes by 2035 (US Department of Agriculture).

The process begins with milling cotton waste; both cotton linter and cotton hulls were used separately for comparison. Then, the residues received a simple one-step alkaline pretreatment ranging from 0 to 120 mg/g potassium hydroxide in biomass for twelve hours. It was determined that 60 mg potassium hydroxide at 50 degrees celsius is the optimal condition due to high sugar yield and low inhibitors. After pretreatment, carbon dioxide is incorporated into the process to decrease pH and add a source of carbonate. From this point, the biomass enters the phase of liquid and solid separation, where it will either be converted into the protein feed or continue onto polymerization, ultimately becoming polylactic acid. Overall, this novel bioprocess both produces promising products and utilizes cotton waste.

Visualizing Dune Volume Change Across the Pea Island National Wildlife Refuge

Author(s): **Vega Sproul**
Mentor(s): **Dr. Elizabeth Sciaudone**
Poster: **38**

The Pea Island National Wildlife Refuge (PINWR) is located on a dynamic coastal barrier island system that experiences severe storms multiple times per year. These storms can damage the coastal roadway that serves as a critical link to communities south of the Refuge. The North Carolina Department of Transportation funds an ongoing Coastal Monitoring Program to inform future planning to maintain the transportation corridor. As part of this effort, NCDOT has developed digital terrain models of the barrier island, four times per year since 2012. These terrain models were used to extract beach and dune profiles across the PINWR study area. Navigating the large dune profile dataset is a daunting task, yet is essential in planning for management of the Refuge and the coastal highway.

To make it easier for engineers and coastal managers to navigate through a 10-year, seasonal dune profile dataset, a graphical user interface (GUI) that allows users to easily traverse, visualize, and understand this dataset was created. The user can choose a specific transect of interest, select a time range, and include or exclude different seasonal terrain models. This Matlab-based GUI creates figures highlighting dune evolution and calculates and organizes dune parameters such as volume, maximum dune elevation, and beach width into an exportable table. The creation of this tool improved the format of previous dune profile figures and enhanced the inherent value of these data. This tool helps our research team provide accessible information in the annual Coastal Monitoring Program report.

Characterization of Stable Coamorphous Pharmaceuticals

Author(s): **Naomi Bouedo**
Mentor(s): **Dr. Sindee Simon**
Poster: **39**

Amorphous or glassy pharmaceuticals have increased dissolution rates and biosolubilities relative to their crystalline counterparts. However, glasses are inherently thermodynamically unstable and can recrystallize during processing, storage, or use. One potential solution is the development of coamorphous pharmaceuticals. Such materials consist of an active pharmaceutical and a small molecule excipient, and can provide stability against recrystallization during storage by reducing molecular mobility often through an increase in the glass transition temperature (Tg). Our recent work has focused on examining the properties of the drug-small molecule excipient combination of indomethacin and cholic acid using differential scanning calorimetry to measure Tg as a function of composition and as a function of cooling rate. Results show that the system is a good coamorphous glass-former, and the composition dependence of Tg is well described by the Fox equation, suggesting ideal intermolecular interactions between indomethacin and cholic acid. The dependence of the Tg on cooling rate is also examined, and the dynamic fragility (m) is found to be a minimum for the mixture containing a 1:1 weight ratio of indomethacin and cholic acid. The minimum in fragility suggests that this 50 wt % mixture has the best molecular level packing. Future work will examine the long term stability against crystallization and the dissolution behavior of these coamorphous materials across the entire composition range.

Novel Semi-crystalline Thermoplastic Elastomer Gels

Author(s): **Andrew Balsbough**
Mentor(s): **Dr. Richard Spontak**
Poster: **40**

Thermoplastic elastomer gels (TPEGs), multifunctional polymers selectively swollen with a midblock-selective, low-volatility oil, are scientifically important because of the insights they provide regarding self-assembly, as well as technologically relevant because of their applications as anthropomorphic surrogates for crash survival and surgical studies, stimuli-responsive materials for high-precision shape-memory and electroactuation, and vibration-dampening barrier materials to protect underground fiber optics cables for telecommunication companies. The ESEBE copolymer consists of crystallizable high-density polyethylene (E) endblocks and a random copolymer midblock composed of styrene (S) and ethylene-co-butylene (EB). To assess the effect of oil content on bulk mechanical and thermal properties, midblock-compatible mineral oil was added to the copolymer at different loading levels, and the resulting gels were subjected to differential scanning calorimetry

(DSC) and quasistatic uniaxial strain analysis. The DSC results confirmed that the parent copolymer exhibited the highest melting temperature (Tm) at 98.6 °C, whereas the TPEG with the highest oil fraction (80 wt%) exhibited the lowest (Tm = 78.9 °C). Copolymer crystallinity values after the first and second heats were 14.3 ± 0.4% and 10.3 ± 0.7%, respectively, implying that (i) the crystal structure, not population, is strongly influenced by gel content and (ii) crystallization from solution at high temperature impedes crystal growth. Of all the TPEGs tested, the one with 40 wt% oil reached the greatest uniaxial tensile strain of 3500%. In addition to these property measurements, the crystallinity, and morphologies of the TPEGs will be addressed in the presentation.

Forget Me Not: Early detection of Alzheimer's Disease

Author(s): **Neha Suresh, Ramachandran Sekanipuram Srikanthan, Rashani LNU, & Gabriel Francis**
Mentor(s): **Dr. Daniel Stancil**
Poster: **41**

Alzheimer's disease (AD) is a severe neurodegenerative disease that is caused by a build-up of Amyloid Beta Plaque (Aβ) and neuro fibrillary tangles. The build-up of Aβ plaque begins around 20 years before onset of symptoms. Researchers are of the opinion that an early prognosis of Alzheimer's could lead to better patient care and targeted drug therapy. Our Project "ForgetMeNot" holistically focuses on early detection and treatment of Alzheimer's disease using Quantum Machine Learning. We develop a quantum hybrid model to classify whether the patient has the early symptoms of AD which is the Mild cognitive impairment (MCI) or they are cognitively normal. The ADNI dataset provides various MRI Scan images of the patient's brain and their classification based on 5 classes including AD, early MCI, late MCI, MCI and cognitively normal. The classical feature extraction model consists of two neural networks Resnet18 and DenseNet121 which are being trained to extract features from the scan images. These features are concatenated and weight randomly selected to be passed to the quantum model. These features are now converted to quantum state by using various available feature maps. A parameterized quantum circuit is used as a model and is being trained from these encoded quantum states to provide classification. The final results are transformed from Hilbert space (quantum state) to classical values. This model is being deployed in a separate server suited for accelerated computing. The front end will be from a website or mobile application which uses REST calls to get the classification.

Geometric Optimization and 3D Printing Reinforcing Steel

Author(s): **Natalie Hackman**
Mentor(s): **Dr. Jessi Thangjitham**
Poster: **42**

The use of high strength reinforcing steel in high seismic areas could improve bridge designs by reducing congestion, construction time, and environmental impact. It has been found from material tests and large-scale experimental tests of columns reinforced with high strength steel, that rebar geometry influences the seismic behavior. The relationship between the rib geometry of reinforcing steel and resulting strain concentrations from buckling will help define an optimal rebar geometry to improve seismic behavior. This study examines rebar geometries and strives to create a database of these rebar geometries and their correlating strains under the same prescribed loading. To analyze this relationship, a method of 3D scanning and then 3D printing the rebar with flexible resin was performed. Next, the rebar was tested by buckling the 3D printed rebar to a prescribed displacement. This semester, our focus was on meshing the 3D scanned and extruded rebar to be used in finite element analysis. The number of nodes, quadratic tetrahedra elements, and coarseness of the meshes were recorded which can be used to analyze the level of detail of the mesh. We have begun performing the finite element analysis on the rebar and plan to continue in the summer. Additionally, the rebar properties of rib height, rib radius, and distance between ribs were measured by taking 10 measurements from each side of the rebar and averaging the results. The final results will be the recommendation of optimal rebar geometry properties to improve the seismic performance of high strength reinforcing steel.

Syring Analysis for Foam Sclerotherapy

Author(s): **Alex Almaraz, Lynne Dale, Katarina McGarry, & Tal Dor-El**
Mentor(s): **Dr. Jackson Thornton**
Poster: **43**

Varicose veins are a disease caused by damaged vein valves that produce venous deformity and vein dilation. Symptomatic Varicose Veins can cause a significant amount of pain and greatly impact the quality of life in more than 3 million new patients per year. Foam Sclerotherapy is one of the leading, minimally invasive treatments for Varicose veins. However, the treatment delivery device comes with challenges affecting foam stability. TriboFilm Research has extensive experience in the medical device business involving silicone oil lubricant contamination issues. The objective of this project is to generate preliminary data comparing TriboFilm's syringe coating technology against their competitors in order to secure an NIH small business grant which will fund further research on this treatment delivery system. In order to accomplish this goal, our approach will be to devise a foam characterization

method by building off current literature using optical microscopy techniques to determine bubble size, half-life, and foam density. In addition to our characterization method, a foam production analysis will be performed using a novel foam production machine to determine precise foam processing settings including the following: number of pump cycles, pump speed, and plunger force. Both of these tactics will allow us to learn more about the properties of the foam in order to produce the most stable and consistent therapy for use in future syringe optimization testing.

Polymer Compatibility of Microneedle Patches for Nucleic Acid Extraction and Amplification of Tomato Leaf DNA

Author(s): **Emily Ostermann**
Mentor(s): **Dr. Qingshan Wei**
Poster: **44**

Pathogenic infection of plants is a major threat to world agriculture. This threat can be mitigated by improved rapid, point-of-care diagnostic technologies for plant pathogen detection. The steps for point-of-care pathogen detection are nucleic acid (DNA/RNA) extraction, amplification, and amplicon detection. Nucleic acid extraction poses the greatest challenge. We have developed polymer-based microneedle (MN) patches for DNA extraction from plant leaves. MN patches fabricated from polyvinyl alcohol (PVA) can extract DNA from plant tissue within less than a minute, an advantage over the conventional cetyl trimethylammonium bromide method. MN-extracted DNA can be isolated by a buffer or water wash and analyzed for pathogen DNA by polymerase chain reaction (PCR) or loop-mediated isothermal amplification (LAMP). To further improve DNA extraction efficiency, MN patches can be fabricated from polymers exhibiting pH-dependent DNA binding and release properties. The first step toward determining the optimal polymer for fabrication of MN patches with enhanced extraction efficiency is to ensure that polymer residues do not inhibit PCR or LAMP. This compatibility test was the focus of this research project. MN patches were fabricated from chitosan, carboxymethyl chitosan (CMC), and hyaluronic acid (HLA). Using a PVA standard, compatibility of chitosan with PCR and compatibility of all four polymers with LAMP of rbcL gene were tested via direct addition of polymer to reaction mixtures and amplification of MN-extracted DNA samples. It was determined that chitosan dissolved in a high concentration of acetic acid may inhibit PCR and LAMP, HLA may inhibit LAMP, and CMC is compatible with LAMP.

Assessing the Use of LAMMPS with ReaxFF to Simulate Glucose Pyrolysis

Author(s): **Mitchell Haselow**
Mentor(s): **Dr. Phillip Westmoreland**
Poster: **45**

LAMMPS molecular dynamics software has been used with the reactive force field ReaxFF to probe glucose pyrolysis to predict reaction rates and products. Using renewable fuels is an important approach to address climate change, and understanding the chemistry of biomass pyrolysis has the potential to improve renewable-biofuel production. Woody biomass is composed of polysaccharide polymers such as cellulose, which is made up of glucose monomers. The objective here was to determine the capabilities of LAMMPS for predicting rates and products from glucose pyrolysis and to be a tool for visualizing and better understanding the pyrolysis reaction mechanisms. Multiple LAMMPS simulations were performed at high temperatures and approximately nanosecond runtimes. Post-processing programs were developed to analyze the output of the simulations. The code made it possible to determine glucose pyrolysis yields. The simulation results were compared with experimental data, revealing similar products including acyclic glucose, formic acid, glycolaldehyde, water, 1,2-ethenediol, and glyoxal. However, the simulations did not find cyclic compounds such as furans, furfurals, and levoglucosan that were present in the experimental data. We conclude that the concerted reactions leading to five-membered rings are not described well by the ReaxFF force field, which is better suited to simple bond-breaking.

Novel Chitosan-Glycerol Injectable Gel for Intratumoral Delivery of Immunotherapeutics

Author(s): **Robert Korbin**
Mentor(s): **Dr. David Zaharoff**
Poster: **46**

Localized cancer therapeutic delivery provides several advantages over systemic delivery, including increased retention and reduction of systemic side effects. In particular, intratumoral injections are an advantageous delivery method for cancer treatment. However, the dense extracellular matrix and higher pressure tumor environment severely limit injection retention, as less viscous solutions easily return via the needle track. Gel delivery systems address this limitation due to their increased viscosity and hence improve retention at the tumor site, allowing for the long-term, controlled release of therapeutics. Chitosan, a polysaccharide derived from shells and scales of crustaceans and fish, has been used in gel creation due to its wide availability and its biocompatible nature.

A novel physically crosslinked chitosan-glycerol injectable gel was developed to improve therapeutic retention for intratumoral delivery. Different relative glycerol to chitosan volumes, ranging from 5 to 95% glycerol, were tested to determine the optimal gelation conditions for a variety of chitosan types. Phosphate-buffered saline was incorporated into the solution, which was then raised to a pH of 7.8 with sodium hydroxide. After centrifugation at 10,000 rpm for 5 minutes, chitosan-glycerol gel was formed. Glycerol most significantly impacted gelation conditions independent of chitosan concentration, with gelation occurring between 70-85% relative volume glycerol. Chitosan viscosity also had a significant impact. The gel was injected through a 25-gauge needle into gelatin-based tumor phantoms, and it displayed increased load retention time compared to various saline and chitosan-based solutions. Due to this increased retention time, chitosan-glycerol gel offers an effective platform for intratumoral delivery of immunotherapeutics.

Development of Dissolvable Microneedle Patch-based Vaccines

Author(s): **Lauren Reynolds**
Mentor(s): **Dr. David Zaharoff**
Poster: **47**

Microneedle arrays provide a more beneficial, alternative route for vaccination. They are less painful, simpler, and easier to transport than needle-and-syringe vaccinations. No pain is induced because the microneedles do not reach the depth of the pain receptors in the skin. Furthermore, the simplicity of microneedles helps reduce error in vaccine administration by simplifying the vaccination process and eliminates risk associated with disposal of sharps. Finally, the simplicity of microneedle patches eases the burden of transporting vaccines because of their compact size and less temperature-sensitive nature. Such benefits could broaden access to vaccinations and reduce vaccine waste.

Several different materials were chosen to evaluate their application in microneedles including chitosan, carboxymethylcellulose (CMC), sodium alginate, and sodium hyaluronate. Several formulations of each material were evaluated for their ability to form microneedle arrays containing India Ink (for visualization). This process involved fabrication of 10x10 microneedle arrays using 100 uL of each polymer solution (polymer in deionized water) pipetted into a PDMS mold, centrifugation at 2100 xg for 2 minutes, and overnight drying. The arrays could then be imaged with a digital microscope and evaluated for their dissolution ability (desired within 2 minutes) in a gelatin-based skin model. Successful formulations from this preliminary testing included multiple CMC formulations between 3 and 5% as well as different hyaluronate-CMC and hyaluronate-alginate solutions in 1.5-2% concentrations. In forthcoming in vivo studies, microneedles formed from these solutions will be applied to mice to determine their ability to puncture and dissolve within skin in a murine model.

The Use of Machine Learning to Manage Business Risk Within the Financial Industry

Author(s): **Jackson Beck**
Mentor(s): **Dr. Ajmani**
Poster: **1**

As a result of the Sarbanes-Oxley Act of 2002 and the financial crisis of 2008, financial institutions have begun to prioritize risk management recognizing its cost-saving benefits within the industry and its impact on the overall economy. Due to rapid technological advancement over the past few decades, dynamic machine learning algorithms have become a popular tool utilized by financial institutions to manage business risks. While other risk management strategies are useful, machine learning algorithms can extract relevant information from the massive amounts of incoming data that is used to assess risks. Without machine learning algorithms, it would be unlikely that financial institutions would be able to sufficiently analyze business risks in today's environment because the human brain cannot produce satisfactory insights from the great amount of complex data flowing into the financial industry on a daily basis. Even though the use of machine learning as a risk management tool continues to grow in popularity, most that depend on it truly do not understand what it is or its true power. As a result, the goal of this research is to further promote the understanding of machine learning algorithms and their current and potential power to manage business risk associated with the financial industry.

Best Strategies for Club Advertisement: Understanding Your Target Audience

Author(s): **Johnny Nguyen**
Mentor(s): **Dr. Thomas Byrnes**
Poster: **2**

At North Carolina State University, joining a student organization is an effective way to improve a person’s college experience, to be successful with their courses, and to develop professional skills. However, there is currently a lack of resources for clubs about the best methods in promoting themselves and recruiting new members. This study aims to provide insights about the general students’ behaviors surrounding their motivations to join a club, strategies used to find a club, and reasons to not be a part of a club. The primary population of this research was the students from the Poole College of Management at North Carolina State University. Over the 2021 Fall semester, two surveys were distributed during and after a student involvement fair within the department to assess their effectiveness. From the results, both attended students and clubs overwhelmingly perceived the event as being successful.

Another survey was distributed to dive into the students' overall activities when searching for an on-campus organization and their general perspectives about it. The results revealed a variety of resources that were utilized, the timeframe when people were more actively searching, and the determining factors for someone to join or not join clubs. Student organizations at NC State can use these findings to adapt their promotional and operational strategies to improve efforts in recruiting new and retaining existing members. Future research can build upon this study to further explore more in-depth about the students' behaviors in discovering and joining clubs.

How Do Funding and Demographics Affect Graduate School Success?

Author(s): **Alexandra Addison, Dyllan Baranchak, Grace Hilpl, Livia Popa, & Abigail McManus**
Mentor(s): **Dr. Emily Griffith**
Poster: **3**

The purpose of this research project was to address the intersectionality between demographic factors and funding and their effects on students' success. The project aimed to answer the question of "How do funding and demographics affect graduate school success?". Our research intends to focus on the impact of specific forms of financial support in combination with demographic factors such as race and gender, and how this will have an effect on student success in graduate school, which is overlooked in current research. We will be using education data from a large research institution to accomplish this. We defined success as having either completed a degree, or being currently enrolled in a graduate program. With this in mind, we used frequency tables to capture general statistics about the roles of demographic factors and funding in graduate student success. Additionally, we utilized t-tests for proportions to compare demographic and financial groups to each other and used logistic regression to see how demographic factors and funding together affected the success of graduate students. We hope to determine whether the interaction between demographic factors and types of funding are statistically significant in predicting graduate student success. Our findings can be used for future studies to determine an improved method of retaining graduate students that includes the research conducted on funding's impact on student's success. This information can be used to help further guide students to degree attainment with this aspect in mind.

Predictive Ability of GRE Scores on Graduate Student Success

Author(s): **Adrianne Caudill, Anthony Wang, Helen Reed, Roland Graham, & Patrick O'Keefe**
Mentor(s): **Dr. Emily Griffith**
Poster: **4**

In recent years, there has been a growing trend of large research institutions making their Master's and Ph.D. programs' GRE admission requirement optional. As more programs drop GRE requirements, we are investigating if GRE scores are a good predictor of graduate school STEM student success at a large research institution to provide insight on whether the GRE admission requirement should be optional. We focus on how scores from different testing areas of the GRE exams are associated with graduate STEM students' completion rate and whether this correlation differs between Master's and Ph.D. STEM programs at a large research institute. While there is extensive research on GRE scores overall, there is less research comparing the predictive ability of GRE scores on Master's versus Ph.D. success in STEM fields. There is also less literature exploring the differences in prediction between the different areas of the test. We performed logistic regression to determine if GRE scores are a predictor of completion, and identified which GRE score parts are impactful variables. If higher scores on GRE test sections correspond to more degree completion, then GRE scores are a predictor of graduate student success. Future research on how GRE scores predict success in non-STEM fields is needed.

Assessing Graduate Student Graduation Rates by College of Study

Author(s): **William Fryer, John Healy, Katelyn McInerney, Dihan Su, & Trey Capps**
Mentor(s): **Dr. Emily Griffith**
Poster: **5**

The purpose of this analysis is to understand differences in graduate student success trends by college of study. The research question of interest is how student success, defined by attainment of a degree, ideally in the initially chosen degree plan, differs depending on the student's 'home' college after controlling for other factors. Although previous research has shown that degree completion rates differ by the department that the student is enrolled in, no studies have done a comprehensive comparison study across all departments in a quantitative manner. The studies that do perform comparisons typically only compare qualitative differences in departments with highest and lowest completion rates. Therefore, our analysis fills an important gap in the literature. In this study, graduate students of a large research university in the United States over the past 10 years were the research subjects. We fit a logistic regression model and a multiple linear regression model to measure success trends comparing different colleges. Our hypothesis was that

success trends would tend to differ, especially by predominately STEM versus non-STEM programs. These findings will be important for future research in programs by college since the amount of variability between colleges may be an important indicator.

Impact of COVID-19 in the Academic Performance of Master's Students

Author(s): **Lohan Rossi, Alyson Salinas, Yueqi Gu, & Grace Salo**
Mentor(s): **Dr. Griffith**
Poster: **6**

The COVID-19 pandemic has caused major disruptions in many areas of life and left virtually no one untouched, including Master's students. Therefore, our group seeks to use the metrics of GPA, Pass/Fail, and Degree Completion from a large university to measure how the pandemic has specifically impacted master's students' academic success. Due to the recent nature of the pandemic, little quantitative research exists to analyze this impact. We investigated whether each of these academic success indicators were significantly affected by COVID-19 through individual statistical tests, which compared if the means/proportions were statistically different between pre- and intra- COVID-19 Master's students. We found a statistical difference between pre- and intra-COVID-19 for all three variables: GPA, Pass/Fail, and Degree Completion. Our findings indicate that the COVID-19 pandemic has taken a significant toll on Master's students in particular. We acknowledge the effect of the Enhanced Satisfactory/Unsatisfactory Grading Option in effect during the pandemic, and we thus attribute student success in GPA to the use of this option, as demonstrated by a higher use of Pass/Fail. Future Research could measure if the observed significant impact by COVID-19 will continue to affect the academic landscape. Additionally, the introduction of new educational tools and methods as a result of Covid-19 raises the question of whether these new technologies are useful in a post-pandemic world.

Analysis of Bactrocera dorsalis Count in Senegal and Environmental Factors Affecting Bactrocera dorsalis and Fopius arisanus Growth

Author(s): **Hang Nguyen**
Mentor(s): **Dr. John Banks**
Poster: **7**

The purpose of this research is to analyze the changes in daily temperature, humidity, and Bactrocera dorsalis (Oriental Fruit Fly) count in three regions of Senegal between October 2017 and March 2019 to inform a delayed differential equations model of the population dynamics between B. dorsalis and a parasitoid called Fopius arisanus.

After accounting for missing measurements using cold deck imputation from publicly available weather data, we tested for differences in daily temperature, humidity, and fruit fly count each month. To factor in autocorrelation between measurements, we used 99% z confidence intervals of pairwise differences for environmental variables in our hypothesis tests. We compared the fruit fly counts using the Kolmogorov-Smirnov Test for the distance between the count distributions.

Our analyses show that for all months, there are statistically significant differences in temperature and humidity between the three regions. For most months there is sufficient evidence at alpha = 0.05 that the fruit fly count distributions for each region are different. In addition, we found that the mean daily temperature and counts both peak during the short rainy season from July to September in the North and June to October in the South.

The results lead us to conclude that environmental variables and fruit fly counts are different between the three regions most of the time, and that there is a relationship between temperature and fruit fly growth. This motivates us to explore different models of B. dorsalis and F. arianus dynamics using temperature for each region in Senegal.

Simulated Nitrogen Deposition and Drought Effects on Acer rubrum Tree Growth and Insect Herbivores

Author(s): **Molly Carlson**
Mentor(s): **Dr. Steve Frank**
Poster: **8**

Nitrogen deposition is known to be higher in urban environments when compared to rural environments and its ecological effects are not well studied. Studies have shown that nitrogen deposition on urban trees has increased tree foliar nitrogen content and causes drought stress. However, it is not well studied how nitrogen deposition influences insect herbivores or tree growth. Our goal was to examine the effects of simulated nitrogen deposition and water stress on tree performance and insect herbivore abundance and damage. We hypothesized that nitrogen deposition and water stress will affect tree performance and herbivore behavior. A common garden of 192 trees were randomized by three variables: genotype, water, and nitrogen. We included four red maple (Acer rubrum) genotypes: ‘October Glory’, ‘Sun Valley’, ‘Autumn Flame’, and wildtype. We measured water stress via water potential and confirmed treatment effectiveness with volumetric soil moisture. Tree basal area growth, herbivore abundance via beating sampling, and herbivore damage via surveys were compared across all three variables. Nitrogen deposition did not influence tree water stress. However, nitrogen deposition increased tree growth across all genotypes, with ‘October Glory’ having the highest growth rate. Painted Maple Aphids and Potato Leaf Hoppers abundance, as well as damage from Potato

Leaf Hoppers increased with the presence of nitrogen. Wildtype and 'October Glory' were determined to have the highest level of Potato Leaf Hopper damage, compared to 'Autumn Flame' and 'Sun Valley'. These results suggest that nitrogen deposition may affect herbivore abundance and damage in urban environments.

Can Biomaterials Outperform Certified Sustainable Products? A Life Cycle Comparison of Cladding Products

Author(s): **Ross Petersen**
Mentor(s): **Dr. Stephen Kelley**
Poster: **9**

The International Living Future Institute's Living Product Challenge (LPC) is designed to analyze and improve the sustainability of a manufactured product. While the LPC has certified metal and earth-based siding products, no wooden cladding has met certification requirements. Due to leaching concerns and other environmental risks associated with conventional chemical treatment of wood, heat treatment was determined to be the best option to create a wood siding that is more resistant to weathering and decay, while maintaining strength and durability. After confirming that heat treatment performs similarly to conventional chemical treatments, a life cycle assessment of three typical siding products was conducted. Heat treated wood cladding, LPC certified Aluminum sunshades, and PVC siding were all compared using a cradle-to-building with end-of-life (EOL) environmental LCA. While final results are still forthcoming, preliminary data suggests that the inherent renewable properties of biomaterials will overcome the sustainability practices of certified products, especially considering most imperatives for the Living Product Challenge focus on the administrative and operational aspects of manufacturing.

Land Owner Surveys on Hemp Growing

Author(s): **Andrea Casallas**
Mentor(s): **Dr. Zakiya Leggett**
Poster: **10**

Industrial hemp (Cannabis sativa) is an annual herbaceous flowering plant that has been utilized for its fiber, medicinal purposes, as well as for other industrial and consumer products. Data has been collected from Southern landowners who grow hemp to answer what type of industrial-hemp growing operation is most feasible and how much success it brought. Surveys were sent to extension offices in five different states and consisted of questions pertaining to the land owners' experiences and their future plans of growing hemp. The size of their operations ranged from less than 1 acre to over 15 acres. Some operations were also in a greenhouse/high tunnel setting or other forms. Overall there were no drastic

negative experiences reported on any type of hemp operation. With the exception of Kentucky, every state had over 40% of growers say “definitely yes” to growing hemp again. However, the success was not the best (average success rating was ~3 out of 5). Even with room for improvement when looking at success, every type of hemp growing operation had high feasibility of being grown again.

Overfishing

Author(s): **Anna Behnke & David Wagner**
Mentor(s): **Dr. Erin McKenney**
Poster: **11**

The impacts of overfishing on marine organisms are prevalent in every type of oceanic ecosystem. Furthermore, marine species that are not targeted for human consumption can experience indirect casualties, known as bycatch, from the fishing tactics used to retrieve the target organisms.Trawl nets are pulled behind boats to collect everything in their wake; long lines are cast behind ships to hook various species in deeper waters; and gill nets trap every species in a specific area. All of these forms of fishing can accidentally catch various marine mammals and ultimately drown. Oceanic organisms are already threatened by habitat loss, climate change, and pollution; but overfishing now accounts for additional large losses of these species. Fishing charters and organizations are having to move farther and farther away from the shore to deeper waters because of the decrease in fish populations elsewhere. When they fish in these deeper waters, they retrieve other species through bycatch that weren’t previously impacted by overfishing. As overfishing continues, our oceans’ biodiversity is critically damaged. Without ecosystem stability resulting in biodiversity, many oceanic markets such as fisheries and tourism will be greatly affected. In order to combat this, we propose the adoption of strategies similar to the “save the whales” movement, that aim to promote awareness through social media coverage. By doing this, we can effectively make strides toward maintaining much needed biodiversity without directly interfering with the companies and practices that contribute to overfishing.

Environmental and Social Justice

Author(s): **Ella Harlacher & Joel Beebe**
Mentor(s): **Dr. Erin McKenney**
Poster: **12**

Environmental Racism is the disproportionate construction of poisonous space for racialized groups in the United States. Low-income and racialized communities are statistically more likely to be negatively affected by industrial practices that harm the environment. We see this in industrial warehouse placements, that specifically target

areas with weaker political and financial power as sites for destructive dumping. Reinforcing these practices is atemporal rhetoric surrounding the space's value that reifies redlining practices and a lack of enforcement for existing regulations. We seek to define environmental injustice, oppose the system that supports it, and propose solutions that raise class consciousness. To accomplish this goal, we analyzed a diverse set of literature through an interdisciplinary lens to reveal the ways in which a hierarchical construction of space propagates harmful pollution into the environment. We aim to address the issues of societal perspective on environmental injustice, lack of governmental accountability, and the improper regulation of industrial practices. We propose this literature analysis as further support for environmental conservation by first addressing the underlying social and systemic issues that perpetuate environmental degradation. For example: public education is essential to opposing these problems; however, the education system itself has foundations of white privilege. This means that there needs to be a systemic change in the way we conduct education in order to enact a sustainable change in environmental justice.

Poaching and Pet Trade

Author(s): **Kaitlyn Keith & James Patterson**
Mentor(s): **Dr. Erin McKenney**
Poster: **13**

One of the most common questions that is asked when meeting a new person is if they have a pet; the question that is rarely ever asked is where the pet came from or if the species is at any risk of endangerment. Although the pet trade and poaching is a topic that has been discussed for many years, there has been minimal action taken to prevent the native species in some habitats from being poached or sold illegally in the pet trade. The goal of this project is to show how awareness of these practices and legislation can protect the species that are endangered by the pet trade and poaching. To accomplish this goal, we conducted a literature review to identify ways to increase awareness of several cases in which the pet trade and poaching have resulted in the endangerment of species such as turtles and red wolves. We propose to disseminate the information further through public speaking events. We believe the new awareness achieved by these public events would motivate constituents to call for legislators to enact protective policies.

The Damage to Biodiversity by Habitat Fragmentation

Author(s): **Rhianna Klewin & Connor Pogue**
Mentor(s): **Dr. Erin McKenney**
Poster: **14**

Spacial alteration and disruption of habitat are known to have a deleterious impact on global biodiversity by reducing gene flow and severely altering community structures, natural cycles, and ecosystem health, functionality, and stability. Habitat loss has increased exponentially since the industrial revolution and occurs throughout the world as a result of development and urban expansion, which fragments and destroys habitat for anthropogenic use. Habitat corridors connecting larger/intact natural spaces have been shown to remedy some of the deleterious effects of habitat fragmentation, but there is little research on their effectiveness. Our goals with this project are to determine how effective establishing and retaining corridors between large patches of preserved habitat is against the negative impacts of habitat disruption, and to identify other steps that can be taken to reduce the impacts of fragmentation. To accomplish these goals, we conducted an extensive literature review to examine corridor effectiveness across taxa and explore potential alternative solutions. We suspect that increasing connectivity between natural spaces will alleviate pressures caused by fragmentation by encouraging gene flow and allowing migration between different types of habitats. Identifying steps to preserve global biodiversity despite an ever-growing human population is imperative to ensure mutual survival.

Human Effects on Shorebirds in North Carolina

Author(s): **Grace Sigmon & Claire Sholar**
Mentor(s): **Dr. Erin McKenney**
Poster: **15**

Shorebirds are a common and attractive sight on the coast, but their nests in the sand often go unnoticed. While conservation organizations help raise awareness by marking shorebird nests with bright flags, unseen nests are in danger of disruptive human activities, including off-road driving on beaches, other recreational activity, and urban development. The coasts of North Carolina are extremely important nesting sites for multiple species of ground-nesting shorebirds, such as the American oystercatcher (Haematopus palliatus), piping plover (Charadrius melodus) and Least terns (Sternula antillarum). Several anthropogenic hazards are documented as directly affecting shorebird reproductive success. In addition, indirect effects such as landscape disturbances impact the general wellness of shorebirds' habitat and their invertebrate prey. The goal of this project is to identify the most significant risks that shorebirds face in order to better inform conservation

efforts. To accomplish this goal, we conducted an extensive review of published research studies that presented potential threats to shorebirds and measured their physiological responses to the presence of human activity. Even though the greatest threat to shorebirds is currently predation, we hypothesize that anthropogenic activity will continue to increase and thus presents a greater risk to shorebird reproductive success. The conservation of shorebirds and their habitats is critical to protect declining shorebird populations worldwide, in the face of anthropogenic threats.

NC Coastal Communities and their Response to Coastal Erosion

Author(s): **Alexiah Thompson & Helena Jolly**
Mentor(s): **Dr. Erin McKenney**
Poster: **16**

Over the past century, our planet has experienced a global rise in temperatures, and as a result coastal regions have experienced many hardships. Sea level rise has resulted in many issues such as flooding, coastal erosion, saltwater intrusion and the formation of ghost forests. Saltwater intrusion is the central cause of ghost forests because it harms many species of plants that are intolerable to saltwater intrusion.These issues are persistent and will increasingly affect coastal regions in the future as global temperatures and sea levels continue to rise; but coastal wetlands are extremely important for sequestering carbon, protecting them is therefore crucial in our efforts to prevent further climate change. As sea level rise reduces available land for agriculture and the local ecotourism industry, communities must consider methods to mitigate saltwater intrusion. The goal of our project is to examine mitigation strategies, explore their effectiveness, and propose new approaches to dilute the consequences of sea level rise. To accomplish this goal, we investigated advanced technologies that have been used to identify threats to coastal ecosystems and monitor mitigation efforts. Through an extensive literature review, we found that living structures such as trees and vegetation have been highly effective in reducing the effects of saltwater intrusion in surrounding regions.

Invasive Species Effects and Management Proposals

Author(s): **Mary Grace Ussary & Trey Kaufman**
Mentor(s): **Dr. Erin McKenney**
Poster: **17**

Did you know that your adorable 10 inch Burmese Python pet could grow to over 20 feet long if released to the wild? These pythons are just one of a myriad of other invasive species destroying ecosystems across the world. In addition to the global

trouble these species have caused, their harm can be seen locally as well. North Carolina is increasingly plagued by invasive organisms, ranging from feral hogs in the western mountains, to lionfish along the coast. These and other invasive species have wreaked a lot of havoc upon local ecosystems, acted as vectors for zoonotic illness, and caused billions of dollars worth of damage to forestry and agricultural industries. As such, many proposals to manage invasive species have been presented, including acoustic sensors to check grain shipments for pests, culling individuals to reduce population growth, and genetic editing to sterilize insect populations. Coinciding with this, public policy has also been shaped to both prevent future invasive introductions, and to eradicate harmful new populations. After reviewing these publications and policies, we have formulated a set of potential solutions which can be employed by both legislators and conservationists in North Carolina to combat local invasive species.

Climate Change

Author(s): **Hongtu Yang & CJ Dierking**
Mentor(s): **Dr. Erin McKenney**
Poster: **18**

Climate change is altering ecosystem dynamics across the globe and is being driven by anthropogenic forces. Currently, we understand that the accumulation of greenhouse gasses in the atmosphere is affecting global temperatures unevenly, disrupting precipitation patterns, and introducing frequent and unpredictable extreme weather events, which all alter and disrupt species ranges. These effects hasten the extinction of specialist and endemic species, negatively impacting biodiversity, ecosystem function, and ecosystem services. However, research regarding climate change's impact on the relationship between humans and surrounding ecosystems is not thoroughly understood. This project aims to take a closer look at how climate change will impact ecosystems and how those changes will, in turn, affect human activities and populations. We performed an extensive literature review to investigate how climate change is widely affecting disease, plants, and animals, including humans. We propose that climate change will significantly affect human life and entire ecosystems due to changes in species ranges, temperature gradients, air quality, and pathogen transmission. This is relevant to research in conservation since conservation science, by its very nature, is concerned with humans' relationship to the environment and other species. As climate change brings negative stressors to the earth, human responses to the perils of a variety of species must adapt, and the threats facing humanity itself must be addressed as well.

The Effects of Biodiversity Loss

Author(s): **Caitlin Phipps & Dylan Hawkins**
Mentor(s): **Dr. David Zaharoff**
Poster: **19**

In 2020, conservationists estimated that thousands of species are faced with extinction. While the true number is unknown, it is likely much higher; and this number continues to rise due to anthropogenic impacts on the environment. This causes some scientists to suggest that we are heading towards a sixth mass extinction event involving over 75% of species. Despite these grim statistics, previous mass extinctions have been caused by catastrophic events such as volcano eruptions, meteor strikes, and rapid ocean acidification, events far outside of our control. Fortunately, the current trends of climate change have been mostly caused by humans and remain within our ability to repair through the implementation of protected areas, captive breeding/ reintroduction, and comprehensive legislation. In order to have a better understanding of effective strategies to mitigate biodiversity loss, we have conducted an extensive literature review to examine this from diverse perspectives. Strategies that have proven to be effective include extensive policy protection and reforestation. In the last decade alone, nearly 30 species of birds and mammals have been saved from the brink of extinction. With additional public efforts and integrated policies, we hope future conservation efforts will prevent additional extinctions and preserve millions of years of evolutionary history.

Bigger is Not Always Better: Analysis of the Link Between Agritourism Microentreprenurs and an Increased Adoption of Sustainable Agriculture Practices

Author(s): **Kailee Spake**
Mentor(s): **Dr. Duarte Morais**
Poster: **20**

The ever-growing human population is placing an increasing strain on the food systems in place and in turn the environment to provide nutrient-rich foods for the global population. Small-scale farming is often considered a model capable of supporting local food systems sustainably and resiliently. Likewise, there is evidence of a link between involvement in tourism microentrepreneurship and the adoption of sustainable agriculture practices as well as stewardship of working lands on small-scale farms. Minimal research on this link has been completed in the United States, where agriculture revenues have been in the tens of billions to hundreds of billions for decades. This study aims to understand the link between agricultural

tourism and sustainable farming techniques used on small-scale farms in the USA. Through the in-depth analysis of both quantitative and qualitative data collected from the NC Agribusiness and Tourism Survey (NCATS) (March 2022) as well as the consideration of responses from in-person interviews following P1T labs interview protocol and mixed-method photo-elicitation guided discussions with qualifying participants, the following questions will be addressed: What kind of sustainable agriculture practices are used by farmers involved in tourism microentrepreneurship? RQ2) In what ways are farmers sharing their environmentally sustainable agriculture practices with visitors? RQ3) To what extent is farmers' involvement in agritourism microentrepreneurship influencing their adoption of sustainable agriculture practices? Contrary to what conventional agricultural practices may suggest, my findings indicate that the link between land stewardship, involvement in tourism microentrepreneurship, and the adoption of sustainable agriculture practices is supported.

Screening of Groundwater in Wake County for Private Well Users

Author(s): **Holly Walsh**
Mentor(s): **Dr. Elizabeth Nichols**
Poster: **21**

Every five years it is recommended that private well users in Wake County test their groundwater for 53 possible organic chemicals, and it can be frustrating for these individuals to select which chemicals to measure. Currently, the county department of human health services often do not know what specific analytical methods to recommend to private well users to test their well water for regulated organic contaminants. Therefore, there is a gap in water quality information for private well users. My project will contribute to an existing collaboration between Wake County and NC State (PI Nichols) to assess the presence of thousands of organic chemicals and assist with recommendations for groundwater quality analyses to private well users. I will travel and collect 10 groundwater samples from private well users in Wake County to which I will analyze by high resolution mass spectrometry (HRMS). HRMS is more sensitive than current mass spectrometry configurations in current USEPA methods (Figure 1) and it detects thousands of organic chemicals and tens of USEPA ToxCast chemicals in groundwater samples compared to the USEPA methods. After a complete HRMS analysis, I will report on the number of tentatively-identified chemicals (TICs) that are matched as USEPA ToxCast chemicals and which of these chemicals are currently regulated under the Safe Drinking Water Act. I will evaluate my findings in context to recent analyses of groundwater from NCDEQ's groundwater monitoring network.

How Augmented reality impacts Task Performance, Error Frequency, and Workload amongst nurses in the ICU

Author(s): **Imani Bynum**
Mentor(s): **Dr. Anne McLaughlin**
Poster: **22**

In a fast-paced, safety-critical environment such as the hospital ICU, health care workers must use much of their cognitive abilities to perform their tasks properly. Previous studies found that designing technology tailored to those individual cognitive abilities can reduce common mistakes. The purpose of this study is to understand how cognitive support in the form of augmented reality (AR) reduces errors and perceived workload and reduces differences in individual performance. The study will consist of forty-two nurses from the Emory System in Atlanta who will have at least three years of experience as ICU nurses. The nurses will experience two forms of AR support aid. The anticipated results are that the participants who scored high on the ADHD scale will commit more errors during the experiment compared to those who scored low, but receive more benefit from the AR cognitive support technology.

Daily Mindfulness and Memory Failures Depend on Depression

Author(s): **Mike Ni**
Mentor(s): **Dr. Shevaun Neupert**
Poster: **23**

Memory failures occur everyday for individuals throughout the world affecting everyday life ranging from misplacing an item to remembering to take medication. Some of these memory failures are the result of failing to pay attention, which can be related to mindfulness, or the ability to stay focused in the present moment. The purpose of this study was to examine how depression affects the relationship between daily mindfulness and memory failures. Participants were 107 younger (age 18-36) and 117 older (age 60-90) adults who reported on their daily mindfulness and memory failures each day for 8 consecutive days. Participants reported their depressive symptoms on the first day of the study. On days when people experienced decreases in mindfulness, they also experienced increases in memory failures. Importantly, this effect was especially pronounced for people with high levels of depression, relative to low levels of depression. Efforts to boost mindfulness may be the most important for those who also experience high levels of depression.

Computational Studies on Zermelo's Navigation Problem: Preliminary Results

Author(s): **Madhusudan Madhavan**
Mentor(s): **Dr. Alen Alexandrian**
Poster: **24**

Zermelo's Navigation Problem has been a relatively recent but important problem in the field of optimal control. An intriguing aspect of this problem is its broad applicability to various physical fields, such as navigation in quantum fields and three-dimensional obstacle avoidance, along with its seemingly straightforward underlying concept [1, 3]. In this paper, we examine modifications of Zermelo's Navigation Problem for an aircraft in a nonlinear wind-field, computationally solve the relevant optimal control problem, and analyze the preliminary impact of parameters on the optimal trajectory. Particularly, we focus on both sinusoidal and real-world wind fields in a maximum-range formulation that incorporates a form of drag and limited acceleration. To enable computational studies, we discretize the optimal control problem and apply unconstrained optimization routines to the multi-variable system in MATLAB. We then examine the solutions for the analytic wind field with perturbed model parameters, such as final time and initial velocity.

New Approach to 2 x 2 Tables

Author(s): **Shannon Ari**
Mentor(s): **Dr. Dennis Boos**
Poster: **25**

A Monte Carlo simulation project was conducted to produce new results for 2 by 2 tables. Using data that are multinomial, the standard unconditional multinomial approach was tested against a conditional binomial approach. The Monte Carlo simulations were run using 1000 independent data sets of size 20 and size 50. Row probabilites of 0.5 and 0.7 were generated and the true difference in proportions included were 0, 0.2, 0.4, and 0.6.For each data set, Fisher's Exact Test, the Multinomial, and the Binomial approach were used in the one-sided and two-sided scenarios. Furthermore, these tests were done using both the Z and the Boschloo methods. Confidence intervals were also constructed, with analysis done on their length and coverage probability. By conditioning on the row totals, the analysis focuses on the parameter of interest and produces exact tests and confidence intervals for that parameter. In addition, the new approach of using the binomial provides a computing advantage as the test maximizes over one nuisance parameter rather than two with the multinomial approach. Finally, the new approach has shown to be more powerful for certain one-sided tests. These findings are important for statistical analysis of 2 x 2 tables and might provide a better method for inference.

The All or Nothing Effect

Author(s): **Sydney Jordan**
Mentor(s): **Dr. Kimberly Bush**
Poster: **26**

Ninety- eight percent of college athletes will not advance to the professional level and will be left to find a different career path besides playing their desired sport. According to the NCAA database (2021), 48% of division 1 football players are African American. Additionally of that 48% of Black football players, based on trends from 2018, it is estimated that only 51% will graduate. There is an overarching need for proactive measures to ensure the success of young black athletes while attending the university. The purpose of this research project was to gain a better understanding of the experiences and needs of black male Football Players at a Division I University in the United States. Interviews were conducted with current and former division I black male football players and administrators via Zoom. Each interview lasted approximately 30-45 minutes long and were transcribed verbatim. The interview script was divided into three sections: childhood narratives, college classroom experience and an overall reflection. Several themes have emerged in analyzing preliminary data including: accountability, post grad identity crisis, relationship building, etc.All of these themes have led to the overall recommendation of revising aspects of current programing to better cater to the needs of Black male football players. Findings from this study can contribute to the literature to aid administrators, coaches, and support staff in providing more meaningful and effective programming specifically for black male division 1 football student athletes both in the classroom and also with post graduation success.

An investigation into the scent-marking behavior of captive blue-eyed back and crowned lemurs at the Duke Lemur Center

Author(s): **Michael Shea**
Mentor(s): **Dr. Tara Clarke**
Poster: **27**

Lemurs are known to be one of the most conspicuous scent-marking groups of animals. Several studies have shown that olfactory communication is a critical part of their sophisticated social systems. While species like the ring-tailed lemur (Lemur catta) have been extensively studied with regards to olfaction, other species of lemurs remain underrepresented. Therefore, this study focused on two species of Eulemur housed at the Duke Lemur Center, Durham, N.C.; the Endangered crowned lemur (E. coronatus) and the Critically Endangered blue-eyed black lemur (E. flavifrons). Our study sought to examine the various scent-marking behaviors in these two female dominant, group-living species. To investigate scent marking behaviors, we employed instantaneous scan sampling at 30-second intervals for 45 minutes per group (n-11) for a total of 42 hours. Three types of scent glands were

examined (anogenital, head, and wrist) in tandem with various deposition locations such as climbing frames, enclosure gratings, etc. Results reveal that E. flavifrons scent-marked more frequently than E. coronatus. Male E. coronatus scent-marked more frequently than their female conspecifics. In contrast, we found no difference in the amount of scent-marking behavior between male and female E. flavifrons. Further understanding of the olfactory communication and scent-marking in the genus Eulemur is important for gaining more insight into the scent-mark's functional significance as well as behavioral patterns associated with them.

Negative Effects of ACEs on Memory Performance

Author(s): **Diana Leyva, & Rebekah Knight,**
Mentor(s): **Dr. Daniel Gruehn**
Poster: **28**

Childhood experiences impact our development as adults, with 1 in 6 adults having experienced 4 or more types of aversive childhood experiences (ACES), such as abuse and neglect (CDC, 2019). Associations between sexual abuse or physical neglect in childhood may be associated with poor memory performance (Majer et al, 2010), while other studies show that child maltreatment may contribute to risky sexual behaviors in men, more so than women (Brown et al., 2015; Negriff et al., 2015). The purpose of this study was to examine the effects of ACEs on memory performance, specifically sexual abuse. Data was obtained from the Behavioral Risk Factor Surveillance System (BRFSS; August 2021). We expected positive associations between sexual abuse and neglect as negative impacts of ACES affecting men more than women.
As predicted, results indicate that ACE sexual abuse scores are significantly correlated with confusion and memory loss occurrences ($r = .082$, $p < .05$), as well as requiring assistance with day to day activities ($r = -.082$, $p < .05$); Results also suggest this relationship may be stronger in female respondents, ($M = 5.21$, $SD = 4.89$) and a significant predictor of confusion and memory loss ($M = 1.24$, $SD = 1.17$), $F(1,603) = 4.05$, $p < .05$. Future research may benefit from investigating the later coping strategies that are associated, which could explain gender disparities in critical thinking skills from negative ACEs experiences.

Examining the link between working memory and eating habits

Author(s): **Carl Tunehag, & Rebekah Knights**
Mentor(s): **Dr. Duarte Morais**
Poster: **29**

Patients with dementia often show significant changes and difficulty maintaining their eating habits: up to 85% may be malnourished or undernourished (Cipriani et al., 2016). Similarly, research has shown that impairments in both working and episodic memory are associated with difficulty controlling appetite and weight

management (Higgs & Spetter, 2018). We investigated the relationship between working memory and eating behavior using secondary data (Babayan et al., 2018). Those who struggled more with controlling their eating behavior as well as experienced more disturbing hunger feelings performed worse on working memory tasks ($F(2,218) = 6.03$, $p = .003$). We will also investigate if age impacts the strength of this relationship; as we know that there is a relationship between age and these hunger feelings (control: $r = -.301$, $p < .001$); (hunger feelings: $r = -.457$, $p < .001$) as well as between age and working memory performance ($r = -.388$, $p < .001$). Results so far suggest support for the hypothesis that positive eating behavior predicts more accurate working memory.

A Holistic Review of PRessing Issues, Coping Strategies, and Resources Available to Collegiate Athletes

Author(s): **Elijah Kormanek, Logan Yokeley, & Agatha Mitchem**
Mentor(s): **Dr. KangJae Lee**
Poster: **30**

The purpose of this study is to conduct a holistic literature review on (1) the existing common struggles of collegiate student-athletes and (2) various coping strategies and resources available for alleviating their mental health issues. The well-being of student-athletes has been a major issue in sport management, and it has received more attention during the COVID19 pandemic. First, using scholarly article databases, each author reviewed the literature on the common struggles, existing coping strategies, and resources to assist student-athletes, respectively. Second, an email interview was conducted with a university athletic department to gain insights into current programs and resources to help student-athletes. The results from our review showed that common struggles include both physical and mental afflictions such as anxiety, depression, food insecurity, and sleep deprivation. The review also identified existing coping strategies and resources including finding emotional support, creating a healthy sleep schedule, decreasing screen time, and use of university provided resources. Moreover, the interview data shows that counseling services have been offered to student-athletes to help them deal with common stressors. These findings indicate that the majority of previous studies focused on depression and anxiety, yet we argue that food insecurity and sleep deprivation have received relatively limited attention despite being serious issues. The findings are summarized in a table format, and it might serve as a useful resource for universities and their athletic departments. Our information shows a lack of resources available to athletes compared to demand, and that healthy coping strategies should be utilized more often.

How We Perceive and Trust Advice from Virtual Humans: The Influence of Voice Quality

Author(s): **Tara Ferrell**
Mentor(s): **Dr. Christopher Mayhorn**
Poster: **31**

Due to the increase in virtual humans as a pedagogical agent this study investigates how perceptions of virtual humans are affected by voice quality in understanding a budgeting scenario where trust is essential to learning and application. Eighty-six participants were randomly assigned to three conditions where voice quality for a virtual human varied (human voice, low quality text-to-speech, high quality text-to-speech) when narrating a financial literacy course. Measures of trust and course comprehension were collected. Results of the learning assessment suggest no difference in comprehension based on voice quality of a virtual human. No differences were observed between the voice quality groups in participants' perception of trust, the abilities to facilitate learning, credibility of the agent, human-likeness of the agent, or how engaging the agent was. This is possibly due to the lower age demographic who have become increasingly exposed to virtual human voices through popular platforms such as Tik-Tok.

Planned Behavior Barriers and Motivations in Diabetic Retinopathy Eye Screening

Author(s): **Trevor Patten & Ebernoe Guzman-Bonilla**
Mentor(s): **Dr. Anne McLaughlin**
Poster: **32**

Objective: Identify and understand barriers and facilitators for diabetic retinopathy eye screening.

Background: Diabetic Retinopathy (DR) is the leading cause of blindness in adults in the U.S. DR is asymptomatic until later stages becoming Vision-Threatening Diabetic Retinopathy (VTDR). Participation in annual VTDR eye screenings remains low despite treatment showing 95% effectiveness in halting progressive vision loss.

Methods: Data gathered via concept-elicitation interviews from 90 participants at high risk of VTDR will be organized using the Integrated Behavior Model (IBM) to establish the impact of attitudes, perceived norms, personal agency, knowledge and skills, behavior salience, environmental constraints, and habits on patients' screening participation. Data will also be evaluated across three different insurance types.

Expected Results: We expect to gain a comprehensive understanding of the potential barriers and facilitators to diabetic eye screening to understand the way in which highest-risk patients can be engaged to increase screening for VTDR.

Conclusion: The results from these interviews will be a full understanding of the potential barriers and facilitators for diabetic eye screening, specifically for those at high risk of VTDR using the IDM. While barriers and facilitators to diabetic eye screening have been studied before, to the best of our knowledge no studies have focused exclusively on those at highest risk or situated the elicitation using the IBM.
Application: From this research, we will use IBM to construct a larger survey, which will help us create effective interventions for persons at high risk of VTDR.

Evaluation of the Endorsement of Gender Stereotypes in the Perception of Scientists in College Students

Author(s): **Sowmika Vaka, Fiona Presetemon, & Ansley Jewell**
Mentor(s): **Dr. Duarte Morais**
Poster: **33**

Studies show that the endorsement of gender stereotypes and representation plays an important role in the development of youths' attitudes towards STEM fields and interest in pursuing STEM careers (Miller et al., 2018). However, there is limited research on the endorsement of STEM-related gender stereotypes in college students. In order to examine the factors associated with these stereotypes, we conducted a study with 544 college students, aged 18-37 (Mage= 19.08, 57.8% female). Participants were given an online survey that assessed their STEM gender stereotype endorsement and they were tasked with designing an avatar of a scientist. Next, we collected the participants' demographic information and their majors. We examined how participants' gender and endorsement of STEM stereotypes correlate to the scientist they were tasked to create. Next, we ran a logistic regression, and results showed that participants who believe that girls should do well in STEM are more likely to develop a female scientist, and participants who believe boys should do well in STEM are less likely to develop a female scientist. Our research implies that beliefs about women's efficacy in STEM plays an important role in the perception of scientists. The endorsement of gender stereotypes is a powerful influence on gender diversity in STEM majors. Therefore, it is vital to address gender stereotypes in young adults today, both within and outside of STEM subjects.

Resilience Following Traumatic Loss: Daily Uplifts Buffer the Negative Consequences of Losing Loved Ones

Author(s): **Alexandra Early**
Mentor(s): **Dr. Shevan Neupert**
Poster: **34**

Feelings of grief associated with a traumatic event are known to have a substantial impact on one's physical and psychological well-being. The death of a loved one is a particularly common traumatic event that influences people's functioning on a daily level. Evaluating everyday occurrences such as uplifting events (which serve as

sources of peace, satisfaction, or joy) and perceived positive awareness of age-related changes (AARC gains) could shed light on coping mechanisms and resilience processes. We explored how the death of a loved one interacted with uplifting events to predict daily AARC gains.

For this study, 440 participants from the United States aged 50 to 85 (M = 63) were recruited through the online platform Lucid. Participants completed a total of 2,789 daily diary questionnaires over 14 consecutive days from February 2nd 2022 to February 15th 2022 that inquired about subjective aging, health, and daily functioning. Our results suggest that participation in uplifting events are especially beneficial for increases in daily AARC gains for those who experienced the death of three or more loved ones. Additionally, uplifting events were consistently positive across life events. These findings indicate that simple efforts on a daily basis have a considerable impact on an individual's life and their resilience in the wake of other potential traumatic events.

Daily Physical Health and Control Beliefs Predict Subjective Age in Adults

Author(s): **Samuel Macy**
Mentor(s): **Dr. Shevan Neupert**
Poster: **35**

In recent years, there has been an abundance of resources offering ways to feel better. From self-help books to fad diets and motivational speakers, information on easy ways to feel better is ubiquitous. It is against this backdrop that social scientists work to unearth research-supported well-being strategies. The present study sought to examine the effects of daily perceived control and daily physical symptoms on participants' daily felt age, given that feeling younger than one's actual age is a positive factor of well-being for most adults. Data were collected in the form of a 9-day daily diary study assessing daily control beliefs, physical symptoms, and subjective age. 107 younger (aged 18-36) and 116 older (aged 60-90) participants were recruited by Amazon's Mechanical Turk (mTurk) in 2016. Results from multilevel models indicated that on days when people experienced an increase in physical health symptoms, they also felt older. In addition, on days when people experienced decreases in their perceptions of control they also felt older. Importantly, the effects of daily physical symptoms and control were synergistic; on days with no physical symptoms, people reported feeling younger than their chronological age if they also experienced an increase in perceptions of control. These results suggest that daily changes in physical health along with daily changes in perceptions of control work together to form subjective aging experiences among older adults.

Childhood Trauma and Perceptions of Control Later in Life

Author(s): **Amanda I. McIntyre**
Mentor(s): **Dr. Shevan Neupert**
Poster: **36**

We examined the potential enduring effects of early life trauma on later life perceptions of control, which are important for achieving meaningful goals. Data were collected from 806 adults across the U.S. ranging in age from 18 to 77. Participants reported their Adverse Childhood Experiences (ACE) which asked about traumatic events that occurred prior to age 18. Participants also reported on their current perceptions of control over their lives. We ran a multiple regression analysis to determine the predictive utility of adverse childhood events on current perceptions of control. Following prior conventions, we conceptualized scores of four or more ACEs as high exposure and three or below as low exposure. To test for differential effects of ACEs on control beliefs based on age, we tested an interaction between ACEs and age. We found a significant main effect where people with high ACEs reported lower control. The ACEs x Age interaction was significant and suggested that younger people had a stronger relationship between ACEs and control than older adults. That is, high ACEs were not as detrimental to perceived control for older adults compared to younger adults. These results provide evidence that reducing stigma and receiving help surrounding traumatic childhood experiences could be very beneficial, as the effects of these events can persist into adulthood. Providing support to further enhance the increased resiliency demonstrated in later adulthood could also be beneficial.

Daily Physical Activities and Stressors Predicting Daily Physical Health

Author(s): **Peyton Williamson**
Mentor(s): **Dr. Shevan Neupert**
Poster: **37**

In everyday life, the majority of people are faced with stressors; big or small, good or bad. Too much stress can be extremely harmful for one's body, potentially leading to health complications such as high blood pressure, heart disease, amongst others. Physical exercise is an activity with significant health benefits and can be of aid by stimulating the production of endorphins. In this study, we examined the effect of any type of physical activity on the relationship between daily stressors and physical health. With the study being composed of 223 individuals, ranging from 18 to 90 years old, we collected our data in the form of an 8-day daily diary study, assessing the type of activity being achieved, stress levels, and physical symptoms they experienced each day. Our results revealed that increases in daily stressors are associated with increases in daily physical health symptoms, and this effect was especially pronounced on days when people also engaged in high levels of physical activity. These results were determined to be robust, after controlling for the

obligatory nature of one's physical activities, along with their level of education. With this in mind, it can be concluded that not all physical activity can be good for you at all times, and that one must be in tune with their mind and body, allowing for rest and recovery when it is needed in order to reap its full benefits.

Father Communication About Sexual Risks and Protection Related to Sexual Health Outcomes in Adolescents

Author(s): **Megan Armstrong**
Mentor(s): **Dr. Laura Widman**
Poster: **38**

Parent-child communication about sex is important to shape sexual experiences and decision-making in adolescence. This is particularly true in regards to sexual risk behaviors related to disease and contraception. A majority of the research related to parent-child sex communication is focused on mothers, leaving a gap in research regarding father-child communication.

Participants were 403 adolescents who had a father or male caregiver. Participants were ages 13-19 from the southeast U.S. (Mage = 15.06; 35% White, 33% Latinx, 25% Black; 58% girls, 41% boys). Participants self-reported frequency of communication about sexual risks and protection with fathers and with partners. They completed validated scale assessments of attitudes and self-efficacy for condom use and partner communication.

Of the participants with a father figure, only 34.5% had ever talked with their father about sexual risk or protection. There was a negative correlation between father communication and condom attitudes ($r=-.134$, $p<.01$), and a positive correlation between father communication and communication with a partner about risk or protection ($r=.195$, $p<.01$). For boys, there was a positive correlation between communication with fathers and sexual self-efficacy ($r= .16$, $p<.05$).

The results suggest that more communication with fathers about risk and protection is associated with more negative condom attitudes. This highlights a need to understand the conversations that fathers are having with their children about risks and protection related to sex. Future research should work to educate fathers on sexual health topics and equip them with knowledge to communicate with their children.

Barriers To Child-Parent Sexual Communication: “My child is too young”

Author(s): **Lily Mullins, Carina Becker, & Megan Armstrong**
Mentor(s): **Dr. Laura Widman**
Poster: **39**

While many (≈80%) parents report talking to their kids about sex, these conversations vary in quality and frequency. With an increased risk of negative sexual outcomes for adolescents, we sought to explore barriers to parents discussing the risks and positive aspects of sex. We specifically looked into the barrier of child age since many parents express that their children are too young to discuss sex, but many teens start exploring their sexuality by age 13 or younger. For this study, 880 parents (M age=40.9, SD=6.9) completed an online survey through MTurk. All parents had a child aged 13-17 (M age=14.7, SD=1.4). Parents were asked the likelihood of discussing the positive and negative aspects of sex with their child. 325 (36.9%) parents reported a low likelihood that they’d talk with their kids in the next year about the risks and benefits of sex. Those parents were asked to identify the barriers to communication from 10 options. 34.5% (112) of those parents reported: “my child is too young.” On average, parents who believed their child was too young to have these conversations had younger teens (M age=13.9), compared to parents who didn’t believe their child was too young (M age=15.2), ($t=9.29(323)$, $p<.001$). However, we got the response of “my child is too young” from parents with teens in all age ranges. While parents who identified their child’s age as a barrier to sexual communication did have younger children, these conversations should be started early and occur regularly.

The Correlation Between Self-Worth and Delinquent Activity in Adolescent Girls

Author(s): **Anjali Singh**
Mentor(s): **Dr. Laura Widman**
Poster: **40**

Studying adolescent delinquent behavior can aid us in understanding a child’s future and predicting their view of themself. Data collected can be used to create resources for adolescents through their developmental period. This study will explore the relationship between self-worth and delinquent behavior. Delinquent activities can be fueled by an adolescent's view of themselves and as they grow up their view of themselves could alter their future. Students that don’t take part in delinquent behavior are also more likely to excel academically which is seen as a necessity in our society. Self-worth also correlates with mental health which is why this research is important. We hypothesize that students with lower self-worth will take part in more delinquent behavior.

The data collected was from 222 tenth-grade girls (mean age=15.2; 38% White, 29% Hispanic, 25% Black) who were part of a larger study in Fall 2015. We used the 9-item Flourishing Scale (Diener et al., 2009) to assess well-being and the 13-item Delinquency Scale (Browning et al., 1999) to assess delinquency. We re-coded delinquency into 0=0 acts, 1=1 act, or 2=2 or more acts. Thirty-two percent of girls engaged in at least one act of delinquency. As predicted, we found a significant negative correlation between self-worth and delinquent activity (r = -.17, p = .013). Further research should examine the relationship between self-worth and delinquency in more diverse samples of male and non-binary adolescents."

The Effect of Density Clumps on the Accretion Process in High Mass X-ray Binaries

Author(s): **Keanan Scarbro**
Mentor(s): **Dr. John Blondin**
Poster: **41**

Supergiant high mass X-ray binaries (SgHMXBs) are binary star systems composed of a massive O/B-type star and an orbiting compact companion, either a neutron star or a black hole. The massive star sheds mass through radiation-driving, and part of this stellar outflow is captured gravitationally by the compact object. Some of this captured mass is accreted onto the compact object, resulting in X-ray emission. Observations of X-ray luminosities in SgHMXBs contrast with theoretical values assuming a smooth stellar wind. The large variation in X-ray flux observed could partly be explained by assuming an inhomogeneous (clumpy) stellar outflow. We use 3D hydrodynamics simulations of an inhomogeneous stellar wind to evaluate the effect that density clumps would have on the accretion process of the compact object. To further examine X-ray variability, we analyze the effect of this inhomogeneous outflow on the accretor for three different accretion regimes. Lastly, we compare our results to observational X-ray flux data of the archetypal SgHMXB Vela X-1.

The Effect of Wind peed and Roche Lobe Geometries on the Wind Dynamics of Vela X-1

Author(s): **Anna Taylor**
Mentor(s): **Dr. John Blondin**
Poster: **42**

I present three-dimensional hydrodynamic simulations of the circumstellar gas flow in the High-Mass X-Ray Binary Vela X-1 to investigate the

gravitational capture of the donor star's wind and subsequent accretion onto the neutron star companion. Vela X-1 is a binary system with a supergiant companion star and a neutron star. Mass transfer to the neutron star proceeds through the capture of this stellar wind directly onto the compact object. In this accretion model, a supersonic flow is deflected by the gravitational field of a point mass, and a dense tail is formed in its wake. The mass accretion rate turns out to be extremely sensitive to the relative speed of the flow with respect to the accretor, therefore, the wind and orbital speed of the system significantly impacts the dynamics of the wind. I use these simulations to investigate the impact of the varying wind speed and geometries on the gas dynamics. I analyze the mass flux and angular momentum to see where the wind is coming from and see which parameters produce accretion discs on the compact star. I present visualizations of the different simulations of Vela X-1, along with a graphical analysis of variables that show the effect of the changing wind speed and Roche lobe geometries on the wind dynamics.

Plasticizing Chitosan in ORder to Melt Electrospin Chitosan-Based Fibers

Author(s): **Samuel Thornton**
Mentor(s): **Dr. Tara Clarke**
Poster: **43**

In order to combat climate change, it is necessary to reduce use of commercial thermoplastics which require fossil fuels. Water filtration systems commonly use commercial thermoplastic fibers, so we wish to find green alternatives for fiber-forming materials in water filtration. The abundant biopolymer chitosan, found in the shells of crustaceans, has unique absorption and anti-microbial properties which make it a desirable candidate for this purpose. Electrospinning is a common practice for creating advantageously small fibers from polymer solutions and melts; however, previous research has indicated chitosan is difficult to solution electrospin, and furthermore chitosan degrades before it melts. Thus, the goal of this project is to plasticize chitosan by the addition of plasticizing agents in order to create a viable melt (or solution) to electrospin chitosan-based fibers. The main challenge of chitosan is that it is both highly viscous and highly conductive. Our lab has previously addressed high viscosity and high conductivity separately in electrospinning, but the combination of the two has not been extensively explored. A mock solution of the polymer polyethylene oxide (PEO) with varying polymer concentration (to tune viscosity) and ionic salt (to enhance conductivity) was created to understand the limit of high viscosity and high conductivity in electrospinning. Data is

presented on the effects the plasticizer glycerol on chitosan and the limits of high viscosity and conductivity in mock PEO solution and chitosan electrospinning.

Modeling Exciton Diffusion in Organic Solar Cells using Stochastic Partial Differential Equations

Author(s): **Aidan Kelly**
Mentor(s): **Dr. Daniel Dougherty**
Poster: **44**

Advancements in Power Conversion Efficiency (PCE) of Organic Solar Cells (OSC) have inspired research into Exciton Diffusion in OSCs'. An exciton is generated by incident photons on an OSC. The photons cause an electron to be excited within one of the molecules in the OSC and the absence of this electron creates a "hole" in the ground state. This combination of the electron and hole pair bound by their mutual Coulomb attraction is known as an exciton. Once an exciton is generated within the donor material of an OSC it will proceed to diffuse towards the interface with the acceptor material. The use of computational methods to explore Exciton diffusion between the acceptor and donor regions of an OSC could lead to keen insight into the properties of the system. One such method is to model an OSC by using a Stochastic Differential Equation known as the Edwards-Wilkinson equation. A Stochastic model allows for the randomness associated with Exciton generation to be explored using numerical methods. Further exploration of this modeling process has the potential to make predictions of OSC behavior that could be tested and reproduced in an experimental setting.

Modeling the Longevity of Jupiter's Great Red Spot with EPIC

Author(s): **Caleb Keaveney**
Mentor(s): **Dr. Gary Lackmann**
Poster: **45**

Jupiter's Great Red Spot (GRS) is the oldest discrete meteorological phenomenon known to exist in the universe. Observed continuously for over 150 years, with possible sightings as early as the 1600s, the GRS is a high-pressure anticyclone sandwiched between Jupiter's South Equatorial Belt and South Tropical Zone. While it remains the largest storm in the solar system, the GRS has significantly decreased in visible size over the past 100 years. The dynamics driving the Spot's contraction are not well understood. Here, we present findings regarding the dynamical structure of the GRS

through numerical modeling. We use the Explicit Planetary Isentropic Coordinate (EPIC) atmosphere model to run simulations on a GRS-like model vortex embedded in the known Jovian zonal wind profile at the location of the GRS. In particular, we model the GRS as a Gaussian ellipsoidal perturbation on the Montgomery streamfunction, as done successfully by previous EPIC modelers in other cases. We have successfully generated a GRS-like vortex that is meteorologically and numerically stable on the order of several Jupiter days, and are in the process of manipulating this vortex to extend its lifetime. With the model vortex and atmosphere developed through this project, future studies can continue to offer insights into the dynamics that modulate the size of the solar system's largest storm.

Polymer-mediated Removal of Textile Dyes for Environmental Sustainability

Author(s): **Graham Neve**
Mentor(s): **Dr. Januka Budhathoki-Uprety**
Poster: **1**

Dyes, soluble organic compounds that impart color to a substrate, are used in a multitude of products in textiles, pharmaceuticals, cosmetics, packaging, plastic, paper, paint, and leather industries. A significant amount of dyes are lost to the environment every year from industrial processes causing environmental pollution in manufacturing sites with a significant alteration in ecological conditions of aquatic life. Occurrence of some dyes in water pose serious health concerns including toxicity, mutagenicity, and carcinogenicity. Thus, it is important to develop methods to remove dye contaminants from wastewater and mitigate its impact on the environment and health. Synthetic polymers, due to their versatile chemical structures, size and shape, could provide a tunable platform to remove dyes from contaminated sources. This study evaluates the performance of a synthetic polymer to remove textile dyes from dye-contaminated water.

Development of a SNAr Reaction on Resin-bound Peptides for Scope Expansion in Ketoxime Ligations

Author(s): **Meghan Broderick**
Mentor(s): **Dr. Caroline Proulx**
Poster: **2**

Nucleophilic aromatic substitution (SNAr) reactions have been reported on free amino acid residues; however, reaction conditions have not been translated to resin-bound peptides. We previously developed a method for ketoxime ligation that utilizes mild aqueous conditions and electron-rich N-aryl peptides. Methods such as the submonomer peptoid synthesis and Buchwald N-arylation chemistry have been used to expand the side chain diversity at the site of ligation, but we still do not have access to all twenty natural amino acids at that linkage. Here, we report conditions to perform a SNAr reaction on a variety of resin-bound peptides. Additionally, conditions for the on-resin reduction of the N-aryl ring are screened

Rapid Detection of Glucose and Lactate Fluctuations in Rat Dorsal Striatum

Author(s): **Lailah Ligons**
Mentor(s): **Dr. Leslie Sombers**
Poster: **3**

Glucose and lactate are employed in the brain to meet the substantial metabolic demands associated with neurotransmission. Neurodegenerative and dopamine-associated diseases, including Parkinson's disease and drug addiction, have been linked to dysregulation in brain metabolism. However, the precise relationship between these two neuroenergetic species remains unclear due to a critical lack of analytical tools and techniques capable of studying these substrates simultaneously on a sub-second timescale. Thus, it is unclear how these fluctuate on a timescale relevant to neuronal function, leaving many questions unanswered. Fast-scan cyclic voltammetry (FSCV), coupled with carbon-fiber microelectrodes, is commonly used to study dopamine dynamics but is unable to detect non-electroactive species, such as glucose or lactate. However, once paired with carbon-fiber microelectrodes modified with the addition of an enzyme layer containing either glucose oxidase (GOx) or lactate oxidase (LaOx), we can detect glucose and lactate, respectively, on a second-by-second timescale. In this work, the dynamics of glucose and lactate were measured by pairing FSCV with enzyme microbiosensors at a discreet location in brain tissue. These microbiosensors were placed in the dorsal striatum of an anesthetized rat, and electrical stimulation of the dopaminergic midbrain was used to elicit striatal dopamine signaling, and thus a metabolic demand that glucose and lactate fluctuate to meet. In order to understand the impacts of diseases on brain metabolism and to inform potential therapeutic strategies, it is important to have a better understanding of how these substrates fluctuate relative to one another in real-time.

Optimizing the Fabrication of Carbon-Fiber Microbiosensors for Simultaneous Detection of Glucose and Dopamine in Live Brain Tissue

Author(s): **Emilie Norwood**
Mentor(s): **Dr. Leslie Sombers**
Poster: **4**

Neuronal communication is an energetically demanding process. There is substantial evidence indicating a dysregulation in both brain metabolism and dopamine dynamics in several neurological disorders, including Alzheimer's

disease and addiction. However, the precise relationship between these two species remains unclear due to a critical lack of analytical tools and techniques capable of studying energetic substrates and dopamine dynamics simultaneously. Carbon-fiber microelectrodes are commonly coupled with fast-scan cyclic voltammetry (FSCV) for the subsecond detection of electroactive neurotransmitters, such as dopamine, in situ. These electrodes can be modified with oxidase enzymes to create microbiosensors capable of simultaneously quantifying real-time fluctuations of non-electrochemically active substrates, such as glucose or lactate. Hydrogel entrapment of the enzyme within a chitosan matrix on the carbon-fiber surface provides for stable, sensitive, and selective detection of dopamine and the enzyme substrate using FSCV. The purpose of this study is to characterize the chitosan hydrogel that entraps oxidase enzyme on the electrode surface, and the effects of the hydrogel's physical nature on acquired electrochemical data. Hydrogel was deposited using linear sweep voltammetry, and membrane consistency and electrochemical performance were characterized to optimize the deposition potential range and sweep rate. Finally, voltammetric measurements were used to determine how these factors relate to sensor performance. Overall, these experiments are important because they provide an improved understanding of the hydrogel matrix that is integral to microbiosensor function, thus advancing this much-needed technology for monitoring real-time neurochemical kinetics.

A double-barrel microelectrode array for improved electrochemical investigation of neurotransmitter release from single cells in culture

Author(s): **Ruby Shah**
Mentor(s): **Dr. Leslie Sombers**
Poster: **5**

Endogenous opioid peptides are associated with behaviors related to learning, reward, and pain; however, basic fundamental questions regarding the nature of opioid signaling and exocytosis in the brain remain unanswered due to challenges in their real-time detection. Basic detection and characterization of opioid peptide release are important for understanding function and dysfunction (e.g., addiction). To date, there are few approaches available for direct measurement of opioid neuropeptides in vivo, and little data available detail the kinetics of opioid peptide release. Disc carbon-fiber microelectrodes are readily coupled with amperometry for detection of catecholamine release events from isolated, neuroendocrine cells in culture. Amperometric measurements with a single-channel electrode at +500 mV

are conducted to quantify catecholamine release, and peptidergic release may be distinguished by oxidation of tyrosine, an amino acid in opioid enkephalins, +1,000 mV. However, simultaneous detection with a novel dual-channel double-barrel microelectrode will enable simultaneous measurements at both of these potentials to provide unprecedented insight into their release. Electroanalytical characterization of this novel electrode has been conducted for simultaneous detection of catecholamines and met-enkephalin, a principal neuropeptide contained in these cells. Data show that the sensor works appropriately for dual-channel detection of both analytes as demonstrated by assessing sensitivity, selectivity, stability, and coulombic efficiency. Overall, our work provides a new, powerful tool for investigating the fundamentals of opioid release from single cells. This sensor may support future work for investigating the release of opioids and catecholamines while allowing scientists to investigate differences in their kinetics.

Real-time, Simultaneous Measurements of Hydrogen Peroxide and Dopamine Fluctuations in the Dorsal Striatum

Author(s): **Kalynn Turner**
Mentor(s): **Dr. Leslie Sombers**
Poster: **6**

Many neurodegenerative diseases, including Parkinson's disease, have been linked to oxidative stress in the brain. This results from the generation and activity of reactive oxygen species (ROS), such as hydrogen peroxide (H2O2). In the brain, H2O2 is an energetic byproduct of cellular respiration, and is readily created in dopamine (DA) synthesis and metabolism. This short-lived, highly reactive molecule is also a known modulator of DA signaling. However, ROS are difficult to measure in situ, and many questions remain unanswered regarding the interaction of DA and H2O2. In this work, fast-scan cyclic voltammetry (FSCV) is used to simultaneously measure real-time fluctuations of DA and H2O2 at a single recording site in the dorsal striatum of an anesthetized rat. FSCV is commonly used to study DA signaling; however, H2O2 signals can be confounded by pH shifts. To combat this, a novel "double" waveform was coupled with a partial-least-squares regression model to distinguish H2O2 from common interferents. Bipolar electrical stimulations were applied to the midbrain to depolarize the DA cells that project to the dorsal striatum. The resultant DA and H2O2 signals were recorded in striatum in real time. Characterization of these neurochemical dynamics in striatum, a major motor hub in the basal ganglia, and their response to varied

stimulation parameters will elucidate how these molecules fluctuate relative to one another. This will shed light on chemical modulation of striatal function, and will aid in the advancement of informed pharmaceutical and therapeutic treatments for neurodegenerative and dopamine associated disease states.

Real-time, Simultaneous Detection of Dopamine and Glutamate in Rat Striatum Using an Enzyme-modified Carbon-fiber Microelectrode with Fast-scan Cyclic Voltammetry

Author(s): **Laney Kimble**
Mentor(s): **Dr. Leslie Sombers**
Poster: **7**

Glutamatergic and dopaminergic transmission within the striatum is interrelated and linked to several psychiatric, neurodevelopmental, and neurodegenerative pathologies. The striatum is involved in decision making, reward perception, motivation, and movement—hence investigation of these neurotransmitter fluctuations as they relate to striatal function is necessary. Analytical techniques capable of monitoring neurochemical fluctuations on the millisecond timescale are required in order to directly quantify these processes. Fast-scan cyclic voltammetry is an electroanalytical technique with superb temporal resolution that is used to monitor rapid dopamine fluctuations, even in the presence of interferents. FSCV is typically coupled with carbon-fiber microelectrodes (CFME). These can be modified with a chitosan matrix containing an oxidase enzyme to allow for simultaneous detection of non-electroactive analytes. In this work we have modified the CFMEs with glutamate oxidase (GlutOx) to allow for the detection of glutamate in live rat brain tissue. The GlutOx-modified electrodes have been characterized for their stability, selectivity, oxygen dependency, and sensitivity to glutamate and dopamine. Additionally, glutamate has been detected in rat striatal tissue upon electrical stimulation using an ex-vivo brain slice preparation.The signal was verified using the pharmacological agent, DL-TBOA, a selective inhibitor of the excitatory amino acid transporter that is responsible for glutamate reuptake. Future work will entail characterization of dopamine and glutamate kinetics in intact, anesthetized animals via stereotaxic surgery. The ability to simultaneously record rapid fluctuations of glutamate and dopamine at one electrode will enable an improved study of the normal functions, disease states, and interplay of these prolific neurotransmitters in the striatum.

The Right to Play

Author(s): **Drew Dunphy**
Mentor(s): **Dr. Bryan Bell**
Poster: **8**

As defined by the United Nations in their Convention on the Rights of the Child, "every child has the right to rest and leisure, to engage in play and recreational activities appropriate to the child's age, and to participate freely in cultural life and the arts. That member governments shall respect and promote the right of the child to participate fully in cultural and artistic life and shall encourage the provision of appropriate and equal opportunities for cultural, artistic, recreational and leisure activity." The insurance of playgrounds to have accessibility for all children is essential to the development of subsequent generations. Visual impairment poses a challenging barrier in the design of 'traditional' playgrounds but deserves the research and attention of designers. Sight is a gift that many of us overlook, and misconceptions about visual impairment lead to improper and ineffective design; therefore, deep research and conversations are needed to truly understand the needs of those with visual impairment. Freedom by Design, directed by myself and Brooklyn Scotto, has partnered with Governor Morehead School to reenvision what a playground for the students and teachers can be and construct a safe environment for their students. Through conversations with faculty, staff, and students at Governor Morehead School and independent investigation into the components of safe play and visual impairment, my work within Freedom By Design has developed a safe and engaging playground for the students at the school.

The Ontogeny of Feeding Behavior in the Endangered Ring-tailed Lemur (Lemur catta)

Author(s): **Hayden Reed**
Mentor(s): **Dr. Tara Clarke**
Poster: **9**

The ring-tailed lemur (Lemur catta), an endangered Malagasy strepsirrhine, is female dominant, inherently social and lives in matriarchal groups of up to 30 individuals. L. catta are opportunistic omnivorous, primarily feeding on leaves and fruit, but occasionally consume insects and small vertebrates. Given their social nature and generalist diet, this provides an opportunity for individuals to utilize social learning strategies. Previous work with this species has

demonstrated their capability to employ social learning skills in a feeding context. To our knowledge, the ontogeny of ring-tailed lemur feeding ecology has yet to be examined amongst captive populations. Thus, we investigated the development of feeding ecology in captive, free-ranging infant ring-tailed lemurs housed at the Duke Lemur Center, Durham, NC. Specifically, we aimed to understand how feeding behaviors develop; be that through social learning, trial and error, independent exploratory foraging, or a combination of these mechanisms. Our preliminary results reveal that free-ranging infant ring-tailed lemurs, like their wild counterparts, engage in co-feeding behavioral synchrony- a form of social learning. Furthermore, both male and female infants were found to spend more time co-feeding with their mothers, which is analogous to data on wild ring-tailed lemurs. These data suggest that captive free-ranging ring-tailed lemurs, like their wild conspecifics, employ basic social learning feeding strategies (i.e., behavioral synchrony).

Captive aye-aye (Daubentonia madagascariensis) Mother Vocalizations after Giving Birth

Author(s): **Eli Benbenek, Cooper Lamb, & Allie Monahan**
Mentor(s): **Dr. Lisa Paciulli**
Poster: **10**

Effective communication between a mother and her infant can be critical for the infant's survival and for the mother getting her genes into the next genepool. In this study, the vocalizations of a mother aye-aye lemur (Daubentonia madagascariensis) were examined on the day of birth and 2.5 weeks later. It was hypothesized that the mother would vocalize more as time progressed. Sennheiser MKE2-60GOLD lavalier condenser microphones were placed into the aye-aye's enclosure at the Duke Lemur Center to capture any sounds made. Adobe Audition was used by Paciulli Lab Research Assistants to listen to the audio-recordings and see the resulting spectrograms. Audio on the date of birth and 17 days after birth were coded for the time, type, and duration of vocalizations. The mother's vocalizations were coded as one of four calls - an aack, eep, drum, or huff (Stanger & Macedonia 1994). The results showed that the mother vocalized 391 times. She vocalized 107 times the day she gave birth and 284 times 2.5 weeks later. The mother made 199 drums, 124 huffs, 7 eeps, and 0 aacks. Since the mother vocalized more as time went on, the hypothesis was supported. Also, the mother made more vocalizations that indicated stress and anxiety. Limitations of the study include coding vocalizations from only two days. Future research should include analyzing more mothers' vocalizations over a longer time period. Aye-ayes are

endangered, and learning more about their vocalizations could improve their quality of care in captivity.

Infant aye-aye (Daubentonia madagascariensis) Mother Vocalizations after Giving Birth

Author(s): **Tiffany Brocco, Catherine Edbrooke, & Ian Lewis**
Mentor(s): **Dr. Lisa Paciulli**
Poster: **11**

Most infants spend their time sleeping and eating. However, not much is known about aye-aye (Daubentonia madagascariensis) infant behavior. In this study, a captive Duke Lemur Center infant aye-aye was observed during the first month of life and her behaviors were recorded. It was hypothesized that during the first month of life, the infant aye-aye would sleep a lot, followed by being nursed frequently by her mother. Pelco IMM12027-1S cameras were hidden in the enclosure and nest boxes to observe the aye-ayes. Paciulli Lab Research Assistants watched the video-files and recorded behaviors every 2.5 minutes using instantaneous focal animal sampling (Altmann 1974). Data were entered on Google Forms, and the resulting Google Sheets were used for data summaries and analyses. The results showed that the infant aye-aye was visible 4% of the time. When visible, the infant slept 60% of the time, nursed 7% of the time, and rested 6% of the time. As expected, the hypothesis that the infant would sleep and eat a lot was supported. Limitations of this study include that the sample size was small (n=1) and that even with the hidden cameras it was often difficult to see exactly what the infant aye-aye was doing. Future research should be conducted on more infant aye-ayes for a longer period of time, as well as compare the activity budgets of captive and wild aye-ayes throughout development in order to create more comfortable captive environments for aye-ayes.

Captive maternal aye-aye (Daubentonia madagascariensis) Anxiety Behavior Peripartum

Author(s): **Rebecca Olson, Lauren Boyd, & Laurel Hey**
Mentor(s): **Dr. Lisa Paciulli**
Poster: **12**

Anxiety is a negative psychological state induced by stress triggers including parturition. Maternal anxiety in animals is often displayed in the form of stereotypies such as repeated scratching, hair picking, yawning, shaking,

panting, and/or pacing (Bass 2016). In this study, a Duke Lemur Center mother aye-aye's (Daubentonia madagascariensis) anxious behaviors were assessed peripartum. It was hypothesized that the peripartum aye-aye would exhibit anxious behaviors and that the behaviors would change over time. Pelco IMM12027-1S cameras were hidden in the aye-aye enclosure and video footage was stored on Google Drive. Data were collected using continuous focal-animal sampling methodology (Altman 1974) over three consecutive days peripartum. Chi-square tests were conducted to see if there were differences between behaviors exhibited. The day before birth, the mother spent significantly more time (59%) repeatedly constructing and deconstructing nests ($p < 0.05$), while on the day she gave birth, the mother engaged in cleaning behaviors (e.g., auto-grooming) significantly more than any other behavior (51%, $p < 0.05$). The day after birth, the mother acted significantly more hyper-alert and vigilant (67%, $p < 0.05$). In contrast, the mother was not observed yawning, picking hair, or panting/shaking. Thus, the hypothesis that mother aye-ayes experienced stress and engaged in different stereotypies peripartum was supported. Further research is needed on more peripartum aye-ayes and for longer periods of time to explore maternal stress more fully and to see how / if it impacts infant behavior. Such data could help improve aye-aye care in captivity.

Trichromatic Color Vision in Female Coquerel's Sifakas (Propithecus coquereli) Demonstrated with Novel Objects

Author(s): **Jonah Peckham**
Mentor(s): **Dr. Lisa Paciulli**
Poster: **13**

Trichromatic vision is a valuable tool for many diurnal species as it enables them to perceive all three primary colors of visual light. Although most Strepsirrhine primates are dichromats and cannot see red, female coquerel's sifakas (Propithecus coquereli) are trichromats. Because of this visual dimorphism and sifakas being female dominant, it was hypothesized that female sifakas would interact with red-colored objects more than males. Six coquerel's sifakas (3 female, 3 male) were observed at the Duke Lemur Center (DLC). An individual was randomly selected and observed for five minutes without an object in the enclosure, for five minutes with an experimental red wiffleball, and finally for five minutes with a control white wiffleball. The latency to approach the object was recorded, as well as if the object was touched and/or handled. On average, females approached the red object a minute faster than the white object, and interacted with the red object four

times and the white object once. Conversely, on average, males approached the white object 20 seconds faster than the red object, and interacted with the white object six times and the red object once. The hypothesis was supported since females approached the red object faster and interacted with it more than males. Limitations include the small sample size and a limited pool of sifakas. Future research into sifaka trichromacy would provide insight into why they possess it, and also help caretakers develop color-related enrichment for females.

Group the Foods Course Curriculum

Author(s): **Lindsey Childs**
Mentor(s): **Dr. Nicola Singletary**
Poster: **14**

Nutrition education for children is an effective way to instill healthy habits, mitigating the risk of developing severe health conditions in adulthood. This pilot study was conducted to evaluate a nutrition course curriculum centered around games and its ability to increase enjoyment and retention of information in children ages 5-10. The curriculum was created with a mixture of hands-on activities that entailed a card game, a song, arts and crafts, charades, and a taste test. The curriculum was implemented with 4 different groups of children, with each group ranging from 3-6 children. Upon observing and interacting with the children, I gauged their opinions of the course curriculum based on their comments about the games, such as difficulty level, confusion/familiarity, and levels of excitement. I prompted these conversations with questions such as, “What did you think of that activity?” and, “What do you think of the food items you saw in the activities today?” However, most comments made by the children were unprovoked. After examining my notes from each group, I concluded that the children enjoyed the activities that allowed them to interact with something, such as cards, food, or arts and crafts, whereas the song and charades activities were not enjoyed by the children. The children also seemed more invested with the activities if I was joining them in playing or asking them questions related to the material. Future adjustments to this course curriculum will include removing or adjusting the song and charades so they are more hands-on and engaging.

Thermosensitivity of Meiosis Within and Between Species

Author(s): **Mili Jimenez**
Mentor(s): **Dr. Caiti Smukowski Heil**
Poster: **15**

Meiosis is required for the formation of gametes in all sexually reproducing species, however meiosis can fail under certain conditions. For example, the optimal temperature for successful meiosis varies between species of plants and animals. This suggests that meiosis is temperature sensitive, and that natural selection may act on variation in meiotic success as organisms adapt to different environmental conditions. To understand how temperature alters the successful completion of meiosis, we surveyed two metrics of meiosis, sporulation efficiently and spore viability, in the cryotolerant species Saccharomyces uvarum and the thermotolerant species Saccharomyces cerevisiae. We induced meiosis for 6 strains of S. uvarum and 6 strains of S.cerevisiae for 7 days at three different temperatures, 15℃ , 23°C, and 30℃. Sporulation efficiency was assessed by counting the proportion of cells that successfully formed spores. Spore viability was assessed through tetrad dissection of 24 meioses for each strain at each temperature and recorded as the number of alive spores from the total of spores dissected. Our results indicate that there is variation in both sporulation efficiency and spore viability within and between S. uvarum and S. cerevisiae species. In S. uvarum, the threshold of meiotic failure is between 25℃ C and 30℃, while meiosis proceeds normally at 30℃ for strains of S. cerevisiae. We interpret these results to indicate that selection may be acting on meiotic machinery within species. This has implications for the distribution of species ranges and may be important in the divergence of populations into separate species.

Assessing Antimicrobial Properties of Bacteria Isolated from Soil

Author(s): **Nicole McAleese**
Mentor(s): **Dr. Michael Taveirne**
Poster: **16**

Over the past 70 years, novel antibiotic development has declined. With over 2.8 million cases of antibiotic resistant infections yearly, the need to develop novel antibiotics to fight these infections is greater than ever. The goal of our project was to determine if we could isolate bacteria from soil that produced novel antimicrobials. We collected soil from Campus Crossings community and adjacent to Dabney Hall and isolated 32 bacteria using dilutions and the

viable plate count method on R2A media under aerobic conditions at 25C. Spread-patch plates were set up using a bacterial lawn of surrogate ESKAPE pathogens (E. coli and B. subtilis) to assess if soil isolates produced an antimicrobial. We identified three isolates that produced an antimicrobial on R2A media against B. subtilis, and an additional five isolates when grown on R2A supplemented with cycloheximide. We performed a Gram-stain and sequenced the 16S rRNA gene of each isolate for identification. We also worked to characterize the mechanism of action of the antimicrobials using a patch-patch plate assay and determined the antimicrobials are most likely part of a contact dependent inhibition system. It can be concluded that soil bacteria have the potential to produce novel antimicrobial, and that added stressors can cause additional antimicrobial properties to be expressed. Future research will further explore the effectiveness of these potential antimicrobials against a broader set of known antibiotic resistant bacterial pathogens. We also plan to test different stressors to see if these soil isolates can produce additional antimicrobials under different conditions.

Identification of Soil Microbes that Produce Novel Antimicrobials Effective Against Common ESKAPE Surrogate Pathogens

Author(s): **Spencer Watts**
Mentor(s): **Dr. Michael Taveirne**
Poster: **17**

Over the last 20 years, the world has seen an increase in antibiotic resistant infections and a decrease in the production of novel antibiotics. This global crisis has resulted in nearly 3 million antibiotic resistant infections each year and a cost of 4.6 billion dollars annually in treatment within the United States. To combat this trend, bacteria were isolated from local soil samples collected from Lake Johnson Park in Raleigh, NC to determine if they produce antimicrobials against common pathogens that have shown an increase in antibiotic resistance. Bacteria have evolutionarily developed over millions of years to combat other bacteria; one method is through the production of antimicrobials. From our soil sample, we isolated 64 bacteria and plated them in the presence of 2 different ESKAPE surrogate pathogens to assess their ability to produce effective antimicrobials against them. We were able to identify 2 isolates that produce an antimicrobial against the ESKAPE surrogate pathogen Staphylococcus epidermis. The mechanism in which these two isolates produced an antimicrobial against S. epidermis was determined to likely come from a contact-dependent secretion system. Gram-stain and PCR amplification and sequencing of our isolates' 16s rRNA

gene was completed to identify our isolates. Future research will investigate the mechanism of action the isolate uses to produce the antimicrobials, purification and identification of the compound that inhibits the growth of the pathogen, and if medicinal use of the antimicrobial is possible.

Assessing Soil from Umstead State Park for the presence of bacteria that can produce novel antimicrobials

Author(s): **Manas Patel**
Mentor(s): **Dr. Michael Taveirne**
Poster: **18**

ESKAPE pathogens are a group of bacterial pathogens responsible for majority of the nosocomial infections throughout the world. The CDC estimates that antimicrobial resistant threats account more than 2.8 million infections annually leading to the death of 35,000 people. Many current clinically used antibiotics are becoming ineffective due to the increased rate of antimicrobial resistant bacteria. The goal of this project was to identify novel antimicrobials that could be used to treat infections by antibiotic resistant bacteria. We isolated bacteria from soil collected from Umstead State Park in Raleigh, NC and assessed their potential to produce novel antimicrobial metabolites against ESKAPE surrogates Proteus vulgaris and Staphylococcus epidermidis. We isolated 64 bacteria from our soil samples using a viable plate count assay on R2A media. We assessed each isolate's ability to produce a novel antimicrobial using a spread-patch plate assay. Three of our isolates produced a potential novel antimicrobial against at least one of the ESKAPE surrogates. Using the patch plate method, we determined that the novel antimicrobials are most likely part of a contact dependent inhibition system. We performed PCR to amplify the 16S rRNA gene and performed sanger sequencing to identify each isolate. Future experimentation aims to accurately determine the bacterial species that produces the antimicrobial compounds and purify the antimicrobial to assess the specific mechanisms of their antimicrobial properties.

Turmeric Zone: Turmeric Honey Lollipop

Author(s): **Alex SwansonBoyd, Morgan Weinberg, Chicaya McDaniel, & Maddi Swain**
Mentor(s): **Dr. Shweta Trivedi**
Poster: **19**

Turmeric Honey Lollipops introduce a novel product that dually functions as a hot beverage additive and snack food. The product is honey-based and incorporates functional ingredients like turmeric and black pepper in a ready-to-eat (RTE) setting. Added sugars and treated ingredients are minimal. The product contains no synthetic flavors, colors, or preservatives. It is stable at ambient conditions with a water activity below 0.5, has less than 5 grams of total sugar and more than 5 milligrams of turmeric.

Phenolics in turmeric (namely curcumin) have been shown to mildly reduce inflammation and function as an antioxidant in large amounts. Although the amount of bioavailable curcumin in each lollipop does not allow for significant health benefits, the product encourages exposure to turmeric and its benefits of routine dietary inclusion.

Discouraging stickiness with minimally processed ingredients was paramount in the development process. The process provided groundwork for proper textural formulation of monosaccharide-based hard confections and future products that prioritize minimally processed ingredients hoping to discourage naturally occurring stickiness. Trials included baking soda, cream of tartar, crystallized honey, and more, with varying levels of effect. However, no final product formulation to reduce stickiness, improve taste and texture has been reached yet, as trials are still being conducted.

Intracellular Localization of a Cell Killing Protein

Author(s): **Jacqueline MacStudy**
Mentor(s): **Dr. Jun Tsuji**
Poster: **20**

A mammalian host protein, gasdermin D (GSDMD) kills own cells after bacterial invasion by forming pores in the cytoplasmic membrane. This GSDMD's action is important for preventing bacterial colonization in cells, however, it is unknown if GSDMD plays another role in host defense

mechanisms. Mitochondria were found to be actively involved in killing intracellular bacteria, which lead to our hypothesis that GSDMD activates the mitochondria to participate in killing intracellular bacteria. To test this hypothesis, we created a green fluorescent protein (GFP)-tagged GSDMD to visualize intracellular localization of GSDMD through fluorescence. We used confocal microscopy to determine where the GFP-GSDMD resides in human culture cells, HeLa cells. We found that when the samples were treated with a cytokine, TNF, and a protein kinase inhibitor, 5z-7oxozeaenol, which mimics bacterial invasion, the GFP-GSDMD was localized in the mitochondria. Western blotting was also performed to confirm that GFP-GSDMD was properly expressed. The results show that upon mimicking bacteria invasion, GSDMD is localized in the mitochondria. The evidence suggests that GSDMD could aid the mitochondria in killing intracellular bacteria, which may be GSDMD's new role in host defense.

Effect of Live IBD Vaccine on Early Protection Against Challenge

Author(s): **Brianna Diaz**
Mentor(s): **Dr. Rocio Crespo**
Poster: **21**

Infectious Bursal Disease (IBD) is a highly contagious and viral disease that affects young chickens under 17 weeks of age. It is characterized by inflammation and atrophy of the bursa of Fabricius. We conducted a study to determine whether in-ovo vaccination helps to produce sufficient antibodies to prevent the disease later in life following in-ovo vaccination. We also investigated whether the vaccines had any effect on growth and weight of the bursa of Fabricius. Following the hatching of the eggs, the birds were separated into different rooms at the NC State University Laboratory Animal Research (LAR) Unit. The 12 treatment groups examined the effects of being specific pathogen free (SPF) or maternal antibody (Mab) positive as well as the effects of the Vaxxitek and Burcell 2+0 vaccines, individually and collectively. During the study, the birds were periodically weighed, bled, and challenged. We found that the birds inoculated with Vaxxitek, on average, had higher growth rates. As expected, the Mab birds that were broilers (meat producing), grew and weighed more than SPF birds which were layers (egg producing). The Mab birds also had larger bursa sizes by the end of the study in comparison to the SPF birds. The information obtained from this study could be directly applied to future studies to determine how single or multiple vaccinations can affect the bird (i.e., weight, bursa development,

etc.). This is important as this disease mainly affects chickens and has no effective treatment.

Recent Advancements in Tau and β-Amyloid Aggregation Research Related to the Pathology of Alzheimer's Disease

Author(s): **Jarica Edwards, Nicolas Mastrovito, Carly Centanni, Alyssa Pope, Emma Hillburn, Bella Black, Alyceanna Campos, & Landon Privette**
Mentor(s): **Dr. Michael Goshe**
Poster: **22**

Alzheimer's disease (AD) is a neurodegenerative disorder that causes cognitive decline and eventually dementia. The disease is caused by the aggregation of proteins, specifically tau and β-amyloid peptide (Aβ), in the brain. Our literature-based project explored some of the recent advancements in various methods used to understand and treat AD. Some potentially therapeutic compounds, such as small molecules, peptides, and monoclonal antibodies were effective in attenuating the physiological development of AD. One study found that the asparagine at residue 368 of tau plays a specific role in the aggregation pathway that is initiated by already-aggregated tau obtained from brain tissue previously affected by AD. Another study showed the importance of lipoprotein-Aβ in the onset and progression of AD and the need to understand its peripheral metabolism. Additionally, a newly-developed process of simulating in vivo conditions within a 3-D model system was used to probe the mechanism of Aβ aggregation in the presence of collagen, agarose, hyaluronic acid, and polyethylene glycol. In our final study, a genetic method was used to distinguish between early and late stage AD using the miR-331-3p and miR-9-5p genes. From this limited literature search of current AD research, it is clear that strides are being made to improve the understanding of AD and provide new avenues to explore more effective treatments. However, it is also apparent that more research is needed to further develop these approaches and others for more effective and comprehensive treatments for Alzheimer's patients.

Studying dietary supplementation effects of algae on nursery pigs

Author(s): **Anusha Chandra**
Mentor(s): **Dr. Sung-Woo Kim**
Poster: **23**

The purpose of this study revolves around the introduction of a powder form Monostroma spp. newly weaned nursery pigs in order to determine potential positive effects on growth performance and nutrient digestibility. The seaweed Monostroma spp. can be considered as an appropriate nutritional supplement, offering a multitude of benefits ranging from antimicrobial effects like enhanced intestinal health to improved digestibility. This study aims to discover the effect of seaweeds as a dietary supplementation fed to newly weaned pigs. Bioactive components from the cell wall may have positive effects on swine that aid in improving animal performance and intestinal health. In this study, 180 pigs (7 kg) will be allotted in randomized complete block design. Dietary treatments are basal diet with green algae (0, 3, 5, 7, and 9%). All pigs were fed experimental diets following NRC (2012) for 14 d to 11 kg. Pigs and feeders will be weighed at d 0, 7, and 14 to assess average daily gain, average daily feed intake, and feed efficiency. At the end of the experiment, pigs will be euthanized to collect jejunal tissues for morphology and disgesta from ileum.

Effects of Carbon Dioxide on the Growth and Wellbeing of Finishing Pigs

Author(s): **Olivia Clark & Kylie Karabinos**
Mentor(s): **Dr. Suzanne Leonard**
Poster: **24**

Carbon dioxide (CO2) is a naturally present greenhouse gas in finishing barns and swine houses. This scientific literature review was conducted to synthesize the effects of excess CO2 on the growth and well-being of finishing pigs. Large quantities of CO2, such as that produced in swine finishing barns, can be hazardous to human and animal health. Carbon dioxide is primarily emitted from manure and higher rates of respiration. The CO2 concentrations fluctuate due to the level of ventilation which is affected by the seasons and indoor housing temperature. Prolonged exposure to CO2 causes metabolic stress on the finishing pigs, and not only hinders weight gain but in high concentrations can cause death. High levels of carbon dioxide is an American Veterinary Medical Association-approved method of euthanasia for pigs. A study on this method of euthanasia provided data on the direct effects of

carbon dioxide. Before the pigs lost consciousness, the carbon dioxide caused labored breathing and suffocation symptoms. The gas also had a direct impact on the pigs' nervous system. By understanding the problems that carbon dioxide causes for pigs and where this gas originates from, producers can utilize the information to modify the way their pigs are raised and mitigate the problems this gas causes for finishing pigs.

The Negative Effects of Humidity on the Growth of Finisher Pigs

Author(s): **Lexi Ezzell & Elizabeth Espino**
Mentor(s): **Dr. Suzanne Leonard**
Poster: **25**

The commercial swine production industry continues to face challenges in regards to efficiently managing the growth of finisher pigs in increased high humidity environments. Many environmental factors, including relative humidity, can negatively affect the growth rate of finishing pigs in a commercial setting. Relative humidity is the concentration of water vapor in the air at any given time; therefore, a high relative humidity would make the air feel warmer than the actual temperature. Through examining various experimental studies regarding this topic, the question remains: How does increased relative humidity have negative effects on pigs? Respiration rate, rectal temperature, skin temperature, heat production, feed intake, and water to feed ratio will ultimately affect a pig's weight gain. When tested under the same temperature and different relative humidity, the inflection point temperature (the temperature above which physiological responses occur) of respiration rate and voluntary feed intake decreased, which led to a decrease in swine body weight gain. Generally, humidity alone has minimal effects on a finisher pig's physiological status. However, varied relative humidity concentrations coupled with increased air temperatures will cause a significant decrease in body weight gain. Studying the effects of relative humidity on finisher pigs' weight gain will provide economic benefit to the industry as well as improve the swines' physiological wellbeing.

Effects of particulate matter on health and performance of finishing swine

Author(s): **Emma Knox & Madison Manzo**
Mentor(s): **Dr. Suzanne Leonard**
Poster: **26**

Particulate matter (PM) on swine farms has a diverse composition, including pathogenic and nonpathogenic microorganisms, endotoxins, and organic material. Swine farms have significant amounts of PM, and research has connected PM to health concerns of both swine and their caretakers. Increased PM concentrations are thought to decrease respiratory function and growth rates, which is of concern with finishing pigs. The objectives of this review were to determine sources of PM, effects of PM on swine health and performance, and potential management options. Relevant scientific literature from reputable research journals were critically evaluated for inclusion in this review. Based on the literature, it was determined that increased levels of PM correlate with increased levels of lesions to the lungs of pigs. These lesions can be assumed to originate from respiratory disease due to the irritation to the epithelial lining of the respiratory tract from PM and high concentrations of pathogenic bacteria. Irritation and bacteria predispose the pig to more severe diseases, negatively impacting the growth rate and final weight. Multiple studies indicated a correlation between higher levels of PM and decreased growth. Controlling the levels of PM in swine finishing barns increases profitability by optimizing swine health, growth, and performance. Lower PM concentrations also correlate with better working conditions for swine caretakers. The information presented in this review can be used as a baseline for PM effects and opportunities to control PM, resulting in better management of swine farms to improve pig health and growth.

Effects of heat stress on finishing pig productivity

Author(s): **Meghan McGuire & Abigail Todd**
Mentor(s): **Dr. Suzanne Leonard**
Poster: **27**

Heat stress refers to when a pig's normal body temperature (approximately 23.5 ℃) rises above the level at which it cannot be controlled through normal mechanisms such as panting and sweating (28.5 °C-30 °C). In this literature review, we analyzed several studies on how heat stress lowered finishing pig productivity. Prolonged heat stress can have negative consequences for production as it increases adipose tissue, reduces thyroid activity, decreases

muscle weight induces skeletal atrophy, increases the pH of meat, and promotes female and male infertility. Under heat-stressed conditions, pigs will voluntarily lower their feed intake to reduce metabolic heat production. With the continuing threat of global warming, the livestock industry is expected to experience higher ambient temperatures resulting in reduced animal productivity and economic profitability. While some management methods to reduce heat stress exist, they are limited to increasing ventilation rates, evaporative pads, fogging and misting, conductive floor cooling, and ceiling and attic insulation. These methods should be evaluated by producers based on their practicality, effectiveness, and cost on an individual basis.

Impact of Ammonia on the Production and Health of Finisher Pigs

Author(s): **Jordan Peeler**
Mentor(s): **Dr. Suzanne Leonard**
Poster: **28**

Ammonia, a compound naturally produced from the decomposition of organic matter such as animal wastes, has a current recommended exposure limit of approximately 25 ppm. Above this threshold, ammonia can produce many negative consequences on the production of swine, and concentrated animal feeding operations have been labeled as a major source of ammonia. The objective of this study was to investigate scientific literature regarding the effects of ammonia on finisher pigs as well as what has been done to reduce ammonia concentrations. Scholarly search engines were used to identify relevant articles which fit the criteria of our research, including finisher pigs, slatted floor, and related to pig growth and performance. Ammonia has a toxic effect on kidneys, causing damage and dysfunction through altering gene networks that are associated with oxidative stress, immune dysfunction, and apoptosis. Chronic exposure to ammonia caused a depression in body weight relative to pigs kept in clean air, correlated with the amount of dust in the barn. High ammonia concentrations have resulted in an increase in pneumonia lesions. However, certain studies have been conducted to measure the amount of ammonia and explore remedies, such as decreasing dietary crude protein and different modes of ventilation. From the information gathered, it can be concluded that regulating ammonia is extremely important in swine production due to the many negative health effects it causes on production. Research must continue in this area to ensure that our swine are being produced to their best extent in a safe environment.

Aye-Aye (Daubentonia madagascariensis) Infant Vocalizations during the First Two and a Half Weeks of Life

Author(s): **Jenna DeVito & Allie Monahan**
Mentor(s): **Dr. Lisa Paciulli**
Poster: **29**

Effective communication between an infant and its mother can be critical for the infant's survival. In this study, the vocalizations of a newborn captive infant aye-aye lemur (Daubentonia madagascariensis) were examined for the first 2.5 weeks of life. It was hypothesized that as the infant grew she would vocalize more. Sennheiser MKE2-60GOLD lavalier condenser microphones were placed into the aye-aye's enclosure at the Duke Lemur Center to capture any sounds made. Adobe Audition was used by Paciulli Lab Research Assistants to listen to the audio-recordings and see the resulting spectrograms. Audio on the date of birth, three days after birth, and 17 days after birth were coded for the time, type, and duration of vocalizations. The infant's vocalizations were coded as one of six calls - a plea, scream, sneeze, grunt, rasp, or cree (Winn 1994; Stanger & Macedonia 1994). The results showed that the infant vocalized 69 times. On the date of birth, the infant did not vocalize, while three days after birth, she vocalized thirteen times. Seventeen days after birth, the infant vocalized 56 times. Since the infant vocalized more as time went on, the hypothesis was supported. This demonstrates that it may have taken time for the infant's vocal cords to fully develop. Limitations of the study include coding vocalizations from only three days of the infant's life. Future research should include analyzing infant vocalizations over a longer time period. Aye-ayes are endangered, and learning more about their vocalizations could improve their quality of care in captivity.

Ireland: Global Food Systems and SustainableAgriculture Study Abroad

Author(s): **Lindsey Britton**
Mentor(s): **Dr. Carrie Pickworth**
Poster: **30**

Traveling to Ireland for the Global Food Systems and Sustainable Agriculture Study Abroad that I completed in the Summer of 2019 was an experience I will always cherish and reflect upon in my future academic and professional career. The Study Abroad focused on vegetable and livestock production in Ireland with an emphasis on the cultural differences between farming in the United States and Ireland. Throughout the two weeks spent in Ireland we traveled to different cities which held unique cultural attractions that we were able to explore and learn the history of, such as the story behind the Titanic and the lives that were lost in the Kilmainham Gaol. Some of the most breathtaking attractions included Connemara National Park and the Cliffs of Moher, both of which are natural landmarks that exhibit the true beauty of Ireland. During the farm tours of Lyon, Campbell Tweed, and Rathbaun Farms we

were able to see sheep and beef production on a scale very different from what is seen in the United States. These farm tours allowed me to develop a deep appreciation for conserving tradition, as that is what most of Ireland is known for. While the Irish are extreme innovators and researchers as we learned during tours of the University College Dublin and Mash Direct Organization, almost all businesses stemmed from a family owned and operated enterprise. The Study Abroad to Ireland was an eye opening experience that allowed me to develop a deeper understanding of Irish culture and farming practices.

Peanut Skins for Sustainable Packaging

Author(s): **Justin Ammann**
Mentor(s): **Dr. Fernanda Santos**
Poster: **31**

Peanut skins, as a waste product of the peanut industry, have shown to be problematic in terms of their impact on the environment. Similar outcomes have been observed with regards to spent coffee grounds and byproducts of olive oil production. Despite their detrimental impact on the environment, past studies have found beneficial uses for these waste products in active food packaging. Given this data, it is reasonable to consider the use of peanut skins for the improvement of active food packaging. The objective of this study is therefore to gather information to determine if peanut skin-integrated polymers would be effective as an active packaging material. In order to measure the effectiveness of the polymers, suggested mechanical and chemical properties to be examined include tensile strength, thermal behavior, permeability, antimicrobial activity, and absorptive/emissive activity among many others. Ultimately, by utilizing peanut skins in active food packaging, the proposed study aims to identify a more sustainable and environmentally-friendly outlet for the management of peanut skins as a waste product.

Bioinformatics Analysis of Lotus japonicus miRNA Gene Sequences

Author(s): **Emma Simpson**
Mentor(s): **Dr. Heike Sederoff**
Poster: **32**

Eukaryotic organisms have a number of genes that encode short RNAs. The function of these microRNAs (miRNAs) in plants is diverse but centers around regulating the abundance of highly conserved transcription factors and regulatory genes in plants. Each plant miRNA averages a length of about 21-22 nucleotides but reaches lengths of 20-24 nucleotides long in rare cases. This study focuses on analyzing the similarities between miRNA sequences in six plants of interest: Lotus japonicus, Arabidopsis thaliana, Glycine max, Medicago truncatula, Hordeum vulgare, and

Triticum aestivum. As seen in this study, the conservation of miRNA across these six plant species showed homologs in at least one species except for miRNA 397 in L. japonicus which was present in all 6 species of interest. Other miRNA saw nucleotide lengths averaging about 21-22 nucleotides long while there were only four out of 37 miRNA sequences that were at the extremes of the miRNA nucleotide range at 20 and 24 nucleotides long. We compared those conserved miRNAs to L. japonicus sequencing results from phloem sap, and detected miR166, miR168, and miR396 which have been shown in other species to bind to and degrade transcription factors involved in plant development, flowering time, and pathogen resistance.

Investigating Food Preference in Madagascar Hissing Cockroaches (Gromphadorhina portentosa)

Author(s): **Lindsay Long**
Mentor(s): **Dr. Clyde Sorenson**
Poster: **33**

Madagascar hissing cockroaches (MHR) (Gromphadorhina portentosa) are important for demonstration and educational use, featured in lectures, museum exhibits and widely seen at zoological parks. Based on this wide use, it's important to identify preferred food sources which could be used in the rearing and maintenance of this species . To investigate this question, we designed a two-choice assay to compare roach preference for several fruits. A total of 15 replicates ,per fruit, of individual 3rd instar roaches were starved for 5-7 days and then presented two foods: rat chow and one fruit (apple, avocado, orange, or banana) of ~3.00g, served in separate dishes equidistant from the middle of the testing arena. Roaches were allowed to feed, in the dark, for 1h and afterwards food was weighed and compared to the known starting weight. Comparisons between fruit and rat chow, and well as between fruits, was done using a One-way ANOVA Overall, roaches preferred fruit as compared to rat chow, with significantly more fruit being consumed across all replicates. The most highly consumed fruit was apple. This experiment demonstrates that when given the choice, roaches eat more fruit than chow, and do not show a preference for any of the fruits tested.. These results can inform MHR rearing and maintenance, as well as encourage public interaction through the use of fresh fruit. Additionally, this work raises questions about the role of taste in food selection, and if MHR would forsake nutrition for taste in their feeding habits.

Analyzing Phenotypic Resistance Profiles of ESBL E. coli and Salmonella Found in Backyard Poultry Farms

Author(s): **Angelica Luzzi**
Mentor(s): **Dr. Siddhartha Thakur**
Poster: **34**

With the increase of backyard poultry operations comes increased risk of zoonotic pathogen transmission. The 2020 Salmonella outbreak illuminated concerns regarding increased antibiotic resistance of foodborne diseases. More research is needed on the antibiotic resistance of gram-negative pathogens namely Salmonella and E. coli. Samples were collected from five poultry farms. 26 total samples were taken at each visit and included samples from fecal matter, soil, litter/compost, and swabs of feeders and waterers. Each farm was visited three times across production days 10, 31, and 52. Samples from the fifth poultry farm (PF5) were processed to confirm the presence of E. coli and Salmonella pathogens. Each confirmed sample was isolated and run through Polymerase Chain Reactions to amplify desired sequences and check identification. E. coli isolates were only selected if they phenotypically expressed the beta lactamase enzyme. Sensititre testing was used to analyze the phenotypic resistance profiles of ESBL E. coli and Salmonella isolates. Results showed that ESBL E. coli strains in PF5 were not yet resistant to carbapenem classes of antibiotics. However, carbapenem resistance was found in other farms. Of the 22 Salmonella isolates tested, 19 isolates were resistant to tetracycline. All 22 isolates were resistant to cefoxitin. Additional research is needed to fully understand the scope of antibiotic resistance within foodborne pathogens such as ESBL E. coli and Salmonella in a backyard poultry environment. Increased knowledge in this upcoming industry will ultimately help producers to improve their biosecurity measures, while keeping their families and consumers safe.

The Relationship Between Testing Anxiety and Learning Approaches in Undergraduate STEM Courses

Author(s): **Lindsay Strickland**
Mentor(s): **Dr. Miriam Ferzli**
Poster: **35**

There are three causes of testing anxiety as determined by The Anxiety and Depression Association of America (2016): fear of failure, lack of preparation, and poor test history. To examine the lack of preparation cause of testing anxiety, we examined the association between a student's approach to learning and studying and their anxiety levels. We utilized the ASSIST survey to group students into three different categories of learning approaches: deep learners (those who seek meaning and relate ideas), strategic learners (those students who are organized studiers and highly motivated), and surface learners (those students who lack purpose and are

syllabus-bound learners). We hypothesized that students in large enrollment, introductory chemistry and biology courses, would begin as surface learners and gradually shift towards a more strategic learning approach and that surface learners would have higher levels of testing anxiety in comparison to deep and strategic learners. Along with ASSIST questions to gauge learning approaches, Likert-scale items were used to classify students by their testing anxiety levels as either “Normal,” “Borderline,” or “Anxiety Classified.” Strategic learning was most common in both courses as the preferred learning approach in students over time. The greatest percentage of “Normal” classified students were strategic learners, whereas surface learners were more often classified as “Anxiety” and “Borderline” students. Helping students to identify their learning approaches may allow them to better understand how to decrease potential sources of test-taking anxiety by making changes to their study and learning habits over time.

Discovering Cultural Competence

Author(s): **Dianna Miller**
Mentor(s): **Dr. Rhonda Sutton**
Poster: **36**

Due to my overall interest in studying abroad, global learning, and social connections, I chose to further develop my cultural competence in the fall semester of 2021. During the four-week span of this high impact experience, I was privileged to connect with students at other institutions around the world. While engaged in experiences virtually, I was able to focus on improving my cultural competence and overall cross-cultural awareness by participating in various exchanges with other participants. These connections allowed me to better understand the roles that culture has in shaping the norms and behaviors of culture. Through this experience, I built a framework for understanding culture, improving cultural competence, and learning about cultural dimensions. I am now able to identify my own cultural preferences while also understanding others’ cultural preferences, promote cultural awareness in various settings, and implement strategies for working across cultural differences.

Inhalation of LSC Exosomes to Treat Rodent Models of COPD

Author(s): **Megan Cislo**
Mentor(s): **Dr. Ke Cheng**
Poster: **37**

Chronic obstructive pulmonary disease is an inflammatory lung disease that causes limitation of airflow, increased mucus production, and alveolar destruction. Current treatment options for COPD are limited to only managing symptoms through pulmonary rehabilitation, supplemental oxygen, and palliative care. In order to create

a therapeutic that could reverse the attributes of COPD, we looked towards lung spheroid cells (LSC). Lung spheroid cells and their products such as secretome and exosomes have previously shown regenerative effects in pulmonary diseases such as idiopathic pulmonary fibrosis and coronavirus disease 2019. LSC exosomes (LSC-Exo) are extracellular vesicles secreted by lung spheroid cells with a unique intravesicular composition derived from pulmonary microenvironments, making them a unique nanomedicine tailored for pulmonary disease. LSC-Exo delivered via jet nebulization were able to reverse pulmonary deficits in rodent models of COPD. Pulmonary function tests post-treatment demonstrated that LSC-Exo treatment increased inspiratory capacity, increased the FEV0.2/FVC ratio, and reduced quasi-static compliance as compared to control groups. These results signify an increase in overall pulmonary function in the lungs, as inspiratory capacity and FEV0.2/FVC ratio are decreased in COPD patients while quasi-static compliance is increased. Additionally, H&E and PAS staining revealed that airway thickness and mucus hypersecretion due to goblet cell hyperplasia were decreased in COPD models receiving LSC-Exo treatment compared to COPD model controls. Our results suggest that LSC-Exo can serve as an inhalable biotherapeutic for treating and reversing the pathophysiology of COPD.

Characterization of Anti-SARS-CoV-2 Metabolite Profiles in Various End Products of Green Teas

Author(s): **Emily Ye**
Mentor(s): **Dr. Deyu Xie**
Poster: **38**

Tea products from the green tea plant (Camelia sinensis) is one of the most popular nonalcoholic beverages around the world given its cheap cost, easy accessibility and numerous health benefits. Our recent investigations reported that flavan-3-ols extracted from green tea were promising pharmaceuticals for the therapy of COVID-19. The mechanism was that they inhibited the main protease activity of the contagious severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) and stopped the replication of the virus. There are numerous end green tea products in the market consumed by the general public. Whether or not various green tea products have the same anti-COVID-19 activities remains uninvestigated. We hypothesize that various green tea end products have different anti-SARS-CoV-2 activities. To prove this, we selected popular green and black loose leaf tea products to test their anti-SARS-CoV-2 activities. Tea products were extracted with organic solvents. The resulting extracts were analyzed with HPLC-qTOF-MS/MS to profile flavan-3-ols, such as epigallocatechin gallate (EGCG), epigallocatechin (EGC), epicatechin (EC), epicatechin gallate (ECG), catechin (CA), and others. Quantification showed that green tea products had significantly higher contents of EGCG than black tea products. In contrast, black teas had higher gallic acid content than green teas had. Green and black tea products had similar levels of CA. The contents of ECG

were similarly detectable in green and black teas. Given that EGCG is a main active anti-SARS-CoV-2 compound, our data indicate that green teas likely have a better anti-COVID-19 activity than black teas.

Demographics of Cases Presented to an Emergency Veterinary Hospital

Author(s): **Ashley Kropf**
Mentor(s): **Dr. William Flowers**
Poster: **39**

Due to the pandemic, many emergency veterinary hospitals are overwhelmed with patients. This study was designed to characterize the demographics of cases presented to an emergency room of a veterinary hospital in order to allow them to more effectively allocate staff and other resources. Health records of emergency cases seen during the summer of 2021 (n=110 cases in May, June, July and August) were downloaded from the hospital's IDEXX Cornerstone software. Data associated with the chronological (month, day, time); animal history (type, age, home environment); veterinary diagnostic (owner's reason for visit, veterinary diagnosis) and treatment (laboratory, imaging, prescription, hospitalization, follow-up visit) characteristics of each case were analyzed using general linear mixed model procedures for binary data (proc glimmix) using SAS. Digestive problems were the majority of cases (30.3%, $p < 0.05$) followed by skin problems (21.1%) and locomotion problems (15.2%). These were likely to involve dogs (80.9%; $p < 0.05$) that lived indoors (91.4%, $p < 0.05$) and were the only pet at home (43.3%, $p < 0.05$). Laboratory work, imaging/x-rays, and hospitalization were required in only 30.9%, 17.5%, and 7.3% of cases, respectively ($p < 0.05$) while medications were prescribed in 72.2% of cases ($p < 0.05$). The most common reason for owner's bringing their pet to the emergency hospital was a urination/defecation problem (19.4%) while the most frequent veterinary diagnosis was a digestive problem (30.3%). In summary, the majority of visits to this emergency hospital during the summer involved dogs with digestive problems that required medications.

Qualitative Analysis of Healthcare Experiences and Support among Women with Gestational Diabetes Mellitus

Author(s): **Jenny Iruela**
Mentor(s): **Dr. April Fogleman**
Poster: **40**

Gestational diabetes mellitus (GDM) affects approximately 9% of pregnant women in the United States. Over the past few decades, the prevalence of GDM has increased alongside obesity leading to higher incidences of negative maternal and infant outcomes. While there is a lot of current research supporting the standard of

practice for GDM, there is a lack of literature discussing the healthcare experiences of women with GDM. This is a vital topic to study as it can help providers better understand how to effectively manage GDM, improve the quality of patient care, and decrease negative maternal and infant outcomes. The purpose of this study is to conduct a qualitative analysis on the healthcare experiences of women with GDM and identify the types of support and management methods their providers utilize while identifying gaps in the care received. Data were collected through qualitative in-depth interviews via Zoom. Purposive sampling technique was used to recruit participants by posting an online flier and survey in Facebook groups centered around maternal health. Inclusion criteria were women who must have an age ≥18 years, reside in the United States, and have a current or previous diagnosis of GDM. Thematic analysis was conducted to analyze and interpret data. The results of this study include themes that identify recurrent patient experiences within GDM management, areas in which patient care needs to be improved, and the common resources providers recommend.

Examining Research Techniques in Neuroscience: Stereotaxic Surgery, Central Drug Delivery, and Optogenetics

Author(s): **Reshma Goud, Kaylin McKeown, Lindsey Frye, Gracie Ford, Katherine Stalford, & Anna Thomas**
Mentor(s): **Dr. Casey Nestor**
Poster: **41**

The field of neuroscience has pioneered many techniques such as stereotaxic surgery, central drug delivery, and optogenetics to investigate brain function to identify and treat neurological diseases. Indeed, stereotaxic surgery is a surgical intervention that allows scientists to pinpoint small targets within the body including specific brain areas in living organisms. This method has advanced neuroscience in areas of radiation therapy and drug delivery. While surgical intervention is a viable option, use of peripheral medicine has valuable potential. Furthermore, while the central nervous system (CNS) is impacted by numerous diseases, peripheral treatment can be challenging because of the blood-brain barrier. Bypassing this barrier with central drug delivery enables treatment of disorders by achieving a therapeutic response through the central delivery of a selective active pharmaceutical ingredient. However, conventional central drug delivery tends to be unable to achieve sustained release and suffers from plasma drug level fluctuations and poor bioavailability. Thus, novel approaches are being utilized to improve this system. As research and treatments continue to evolve, neuroscientists have developed tools with both precision and accuracy. For example, optogenetics targets photosensitive proteins at the neural-specific targets, as opposed to classic non-specific approaches such as electrical stimulation. By using light to target genetically inserted opsin proteins, optogenetics serves to target selected neural

networks and manipulate biological functions at the cellular level. While this technique is still in an infancy of use in humans, it has powerful applications in neuroscience, cardiovascular, and a broad range of clinical research areas across several biomedical models.

Evaluating Depression, Anxiety, and Stress in Pre-veterinary Students using DASS-21

Author(s): **Georgia Daniel & Linzi Long**
Mentor(s): **Dr. Shweta Trivedi**
Poster: **42**

Various factors including compassion fatigue, burnout and financial stress have led to a decline in the mental wellbeing in the veterinary community. While veterinary wellbeing has been studied, pre-veterinary mental wellbeing in American universities has not. A Qualtrics-based survey was distributed in Fall 2021 as a pre-test in September and a post-test in November utilizing the Depression Anxiety Stress Scale (DASS-21). Out of 233 pre-test and 184 post-test respondents, 166 pre-veterinary students responded to both surveys. Severe or extremely severe levels of depression were present in 23.2% of pre-test respondents and 34.5% of post-test respondents. The highest levels of anxiety were experienced by juniors (51.4%, 52.1%) reporting severe or extremely severe symptoms. Extreme or severely extreme anxiety was present in freshmen (27.3%, 33.3%), sophomores (41.5%, 36.6%), and seniors (31.9%, 40.0%). Seniors (34%, 35.6%) and juniors (28.6%, 45.8%) were shown to have their levels of severe or extremely severe stress increase in the post-test compared to the pre-test. The results from this study can inform universities of the mental health factors to focus future preventive measures on.

The Environmental and Economic Role of Historical Hemp Production in Rural France

Author(s): **Katelyn Bohn**
Mentor(s): **Dr. Seth Murray**
Room: **3210**

Prior to the wide-spread adoption and commercial availability of cotton clothing after World War I, hemp cultivation was an integral part of the domestic farming economy and society in the late 19th-century and early 20th century in Burgundy, France. The impacts of hemp production are illustrated in government agricultural reports available in municipal and regional archives. Notably, these reports detailed whether farmers would receive an annual subsidy from the government for their hemp production based on the amount cultivated, and included audits of these declarations by municipal employees. These archival documents also reveal concerns about water quality and environmental conditions that influenced crop quantity and quality. Research was primarily conducted on written documents and quantitative data from 1881 to 1907 in the French villages Toulon-sur-Arroux, Marly-sur-Arroux, Sainte Radegonde, and Issy-l'Évêque. Documents were manually transcribed from their original French, scrutinized for numerical errors, and summarized. Additionally, these documents were indexed for relevant information about the economic, societal, and environmental impacts of hemp production. Some documents warned about the pollution of the water system from hemp production, and some documents describe the challenging climatic conditions which caused poor crop yields. Purported tax evasion attempts by farmers, or honest miscalculations of their production which were often corrected by auditors, highlight underlying economic concerns. These written interactions between the farmers and municipal employees help us establish a detailed history of household farming in Burgundy, and reveal the strategically important role that hemp played during a period of profound change in rural France.

The Debate Over the Best Use of Public Lands Through the Hetch Hetchy Valley Controversy

Author(s): **Benjamin Harris**
Mentor(s): **Dr. Sean Cassidy**
Room: **3210**

The Hetch Hetchy Valley is located in the northwest corner of the Yosemite Valley. When it was first explored by Americans traveling west like painter Albert Bierstadt, the area was heralded as a sister valley of almost equal beauty to the more famous Yosemite Valley. Today, Hetch Hetchy and its beautiful landscape sit underwater because the valley was flooded in the early 1900s to provide drinking water for the citizens of San Francisco. The debate over whether the valley should be dammed or

not brought the concepts of preservation and conservation to the public forefront and introduced Americans to major figures in the environmentalism movement like John Muir (the leader of the preservation movement) and Gifford Pinchot (a conservationist and forester). While the story of the Hetch Hetchy Valley has often been framed as a battle between Muir and Pinchot, the fight to dam Hetch Hetchy can better be described as an argument over the best use of public lands. At Hetch Hetchy, San Francisco prevailed in its attempt to secure water for its citizens, but the public nature of the debate thrust water rights in the American West into the national spotlight. Water rights remain a contentious issue in the region, where drought conditions worsen each year and water value is constantly increasing.

Demystifying Dendrology: An Online Preparation Course Develops a Growth Mindset and Successful Strategies for Learning Tree Identification

Author(s): **Casey Wofford**
Mentor(s): **Dr. Steph Jeffries**
Room: **3210**

Many students taking Dendrology for the first time have not had previous experience with learning plant identification. This can be an early setback in an important course that is required for several undergraduate programs. We developed a four-week, online preparation course to increase student confidence and share successful strategies for learning plant identification. The main focus was on basic vocabulary, use of effective study strategies, and identification of key characteristics within species. Students practiced these skills by learning 30 tree species while utilizing flashcards, guided notes, and our ILEX (Identify-Learn-EXplore) practice tool. We surveyed students at the end of the preparation course and at the end of the main Dendrology course to assess the effectiveness of this approach. Results from 31 students who completed the post preparation course survey indicated that students found the prep course “extremely helpful” in understanding and applying botanical knowledge (61%), developing beginning experience with plant identification (61%), and using effective strategies to practice plant identification skills (58%). Results from 10 students who completed the post dendrology survey Exposure to different practice strategies and identification tools in the preparation course helps students develop a growth mindset that enhances their success in Dendrology.

Something on the Way to Becoming Something Else: The Agency of Objects in Textile Making and Memory Preservation

Author(s): **Lara Rabinowitz**
Mentor(s): **Dr. Kate Nartker**
Room: **3221**

This creative study explores the idea that objects have agency– the power to act upon and affect others. The concept arises from new materialism, an interdisciplinary field that seeks to correct the notion that objects and materials are passive and separate from humans, and instead emphasizes how materials have the ability to act upon us. In the study, the student-maker worked with the TC2 loom and an assemblage of artifacts from daily life to explore how objects can be transformed into new creations. For each creation, the vitality of the object, along with textile materials, technology, and nonmaterial factors led to the creation of end products embedded with memory, affectivity, and new meaning. The study includes a reflection upon the creative process, drawing on ideas from assemblage theory. Key findings include: 1) assemblage theory can be applied to the textile making process; memories, ideas, objects, materials, and processes can literally be woven into new textiles, 2) everyday objects compel us to create new objects; these new objects can hold meaning and may have new uses and agency, 3) the TC2 loom creates a state of flow and allows new creations to materialize; the maker and the machine act upon each other– neither knows how colors, materials, and weave structures will turn out– it is a mutually constituting experience.

The Lovers

Author(s): **Leeman Smith**
Mentor(s): **Dr. Traci Lamar**
Room: **3221**

The Lovers is a project focused on developing my textile design senior collection. The collection represents a deep exploration into the connection between the different levels of self and how they interact with each other to culminate in a true and self-actualized individual. This collection is an art installation composed of three large-scale, wall sized textile tapestries created with a variety of textile crafts. I will be exploring the techniques of applique quilting, digital knitted design, digital printing, hand tufting, hand embroidery and embellishment, couching, as well as beading. For this collection I intend to use natural materials such as cotton, wool, and found materials that would otherwise be wasted. Natural materials are vital in the practice of magick and self-discovery, they help engender a positive journey in life and bring you closer to the earth's power (Amber K., 1991). This collection is inspired by my love of textile tapestries, hand crafting, explorative art, and my lifelong interest in the magickal arts. In this collection I utilized imagery of the magickal arts to reconcile

with the sides of myself that I feel are half-male and half-female. This collection was created to establish a visionary experience through the use of textile crafts and technology that explores the three levels of the self and how they interact while trying to balance the sacred relationship that exists between femininity and masculinity.

Observing handedness between species and sex of Brown lemurs, Red-ruffed lemurs, and Ring-tailed lemurs

Author(s): **Natalie Deans**
Mentor(s): **Dr. Vivek Fellner**
Room: **3222**

For years, scientists have been trying to answer the question of whether non-human primates exhibit handedness or not. The term “handedness” refers to the preference of using either the left or right hand more than the other. The majority of research on handedness has been done with Great Apes, who tend to demonstrate right-hand preference. There has been some research with Ring-tailed lemurs, which found that they tend to exhibit left-handedness. However, there has not been any research comparing handedness between different species of lemurs. In this project, three species of lemurs at Roer’s Zoofari were tested for handedness. Based on current research with Ring-tailed lemurs, my hypothesis was that all three species would demonstrate left-hand preference. There were 2 Ring-Tailed lemurs (2 females), 3 Brown lemurs (2 females and 1 male), and 5 Red-ruffed lemurs (3 females and 2 males). Pieces of fruit were placed on the ground through the bars of the cage, and the hand they used to first grab/hold the fruit was recorded in nine trials. It was concluded that all the lemurs as a whole exhibited left-hand preference. This aligned with my hypothesis. In terms of individual species, Red-ruffed lemurs demonstrated left-handedness, but Ring-tailed lemurs and Brown lemurs did not have statistically significant results to conclude that they are left-handed. Therefore, they could be considered “ambidextrous,” or have no preference. Both males and females exhibited left-handedness, with a higher percentage of males than females showing left-hand preference.

Conserving the Crystal Skipper: Vegetation Analyses and Steps to take to Conserve a North Carolina Endemic Species

Author(s): **Virginia Barnes & Maggie Hart**
Mentor(s): **Dr. Carol Price**
Room: **3222**

The crystal skipper is an endemic butterfly only found on the Outer Banks of North Carolina. Their range stretches approximately thirty miles from the dunes of Radio Island along Bogue Banks and on Bear Island at Hammocks Beach State Park. This

species has struggled in population size because of beachfront urbanization which affects flight patterns and habitat areas used as stepping stones to connect larger populations. Over the course of the past year, the goal of our study was to advance our knowledge on the status of skipper populations, the quality of their habitat, and to identify conservation solutions to help strengthen populations. Extensive vegetation sampling was conducted using quadrats at twelve locations. Following sampling, we conducted a Shannon Diversity Index of each location to assess the status of species biodiversity of each site as well as species frequency. Population sampling consisted of using the Pollard Transect Method to count crystal skippers in both flight periods. Using the data from current and past population data, we looked for trends in skipper abundance and its relation to weather patterns. Through our study over the past year, we have been able to learn more about the status of the crystal skipper and their habitat to improve conservation strategies for the future. Using the knowledge we learned through our experiments and the help of our mentor, Dr. Carol Price, we were able to participate in a Recovery Implementation Strategy to focus on the next steps in the crystal conservation program.

Habitat Use and Reproductive Ecology of Sand Tiger Sharks in the Graveyard of the Atlantic

Author(s): **Mikayla Beeson**
Mentor(s): **Dr. Carol Price**
Room: **3222**

Sand tiger sharks, Carcharias taurus, are large, charismatic predators whose populations are globally distributed and aggregate at Northwest Atlantic coast shipwrecks, which act as artificial reefs supporting courtship, mating, and feeding along migratory routes. C. taurus have a spot pattern that is as unique as the human fingerprint, allowing for easy identification of individuals. Globally, sand tiger sharks have experienced significant declines, resulting in their listing as a vulnerable species by the IUCN Red List of Threatened Species. The Northwest Atlantic population has experienced more than 75% declines and is also listed as a species of concern by the National Marine Fisheries Service (Pollard and Smith 2009). We hypothesize that shark utilization of shipwreck reefs varies by season, age, sex, and reproductive status. We use non-invasive diver-collected photography to assess the migratory ecology and life history of C. taurus populations in collaboration with the NC Aquariums' Spot-A-Shark USA citizen science project. To do so, we analyze photographs of individuals using Wildbook, which utilizes Modified Groth and I3S machine learning algorithms to differentiate between individuals based on unique skin spot constellation patterns. Repeat records may suggest site fidelity and provide insight into their movement and behavior over time (Paxton et al. 2019). Our research is vital to understanding C. taurus habitat use, social ecology, and spatial and temporal distribution. Preliminary results suggest that the Northwest Atlantic

subpopulations are diversely spatially distributed between shipwrecks, and mixed-sex aggregations, with a higher than normal male-to-female sex ratio, emphasizing the need for effective population monitoring.

How Perspective is Everything: Microbial Ecosystems Meet Our Digital Age Portrayed Through Textile and Mixed Media Art

Author(s): **Maggie Kimmett**
Mentor(s): **Dr. Traci Lamar**
Room: **3221**

Microbial ecosystems are one of the life forms that teeter on the edge of human comprehension. Although we can't see it with our bare eyes, microbial ecosystems are a whole complex world as diverse as our own. "Microbes Meet the Digital World" is an art installation that uses a variety of textile techniques to emulate the beauty of microbial ecosystems and the structures that they take on, especially in lichen form. I juxtapose this unseen beauty against the humanistic space to pose the thought that perspective is everything.

Identifying the Composition of Secondary Endosymbionts in Different Bemisia Tabaci Populations and their Related Effects on Begomovirus Transmission

Author(s): **Elizabeth Ampolini**
Mentor(s): **Dr. Jose Ascencio-Ibanez**
Poster: **1**

Geminiviruses are a family of single-stranded DNA viruses that cause significant disease in plants worldwide. Global economic loss is several billion dollars per year and detrimentally affects global food security. Within the begomovirus genus, viruses are transmitted by the silverleaf whitefly (Bemisia tabaci). Understanding the virus-insect relationship can create a broader understanding of factors that influence viral transmission. An important part of this relationship is the presence of secondary endosymbionts in the whitefly. Endosymbiont composition in Bemisia tabaci has been shown to affect begomovirus transmission rates, but the phenomenon is not fully understood. Identifying the secondary endosymbionts present within various whitefly populations and comparing corresponding transmission rates may provide insight into a route for limiting begomovirus infections. Our study compared whitefly endosymbionts throughout the United States. Whiteflies were collected from seven locations around the United States and maintained in colonies at NCSU. Total DNA was extracted from each colony and PCR-tested for secondary endosymbionts using primers specific for Cardinium, Rickettsia, Fritschea, Hamiltonella, Arsenophonus, and Wolbachia. To confirm the results, Sanger sequencing was performed with the endosymbiont primers. Different compositions were observed across the whitefly populations. Rickettsia and Hamiltonella were present in some of the populations; Cardinium, Fritschea, Arsenophonus, and Wolbachia were not found in any populations. Continuing experiments will compare transmission of begomoviruses in colonies with different endosymbiont populations. The different compositions of secondary endosymbionts in whiteflies and the corresponding changes in transmission rates can provide might ultimately offer ways of reducing begomovirus transmission via specific antibiotics or other means.

Developing the Open Flexure Microscope for Low-Cost, In-Lab Brightfield and Fluorescent Imaging

Author(s): **Elizabeth Ampolini**
Mentor(s): **Dr. Jose Ascencio-Ibanez**
Poster: **2**

Microscopic imaging is a very basic method of experimental validation; however, these devices can be extremely expensive, and the prohibitive cost can be a significant barrier to research in laboratories with limited funding. The Openflexure Microscope (OFM) is a 3D-printable optical microscope that seeks to provide a laboratory-grade alternative to commercial microscopes for a fraction of the cost. The

open-source design offers a variety of options for both brightfield and fluorescent microscopy, with the potential for tailor-made customization. To address the Biochemistry Undergraduate Research Training Program (BURTP)'s need for quick and accessible imaging, two OFMs were constructed. 3D printed structural elements were obtained from TrnTops LLC. Hardware and optical components were purchased from various manufacturers. Software components were purchased from Raspberry Pi. Total construction time was roughly 8 weeks and followed instructions provided by the OFM website. A brightfield, 20x OFM was created and a GFP-sensitive 5x fluorescent OFM is currently being constructed. The 20x OFM was used to generate images of various plant tissues exposed to geminivirus infection. Customization included adding a dimmer to each light source for easy exposure change and modifying parts to allow light source swaps. Ultimately, the OFM has provided an accessible and high-quality alternative to commercial microscopes. These OFMs will streamline the imaging workload for the BURTP lab.

Effects of Plasmid and Mutagenic Primer Concentrations on Transformation of a Mutated Geminivirus Infectious Clone

Author(s): **Ethan Gates**
Mentor(s): **Dr. Jose Ascencio-Ibanez**
Poster: **3**

"We want to produce a mutagenized plasmid to facilitate geminivirus inoculation for evolution studies. The mutation is on the viral Rep protein which regulates replication of geminiviruses. When a host plant is infected with this mutation, it will initially appear healthy, but will suddenly show symptoms, although much later than the wild type. This is due to a phenomenon known as reversion, where the mutated viral sequence, now present in the host cells, mutates in such a way that its original phenotype is restored, i.e., the plants show symptoms. This reversion may occur in the original mutated site or at a different position in the protein (second site reversions). We used a site directed mutagenesis method. Primers were designed with a single point mutation to change the desired sequence and were PCR amplified with the wild type plasmid as a template. Four different concentrations of primer and plasmid were tested to maximize success of the mutagenesis reaction. Each treatment was transformed into E. coli XL10-Gold Ultracompetent Cells according to the Agilent Quikchange II XL mutagenesis and transformation protocol. Each treatment of cells was plated on selection media and left to grow overnight. Colonies were grown from each plate and 12 colonies were chosen at random for plasmid purification with the aim to find some that contain the mutation. Once plasmids are purified, they will be subjected to PCR and Sanger sequencing to verify the presence of the mutation. If successful, we will use them for geminivirus evolution and diversity studies."

Partial Characterization of infectious clones of Pepper Huasteco Yellow Vein and Pepper Golden Mosaic Viruses in Tomato Lanai

Author(s): **Ashley Kim, Trisha Natarajan, Emely Pacheco, Reshma Goud, & Whitney Pesce**
Mentor(s): **Dr. Jose Ascencio-Ibanez**
Poster: **4**

Begomoviruses are a genus of Geminiviruses that are circular, ssDNA plant-infecting viruses that are mono or bipartite. Geminiviruses are a threat to agriculture causing damage globally to a variety of plants. Infectious clones of the bipartite begomoviruses Pepper Golden Mosaic (PepGMV) and Pepper Huasteco Yellow Vein (PHYVV) were received from collaborators and partially characterized in tomato Lanai, Poblano and Habanero peppers. Initially, the infectious clone's DNA was transformed into E. coli DH5 α strain by electroporation, followed by a plasmid miniprep. DNA restriction enzymes were utilized to confirm the cloned viruses in agarose gel electrophoresis. Once confirmed, the viral DNA was prepared for biolistics using 1µm golden particles. Both viruses were tested on tomato Lanai to determine if an infection was induced and if the tomato Lanai was a susceptible host for PepGMV and PHYVV. The first round of biolistics was performed at 60 psi and was not successful in tomato Lanai, therefore the pressure of delivery was increased to 120 psi. Tomato Lanai was confirmed as a host for PepGMV and PHYVV. The infection is being further characterized by PCR and Sanger sequencing and by analyzing the ploidy status in infected leaves. Geminiviruses have been shown to induce higher ploidy status by inducing DNA replication while inhibiting mitosis in a phenomenon called endoreduplication, but not all geminiviruses induce the same level of higher ploidy. PepGMV and PHYVV geminiviruses increase the battery of pathogens that can be used to inoculate and assess biotic stress in tomato Lanai.

Storage Stability of Liquid Media in Comparison to Rehydrated Powder Media

Author(s): **Seo Young Yang, Rachel Gooley, Alyssa Frostbutter, & Ayah Samara**
Mentor(s): **Dr. Morgan Caudill**
Poster: **5**

Due to the COVID-19 pandemic, KBI Biopharma experienced supply chain issues and could not easily access liquid CHO cell media. As a result, they transitioned from using the liquid version to the powder version that would be rehydrated in-house before use. Since rehydrated powder media has not been well studied, the actual shelf life is unclear. Therefore, an accelerated shelf life study was conducted in order to use the rehydrated powder media to its full extent. The proposed experiments investigated stability of liquid media compared to the rehydrated powder media of the same brand. The media brands commonly used by KBI Biopharma, BalanCD CHO Growth A Medium, Dynamis AGT Medium, and HyClone™ ActiPro™ Cell Culture

Media, were prepared for the experiment. The project analyzed shelf life by observing how the physical and chemical composition of the rehydrated powder media product of the same brand changes over time at different temperature conditions compared to its liquid media counterpart. The physical characteristics that were evaluated were pH and osmolarity and the chemical characteristics of interest were glucose, glutamine, glutamate, and ammonia contents. Results of this study should provide insight into the variability that exists between rehydrated powder media forms and liquid media forms over time. At the time of the submission of this abstract, data from the accelerated shelf life study had not yet been fully collected and therefore results were not recorded into the abstract.

Pickling as a Preservation Method For Shrimp: Qualityand Safety Analysis

Author(s): **Anaya Ahuja, Haoyi An, Beryl Shoemaker, & Taylor Lanier**
Mentor(s): **Dr. Alexander Chouljenko**
Poster: **6**

Shrimp is one of the most widely consumed seafoods in the United States and its popularity is increasing throughout the world. While being popular, shrimp is highly perishable. North Carolina has an abundance of small-scale fishermen and seafood processors. A pickled shrimp product developed for the commercial market would support small-scale fisheries and processors to extend shelf life and allow for off-season availability of shrimp products. Pickled shrimp is not currently available in the marketplace, and there has not been much research done on this topic. This project explores how the quality of white shrimp (Litopenaeus setiferus) can change throughout the brining and pickling processes by examining various parameters including weight gain/loss, moisture content, salt content, protein content, pH, microbial counts, water activity, and texture. This is carried out in 2 phases: brining (1) and pickling (2). Phase 1 compared three different salt brining concentrations (8, 16, and 26%; 0% control) for 24 and 48 h. Results indicated that brining shrimp in 8% salt solution for 48 h resulted in the most weight gain and highest moisture content. These brined shrimp were then pickled in phase 2. Phase 2 explores pickling with different flavor additions (ceviche and citrus inspired) in solutions containing 5% acetic acid vinegar and 8% salt for 4 weeks. Shrimp are measured during refrigerated storage time for weight gain/loss, pH, microbial content, salt content, protein content, water activity, and texture. Phase 2 is currently being conducted and is expected to be complete by 4/15/22.

Biodiversity benefits of ecosystem engineers are negated by invasive predators and anthropogenic disturbance

Author(s): **Claire Waters**
Mentor(s): **Dr. Michael Cove**
Poster: **7**

Ecosystem engineers play vital roles in community assembly by modifying the environment to create habitat for themselves and for various other species. Woodrats (Neotoma sp.) all build and maintain intricate stick-nests that stockpile organic materials and create habitat for other small species but the value of these nests for biodiversity is rarely studied. The Key Largo woodrat (Neotoma floridana smalli) is an insular endangered subspecies endemic to Key Largo, Florida, USA, that has undergone substantial declines due to habitat loss and exotic predators. We leveraged data from a distribution-wide camera trap monitoring grid to survey the migratory and resident bird community visiting supplemental woodrat nest structures in their last remaining habitat. We evaluated the role of woodrat nest use and woodrat stick-nest building on bird abundance using generalized linear models (GLMs) with Poisson distributions. We predicted that woodrat occurrence and nest building would positively correlate with bird diversity and abundance due to the habitat structure that supports prey for birds. We compared the relative support of woodrats to other external environmental, anthropogenic, and exotic predator factors. Bird relative abundance was positively associated with woodrat supplemental nest use and stick-nest building. However, these positive associations were negated by the presence of domestic cats (Felis catus), an exotic predator, and by proximity to human development. Therefore, we provide evidence that woodrats are supplying an ecosystem service in creating foraging grounds for resident and migratory birds, but this positive relationship is overridden by domestic cats and people.

RNA Expression of an Uncoupling Protein after Cold Exposure in Drosophila

Author(s): **Raven Yurtal**
Mentor(s): **Dr. Patricia Estes**
Poster: **8**

Recently emerging cryotherapy and cold-exposure treatments may provide viable means of combating obesity by increasing fat metabolism. This is based on the concept of non-shivering thermogenesis, a process by which mammals control their body temperature under cold exposure before and after shivering thermogenesis. UCP1, found primarily in mammalian brown adipose tissue, is the primary trigger of this process and is linked to increased fat metabolism. Drosophila lack UCP1, but UCP4A is a related gene in the fly genome that we hypothesized will show increased expression under cold exposure. We used Drosophila with silenced sim, a gene

linked to the function and development of the paraventricular nuclei within the hypothalamus, which is involved in autonomic responses and functions such as fat metabolism and appetite, as our model. Similar mutations in mice result in hyperphagy, obesity and hyperinsulinemia, suggesting sim silent Drosophila are appropriate models for obesity and diabetes. We measured expression of UCP4A across the male Drosophila lifespan and their longevity at 4℃. Preliminary data suggested that UCP4A expression increases with age in Drosophila kept at room temperature and decreases slightly when kept cold. Silent sim Drosophila had shortened longevity compared to the wild-type controls at room temperature. When the silenced sim Drosophila and wild-type were kept at 4℃, both genotypes had longevity similar to room temperature controls. UCP4A expression did not increase with cold, suggesting that it might not be similar to mammalian UCP1. Our data suggests that cold has an effect, via an unknown mechanism, on longevity in Drosophila.

Determination of ROx Water's Influence on E. coli CellBiomass Yield and Growth Rate

Author(s): **Darbi Adcox, Sung Kim, Will Shumate, & Jacob Johnson**
Mentor(s): **Dr. Peter Ferket**
Poster: **9**

Reservoir oxygen (ROx), is a theoretical molecular bundle of Oxygen in biological systems that is distinct from dissolved molecular oxygen (O2) and may not be readily available for oxidative respiration unless chemically released by a compound that can accept an electron. ROx water is water that has been treated to produce reservoirs of oxygen. To determine the effects of ROx water on the growth rate and total cell biomass yield of Escherichia coli, cultures were grown in the presence of ROx water. Within the experiment, there were six separate cultures of E. coli. Three of the samples utilized ROx water within its media, while another three served as a control group of E. coli utilizing deionized water for media. The utilized samples of E. coli Green Fluorescent Protein (E. coli GFPUV) were provided by the Biomanufacturing Training and Education Center (BTEC). This is a non-pathogenic strain of E. coli, engineered to fluoresce under UV light. The filtration process sterilizes the ROx water to allow for shaker flask cultures to grow without potential contamination from other microorganisms. The primary goal was to measure the effectiveness of ROx water on the growth of the E. coli and determine if there was a statistically significant difference in cell culture biomass yield and growth rate.

Mining the BioOx Microbiome for BiologicalApplications

Author(s): **Thuy Nguyen, Yue Zuo, Dylan Diedwardo, & William Hernandez-Montalvo**
Mentor(s): **Dr. Peter Ferket**
Poster: **10**

BioOx Media is a liquid media composed of activated sludge and water. It is believed to provide environmental benefits including purification of the air, bioremediation of contaminated soils, and enhancing root development in plants. When used in conjunction with BioOx Air Cleaning Units, BioOx is capable of decontaminating the air. The decontamination occurs when particles enter the bioreactor and come into contact with enzymes from BioOx media. This begins the oxidation process, turning harmful particulates into safer compounds. A specific type of media, named the BOx/ROx (Booster Oxygen/Reserved Oxygen) water, is composed of the original BioOx Media and hydrogen peroxide. The use of hydrogen peroxide kills certain bacteria, creating a more superior BioOx with increased oxygen levels, surpassing levels found in normal environmental conditions. As a result, ROx water contains a limited amount of microorganisms compared to BioOx. It is believed that this microbial community contains the most important microbes required for BioOx to work. However, there is very limited knowledge of the microbial composition found in the biomass, as well as particular metabolic processes that facilitate the oxidative process. By sequencing samples from both the media and bioreactor, specific microbes are able to be identified. This identification allows for analysis and comparison of the microorganisms found in the data. Determining these microbes allow for potential cultivation without reliance from wastewater treatments. Additionally, understanding the niche concept of how bacteria produce BOx and ROx can create a possible novel alternative to any system that utilizes biooxidation.

Cell Adhesion on Natural versus Synthetic Polymers

Author(s): **Katarina McGarry**
Mentor(s): **Dr. Jessica Gluck**
Poster: **11**

"The use of polymer scaffolds is expanded in the field of tissue engineering and regenerative medicine. These scaffolds provide cell sites a kick start into the healing and repairing process of damaged tissue via disease, trauma, or age. Different polymers can be used such as natural, synthetic, or biodegradable synthetics. Natural polymers have the advance of being bioactive but can also therefore cause an immune response. Synthetics are easily manipulated for different situations but are also inert, so they do not initiate cell adhesion. Biodegradable synthetics combine both qualities where they are bioactive but can also be tailored to specific situations.

This study aims to evaluate the cellular response of mouse fibroblast to a natural scaffold made of collagen fibers, a synthetic yarn made of polylactic acid(PLA), and a biodegradable synthetic scaffold consumed of polycaprolactone (PCL) polymer. The samples were analyzed to look for cell proliferation as well as interaction and adhesion to the scaffolds. Live/ Dead assay, Alamar Blue, phalloidin staining and SEM imaging were the test performed in order to evaluate the results. It was found that the cells prefer the collagen-based scaffolds overall. The biodegradable synthetic came in second and the synthetic was last. This research can further aid in the advancement of biocompatible and bioactive medical devices to help repair and regenerate damaged tissues. "

Campus Waste & Who Eats It

Author(s): **Rahul Sharma & Gwen Dallmann**
Mentor(s): **Dr. Carlos Goller**
Poster: **12**

NC State is unique in the fact that it has its own compost facility, processing up to 1,200 tons of organic waste annually. This year, we piloted a research project looking into the microbial composition of compost on NC State's campus through utilization of cutting-edge sequencing technology. We worked with Dr. Carlos Goller of the Biotechnology Program, and Matt Ball and Adam Bensley from the compost facility, to learn more about the science of composting. Successful, high yield extraction of genomic material from soil-like materials is difficult due to recalcitrant properties like high levels of lignocellulose and humic acids. This led to the testing of different transfer and storage protocols to efficiently stabilize and preserve the microbial content, as well as experimenting with many different extraction and lysis methods, followed by multiple quantification methods to ensure high yield and presence of high molecular weight (HMW) DNA. We focused on optimal sample collection, extraction methods, and troubleshooting, as well as an in depth literature review. We successfully extracted metagenomic material and sequenced it using Nanopore technology, resulting in an initial map of the microbial composition of compost soil from NC State composting facilities. This year we developed a high-throughput workflow to be implemented by next years' interns, who will continue to establish a timeseries of the composting process and embark on metabolic modeling and other bioinformatics processes to glean further knowledge from sequencing data. This project is one of eight within the Campus as a Classroom program at NC State.

Analyzing the cellular response to confinement

Author(s): **Samhitha Gali**
Mentor(s): **Dr. Christophe Guilluy**
Poster: **13**

How cells adjust their growth to the spatial and mechanical constraints of their surrounding environment is central to many aspects of biology. During solid tumor progression, cells experience high levels of compressive forces. Our group recently observed that application of compressive forces on the nucleus activates the transcription factor AP1 which in turn stimulates cell cycle progression. However, the mechanosensitive mechanisms that mediate this response are unknown. To assess this cellular response to mechanical force, we developed an experimental system that confine cells and apply compressive forces on their nuclei. In this context, my objective was to validate this experimental system by analyzing its effect on nuclear morphology using fluorescence imaging. Based on the data collected, we observed that the nuclei of confined cells have an increased projected area compared to the nuclei of control cells, indicating that our system efficiently flatten the cell nuclei. In addition, my preliminary results indicate that confinement increases tyrosine phosphorylation in cells. I am now pursuing this work and investigating the signaling pathways that are activated in response to confinement. This work may help understanding how cells respond to compressive forces during solid cancer development.

C/EBP Suppresses the Type-1 Interferon Response to Inhibit Caspase-8 Mediated Apoptosis in Response to DNA Damage

Author(s): **Sophia Gray**
Mentor(s): **Dr. Jonathan Hall**
Poster: **14**

Apoptosis is a form of regulated cell death and is a crucial biological function that removes damaged cells from an organism. One hallmark characteristic of cancer is the evasion of apoptosis, and this is what allows cancer cells to rapidly multiply and eventually give rise to tumors. Two forms of apoptosis are known today: intrinsic and extrinsic apoptosis. Intrinsic apoptosis is mediated by the mitochondria and is characterized by cleavage of caspase-9 followed by caspase-3. Extrinsic apoptosis is mediated by a family of transmembrane receptors called death receptors and results in activation of caspase-8 followed by caspase-3 to ultimately kill the cell. We have implicated the CCAAT Enhancer Binding Protein Beta (C/EBP) transcription factor in the regulation of extrinsic apoptosis in mouse epidermal keratinocytes (Balb/Mk2 cells). We have found keratinocytes that lack C/EBP displayed increased caspase-8 and caspase-3 activation following treatment with a DNA-damaging UVB radiation. Previous work in our lab showed that C/EBP regulates the keratinocyte type 1 IFN

response. Interferon signaling is critically important, as it alerts the body of an infection and aids in the dismantling of viral nucleic acids. In addition to antimicrobial and antiviral responses, the IFN response has also been shown to be activated by DNA damage. We found that the increased caspase-8 and caspase-3 activation we observed in keratinocytes lacking C/EBP is dependent on a type-1 interferon response, highlighting a novel convergence of the interferon and DNA damage induced apoptosis signaling pathways.

Impact of a Virtual Case Study on Student Understanding of Multi-Generational Pedigree Analysis

Author(s): **Abby Hodges**
Mentor(s): **Dr. Chris Halweg**
Poster: **15**

As colleges adjusted to virtual learning during the COVID-19 pandemic, a need for interactive virtual tools also increased. This study sought to determine the impact of a virtual, interrupted case study with personalized feedback on students' understanding of multi-generational pedigree analysis in an undergraduate introduction to genetics course at North Carolina State University, USA. Previous studies on the effectiveness of in-person, interrupted case studies suggested that the intervention would increase student understanding, as measured by higher post assessment scores from students compared to pre-assessment scores. We obtained 217 pre and post-assessment student scores on pedigree-related questions that were addressed in the case study, and found a significant difference in the average student score between the two assessments. Additionally, over ninety percent of students expressed through a post-assessment survey that they believed they learned more about pedigree analysis with this interrupted case study approach. Over half of the participants also stated that they preferred the case study over a traditional lecture. This virtual, interrupted case study approach was effective for students in understanding the specific learning outcomes created regarding multi-generational pedigree analysis, specifically those related to assuming genotypes on a pedigree and calculating genotype probabilities. With this in mind, there is relevance for instructors to expand their types of teaching methods to virtual case studies as they increase their use of online resources.

Correlation Between SEGS-1 Episomes and Cassava Mosaic Disease Progression in TME3 Cultivar Infected with EACMV

Author(s): **Grace Winesett**
Mentor(s): **Dr. Linda Hanley-Bowdoin**
Poster: **16**

Geminiviruses are single-stranded DNA viruses that infect a variety of crops including cassava, which is a staple crop in sub-Saharan Africa. Cassava Mosaic Begomoviruses (CMBs) transmitted by Silverleaf whitefly vectors are responsible for Cassava Mosaic Disease (CMD), which limits cassava production across Africa. CMBs have bipartite genomes with the DNA A component encoding proteins required for replication and the DNA B component encoding proteins that control movement in host plants. Many CMB-resistant cassava have the CMD2 locus. However, SEGS-1 (sequence enhancing geminivirus symptoms), a sequence that occurs in the cassava genome, can enhance CMD symptoms and overcome CMD2 resistance. Additionally, the presence of SEGS-1 has been associated with an increase in viral DNA accumulation and SEGS-1 can occur as a circular episome in infected cassava. This study aims to determine the relationship between episomal SEGS-1 and CMD severity in TME3, a CMD2 cultivar, during infection by East African Cassava Mosaic Virus (EACMV) - Kenya. Some infected TME3 plants exhibited mild to severe CMD symptoms despite the presence of the CMD2 resistance locus. The data collected was used to analyze the progression of viral infection in relation to the presence of SEGS-1 episomes. CMD symptoms peaked between 21 and 28 days post infection (dpi) before recovering, similar to the trends observed for viral DNA levels. SEGS-1 episomes were also detected at 28 dpi. This indicates that although SEGS-1 breaks resistance to EACMV, infected TME3 plants began to recover and exhibit healthier leaves after 28 dpi.

Outta-the-Box

Author(s): **Yueyue Jiang**
Mentor(s): **Dr. Gabriel Harris**
Poster: **17**

The goal of the Outta-the-Box project is to provide a science kit to Middle school students in order to expose them to food science. The kit will guide students through the fermentation process, which is a millenary food preservation method. The box includes a fermentation kit, student and teacher guides/manuals, and recipes for making pickles. In addition, the kits will include test tools, for example, pH test strips, Aerobic Plate Count materials, and lactic acid petrifilms to help students and teachers get a some understanding of their data. While the science kit currently contains guides for both students and teachers, there is an opportunity to make the guides more attractive by designing them into games with the goal of being both interactive and intuitive. The initial beta testing was conducted to assist in creating a

recipe for fermenting cucumbers. The following three salt ranges were used, 3%, 6%, and 9%, and were mixed with cucumbers in a proportion of 55% v/v cucumbers and 45%v/v brine solution. Initial results indicated that 6% salt concentration is superior, which produced pickles close to the desired end-product when compared to 3% and 9%. Based on these results, adjustments were made for the second experiment, and two salt concentrations were finalized (4% & 6%). The second part of the experiment is still in progress, therefore data will be provided in the middle of April.

Exploring Saccharomyces in Dough Environments

Author(s): **Alexxis Gutierrez**
Mentor(s): **Dr. Caiti Heil**
Poster: **18**

There is little knowledge and data available on dough yeast strains in bread domestication. Saccharomyces cerevisiae is the main commercial strain of yeast found in bread around the world. During this project, I have successfully isolated Saccharomyces cerevisiae and Saccharomyces uvarum strains from many different samples of sourdough from many countries using PCR and gel electrophoresis. I have prepared and sent off these strains for genomic sequencing so that we can compare these strains to other Saccharomyces strains and locations that have been previously studied. Currently, I am working with a PhD student in the lab to do the genomic analysis of the strains I have isolated. We are using R Studio to analyze growth assays amongst my isolates in maltose sugar. In addition, I am setting up phenotypic experiments, specifically investigating dough rise rates across my different strains. My work in the lab is done to characterize genotypic and phenotypic characteristics of S. cerevisiae from sourdough environments. Upon more studies, we will also be looking for more phenotypic traits like different tolerance levels to sugar and salt, as well as genetic traits like ploidy. Through my research, I am hoping to bring more data and different perspectives to the knowledge of the diversity of Saccharomyces.

The Identification and Analysis of Wild Nectar Yeast Strains in the Research Triangle Area

Author(s): **Lindsey Wilson**
Mentor(s): **Dr. Caiti Heil**
Poster: **19**

Mutualistic interactions between plant and pollinator species play a vital role in maintaining healthy ecosystem functions and facilitating ecological communities. The nectar composition of flowers is known to influence pollinator preference, but researchers have recently learned that intermediaries such as

yeast colonize nectar, modifying its composition and aroma. These aromas attract pollinators, who play vital roles in microbe distribution. Despite their importance, little is known about the nectar yeast strains in the southeastern United States. Thus, the primary goal of this project is to identify nectar yeast species in the Research Triangle area. Additionally, we will analyze the differences in nectar composition in urban and rural areas, which vary in plant and pollinator diversity. To investigate nectar composition, we collected samples from multiple sites in the Research Triangle. Following collection, we cultured the samples on rich media, isolated unique microbial colonies, and stored them for later use. We performed colony PCR and gel electrophoresis to determine which samples contained nectar yeast species. We then used Sanger sequencing to identify nectar yeasts to genus and/or species level. We currently have 53 confirmed samples from Fall 2021. Future directions of this study include continued sampling during the spring and autumn months and analysis of temporal effects on nectar composition. The microbes found in nectar may differ based on floral seasonality, which could be valuable for understanding seasonal pollination patterns. Combined, this research aims to provide a comprehensive examination of yeast species in local floral nectar and the potential factors influencing nectar composition.

Implications of Maternal Pre-Pregnancy BMI and Mediterranean Diet Adherence on Offspring DNA and Health

Author(s): **Annalise Hafner**
Mentor(s): **Dr. Catherine Hoyo**
Poster: **20**

Maternal pre-pregnancy overweight and obesity are associated with increased risks of poor birth outcomes that contribute to childhood and adult-onset cardiometabolic conditions. There is evidence suggesting that maternal Mediterranean diet adherence (MDA) is associated with improved maternal and offspring birth outcomes. There is also evidence indicating that maternal pre-pregnancy BMI and MDA are associated with differential offspring DNA methylation. The goal of this project was to investigate any relationships between maternal pre-pregnancy BMI and MDA with offspring DNA methylation and cardiometabolic outcomes. Mother-child pairs (n=929) enrolled in the Newborn Epigenetic Study (NEST), recruited from Duke area care facilities between 2009 and 2011. Mediterranean diet adherence (MDA) was calculated based on preconception or first trimester food frequency questionnaire data. Infant cord blood samples were taken at delivery and DNA was extracted via precipitation, subject to bisulfite conversion, PCR protocols, and sequencing to determine differential methylation at target sequences. Child blood pressure, height, and weight were taken at post-delivery follow up visits. Associations between maternal MDA and child systolic

blood pressure, diastolic blood pressure, and weight-for-height percentile by age were analyzed with t-tests. Black participants had significantly lower overall MDA and component scores for fruit, vegetable, dairy, and legume intake. No significant associations were identified between maternal MDA and child cardiometabolic outcomes. DNA sequencing to determine differential methylation was not completed within the project timeframe. Further research is needed to determine the existence and nature of associations between maternal BMI and MDA and childhood cardiometabolic outcomes and differential DNA methylation.

Rhize of Resistance: Comparison of Ralstonia solanacearum infested soil microbiomes in North Carolina tomato fields

Author(s): **Roshni Panwala**
Mentor(s): **Dr. Alejandra Huerta**
Poster: **21**

Healthy soils are defined as optimal physical, chemical, and biological conditions enabling high plant yield and soil function. This includes the diversity of interaction among organisms in agricultural microbiomes. Ralstonia solanacearum (R. sol) is a destructive soil-borne bacterial pathogen that causes bacterial wilt (BW) on tomatoes and is endemic to the Southeastern United States, including three geographically distinct tomato-growing microclimates in North Carolina: The Coastal Plain, Piedmont, and Mountain regions. BW generally appears in patches rather than affecting entire fields, however knowledge of the soil microbial community composition in pathogen-free compared to R. sol infested soils is limited. To better understand how microbes impact BW incidence in the field, we characterized R. sol populations and sequenced the soil microbial communities in the three microclimates mentioned above. R. sol was isolated and characterized via Phylotype PCR and endoglucanase (egl) gene sequencing. Illumina-MiSeq was used to sequence the 16S rRNA genes from DNA samples isolated from bulk and rhizosphere soils of pathogen-free and R. sol infested plants. Results indicate that the R. sol population in NC is more diverse than previously described, with some unique R. sol strains appearing in only one region. The soil microbial composition and diversity from collected samples will provide insight into what microbes and what soil characteristics drive BW incidence in tomato fields in the hope of improving disease management.

Invasive Fig Buttercup: A Community Approach to Stop the Spread

Author(s): **Isabella Hile**
Mentor(s): **Dr. Steph Jeffries**
Poster: **22**

Ficaria verna, commonly known as fig buttercup, was introduced to the United States as an ornamental and is now invading urban floodplains and riparian habitats throughout the East and Pacific Northwest. It was first reported in North Carolina in 2005 and has rapidly spread throughout the state, primarily from home gardens that spread along urban streams. The plant emerges in the winter and reproduces with bulblets that multiply when physical removal is attempted; therefore, it can outcompete native species and is most effectively treated with herbicides. In 2021, the WakeNature Preserves Partnership created toolkits and educational fliers for parks and public lands staff using materials from the NC Invasive Plant Council. In addition, they used social media to raise public awareness. Citizens were encouraged to document fig buttercup occurrences using iNaturalist, which helped City of Raleigh staff track and treat populations. The main goals for this year are to increase outreach to neighborhoods and more effectively monitor the spread and treatment efforts. Employees at Wake County and Raleigh Parks are increasing tracking and treatment using GIS tools to map which areas have been monitored and treated over time to create a more accurate treatment timeline. Conveying the urgency and severity of this plant at this time of the year to more neighborhoods and municipalities is crucial in order to report and treat while it's in flower and before it disappears in May. In summary, we recommend that a multi-level community approach is needed to successfully control fig buttercup.

Fresh Pasta SSOP Revision

Author(s): **Adrianne Caudill, Katie Yoon, Sydney Deloatch, & Catherine Sander**
Mentor(s): **Dr. Lynette Johnston**
Poster: **23**

Previous research found that pathogens with the ability to form biofilms are prevalent in fresh pasta manufacturing which makes effective and consistent sanitation necessary. Namely, Salmonella Enteritidis, E. Coli, yeasts, and molds are commonly targeted during sanitation. Properly written standard sanitizing and operating procedures (SSOPs) are known to increase cleaning and sanitation effectiveness in employees. Working with a North Carolina fresh pasta manufacturer, existing SSOPs were updated with increased clarity and detail. From environmental samples, coliform, E.coli, yeast, and mold were quantified and used to inform the SSOP updates. The new SSOPs were then presented to the company for them to train their employees. Due to time constraints in the project, environmental samples were not taken after implementation of the new SSOPs. NCSU food safety extension

facility will work with the company to ensure the SSOPs fit the companies needs and address all sanitation requirements.

Impact of an Interrupted Case Study with Immediate Personalized Feedback on Student Understanding of Complementation Genetics

Author(s): **Rachel Brookshire**
Mentor(s): **Dr. Whitney Jones**
Poster: **24**

With an increase in online learning in recent years there has been less direct student professor interaction, which has led to delayed personalized feedback on homework and assignments This study aims to analyze the effectiveness of an interactive case study, in the form of a website with embedded questions and immediate personalized feedback, on student understanding of complementation genetics in the Spring 2022 Principles of Genetics course at NC State University. It was hypothesized, based on previous studies on the effectiveness of immediate feedback during completion of homework (Chen et al, 2018), that the involvement of the interrupted case study in learning would increase understanding in students. This effectiveness would be seen in an increase in correct responses by students when comparing the results of a pre-assessment and post-assessment, which are designed to assess the concepts covered in the case study activity. An increase in correct responses was found when comparing the pre assessment and post assessment responses for the 322 students that participated in the study. Almost ninety-five percent of the participants also expressed through a survey at the end of the post-assessment that they believe they learned more about complementation genetics by utilizing the case study and over half of the students also stated that they preferred the virtual case study compared to traditional online lecture videos. The case study is effective in increasing students' understanding of the specified learning outcomes regarding complementation genetics.

An Interrupted Virtual Case Study to Address Student Understanding of Biochemical Pathways

Author(s): **Catherine McMahan**
Mentor(s): **Dr. Whitney Jones**
Poster: **25**

A virtual intervention website was created to support students in a hybrid learning style of a Principles of Genetics (GN 311) course amid a pandemic. The case study would allow insight into the efficacy of online learning to see how effective the virtual experience was in helping students better understand a challenging topic, biochemical pathways. This project contained a pre-assessment and a post-assessment, targeting learning objectives, to measure their understanding of

biochemical pathways before and after use of the intervention website. The assessments asked questions about components of a biochemical pathway and how different mutations affect them. The intervention itself focuses on how biochemical pathways function and on patients who have lysosomal storage disorders caused by mutations in the glycogen degradation pathway. Content is interrupted with checkpoint questions throughout to redirect students away from misconceptions. The post-assessment asked the same questions as the pre-assessment, in addition to several feedback questions to determine if the intervention helped their perceived understanding and how they enjoyed the activity in comparison to traditional lecture.

Effect of diet on growth parameters and endosymbiont concentration in the German cockroach

Author(s): **Ahmed Haija**
Mentor(s): **Dr. Madhavi Kakumanu**
Poster: **26**

Many insect species with imbalanced or nutrient-poor diets depend on microbial symbionts, which supplement essential nutrients and metabolites necessary for host growth and survival. Blattabacterium is a vertically transmitted endosymbiotic bacterium that lives in specialized fat body cells of cockroaches. Blattabacterium is associated with nitrogen recycling, releasing nitrogen from urea and uric acid to synthesize essential amino acids and vitamins that cockroaches use when there are limited resources. Our aim is to analyze the density of Blattabacterium in German cockroaches fed diets with different nitrogen levels, including cat chow (high N), rodent chow (moderate N), and rabbit chow (low N). We hypothesize that the Blattabacterium density will be higher in cockroaches on the N-deficient diet than on N-rich diets. We extracted DNA from various stages of the German cockroach, starting with eggs and through adults, and analyzed the Blattabacterium concentration at each stage. The effect of each diet on cockroaches was evaluated by monitoring growth patterns and molting rates. We observed that cockroaches fed on cat chow developed faster than on rodent chow, while rabbit chow-fed cockroaches took longer to develop. We also found variations in the Blattabacterium concentration among cockroaches fed on different diets. Our findings suggest that the density of the bacterial endosymbiont of cockroaches is affected by the nitrogen content of the cockroach diet. Further studies are needed to understand the mechanistic role of Blattabacterium in nutrient provisioning and survival of cockroaches.

A Hidden Defense: Prophage as a Phage Resistance Mechanism in Listeria monocytogenes

Author(s): **Alyssa McInnis**
Mentor(s): **Dr. Sophia Kathariou**
Poster: **27**

Listeria monocytogenes is a Gram-positive facultative anaerobe found in food-processing plants (FPEs) (Vásquez-Boland et al., 2001). It is the causative agent of listeriosis in humans, and though healthy people experience mild symptoms, symptoms can be life-threatening for pregnant women, immunocompromised persons, and the elderly (Mayo Clinic, 2022). Half of listeriosis cases are attributed to L. monocytogenes serotype 4b (Strydum and Witthuhn, 2015), and sequence type (ST) 382 is an emerging clone of this serotype (Chen et al., 2017). Some L. monocytogenes isolates are resistant to antibiotics and sanitizers used in FPEs (Vásquez-Boland et al., 2001). The U.S. Food and Drug Administration has recently approved the use of bacteriophage as a L. monocytogenes biocontrol (Strydum and Witthuhn, 2015). However, bacteriophage resistance in L. monocytogenes has been identified; in order to prevent resistance and increase the effectiveness of bacteriophage biocontrol, understanding the mechanisms of bacteriophage resistance, such as the presence of a prophage, CRISPR, and restriction modification systems, is important (Strydum and Witthuhn, 2015; Klumpp and Loessner, 2013). Several ST382 strains were screened against four wide-host-range bacteriophages to determine the phage resistance mechanism. Comparative genetic analysis between resistant and susceptible strains showed the presence of a prophage only in resistant strains. Adsorption assays affirmed the phage resistance mechanism is internal, further confirming the prophage as the putative resistance mechanism. The prophage was isolated using mitomycin C and purified, with the future goal of infecting susceptible strains with the isolated prophage to determine if insertion of the prophage causes phage resistance.

Bird Diversity Across a Socioeconomic Gradient in the North Carolina Triangle Area using Triangle Bird Count Data

Author(s): **Evelyn Rowan**
Mentor(s): **Dr. Madhusudan Katti**
Poster: **28**

Species diversity is an important metric that can be used to measure ecosystem stability and functionality, both of which directly impact humans. Tracking changes in species diversity is especially prevalent in urban ecosystems due to the rapidity of urbanization processes. To track these changes, bird count data from NC State's Lab of Reconciliation Ecology's annual Triangle Bird Count (TBC) was used and compared against average home prices for each year data was available. Count data for 2019

and 2021 was available for Carrboro, Cary, Chapel Hill, Durham, Garner, and Raleigh. Species richness and abundance was gathered and calculated using TBC count data at 20 locations chosen based on proximity to single-family residences. Average home price for 2019 and 2021 was calculated using the Zillow Zestimate for each house within a 40 meter radius of each TBC site. The purpose of this research is to determine the relationship between bird species diversity and socioeconomic variables - in this case, average home price. It was predicted that as average home prices increased, bird species richness and abundance would also increase. This phenomenon has been coined the “luxury effect.” However, the findings of this research oppose the patterns recognized by the “luxury effect.” To improve this line of research, a larger sample size should be used. Calculating the average home price of residences within a larger radius of each TBC site to better capture economic factors would also be beneficial.

Impact of Fructose Consumption on the Proliferation of Non-Alcoholic Fatty Liver Disease

Author(s): **Rani Shah**
Mentor(s): **Dr. Arion Kennedy**
Poster: **29**

High fructose consumption is strongly correlated with the development of Non-Alcoholic Fatty Liver Disease via increased lipid accumulation and inflammation. However, the molecular pathways driving fructose-induced inflammation are not fully understood. Fructose-induced liver inflammation depends on macrophages, however, how fructose affects macrophage function is currently unknown. To address this knowledge gap, we used two different types of macrophages, 1) J774 macrophages (a cancer cell line) and 2) primary bone-marrow-derived macrophages (BMDMs) to investigate the impact of fructose on the proliferation and survival of macrophages. We hypothesized that fructose would increase proliferation of macrophages following fructose treatment. Macrophages were treated with 5mM glucose or 5mM fructose for 24 hours. To examine macrophage survival, Ki67, a protein induced during proliferation and CHOP, a pro-apoptotic transcription factor were measured by western blotting. Protein levels of Ki67 did not significantly differ between glucose and fructose in treated J774s. BMDMs expressed F480, a cell surface marker expressed on macrophages, confirming that the BMDMs were macrophages and also expressed ketohexokinase, an enzyme involved in fructose metabolism. Similar to J774s, fructose treatment did not alter Ki67 or CHOP protein expression compared to glucose-treated BMDMs. Our findings demonstrate that fructose does not increase macrophage proliferation or induce cell death in vitro. Future studies will focus on specific metabolic pathways regulated by fructose and how macrophage phenotypes might be affected.

Coverage of Climate Change in Introductory Biology Textbooks, 1970-2019

Author(s): **Rabiya Ansari**
Mentor(s): **Dr. Jennifer Landin**
Poster: **30**

Climate change is one of the primary threats to human society, biodiversity, and ecosystem stability. Yet fewer than half of Americans see climate change as a major threat caused by our own actions (Kennedy, 2020). In this study, we use document analysis to quantify textbook coverage of climate change over five decades. We focused on four topics within college-level Introductory Biology texts: 1) amount of coverage (number of sentences), 2) start location of the topic in the textbook, 3) categorization of coverage (description of the greenhouse effect, consequences of global warming, or possible solutions), and 4) the type of data presented in figures.

We analyzed 58 textbooks, each with at least 3 editions, to emphasize texts with high market penetration. Our findings show that coverage of climate change increased to 56.9 sentences over time, most of that increase occurring in the 1990s. Our data also indicate that climate change coverage moved backward in books, rather than forward, over time. Approximately half of the coverage, from 1990 to 2019, was devoted to a general description of the greenhouse effect. While the content addressing impacts of climate change increased (21% to 34.2%), sentences dedicated to solutions peaked in the 1990s (15.5%) and then decreased in recent decades (to <2.5%). Data figures shift from presenting only global temperatures and CO2 levels before 2000 to include photographic evidence and maps. We hope this study will alert curriculum designers and educators to consider climate change coverage, especially to emphasize personal and actionable solutions.

Angelica keiskei Derived Chalcones Inhibit Coronavirus Replication

Author(s): **Lucas Laszacs**
Mentor(s): **Dr. Scott Laster**
Poster: **31**

Chalcones are α,β-unsaturated ketones commonly found in a wide range of plants. They're well known for their ease of modification and various bioactivities including antimicrobial, antioxidant, anti-inflammatory, anticancer, and antidiabetic activities, making them promising leads for therapeutic drug discovery. We investigated the ability of three chalcones, 4-Hydroxyderricin (4-HD), Xanthoangelol (XA), and Xanthoangelol E (XA-E), to inhibit coronavirus replication. We exposed Human hepatocyte-7 cells infected with Human Coronavirus-229E to various concentrations of each compound and found that both 4-HD and XA inhibited >99.9% of viral replication, with low cytotoxicity, beginning at 40 and 30 ug/mL, respectively. This

suggests that XA and 4-HD are good candidates for further study and development into therapeutic agents against coronavirus infections. XA-E exhibited 40% cytotoxicity at 30 ug/mL with less than 80% viral inhibition indicating it is not a desirable candidate for further study. Enzyme activity assays targeting the coronavirus 3-C like protease and RNA-dependent RNA polymerase represent good leads for future research to elucidate the mechanism(s) by which 4-HD and XA inhibit coronavirus replication.

The Effect of Iron Variation on Phloem Differentiation

Author(s): **Alienor Hedlund**
Mentor(s): **Dr. Terri Long**
Poster: **32**

Iron is an essential plant micronutrient that plays a critical role in plant development. Although iron deficiency causes overall stunted growth, little is known about how iron controls the development of specific developmental processes, particularly in roots. This study was conducted to examine how iron deficiency and excess affect differentiation of sieve elements within the phloem. The first step of sieve element differentiation is the thickening of the cell walls, followed by shrinkage of the nucleus, and finally, enucleation. In this study, we measured three variables in order to examine phloem cell differentiation: distance from the root tip to the beginning of cell wall thickening, from the root tip to the beginning of enucleation, and finally from the root tip to when the cells start lengthening. While measuring the thickened cell wall and the start of enucleation denotes phloem cell differentiation, measuring when the cells start lengthening indicates where the root starts maturing. Through these measurements, we calculated the enucleation ratio, which divided the enucleating cell measurement by the cell lengthening measurement, and an S/E ratio, which divided the thickening of the cell wall by the cell lengthening measurement. This analysis confirmed our previous findings that iron deficiency delays phloem differentiation, but also revealed that excess iron had a similar effect, illustrating the importance of maintaining the right balance of iron for proper differentiation.

Enzymes and Food Upcycling Applications

Author(s): **Robert Wine, Raquel Brito, Ava Mojica, & Josie Vincitorio**
Mentor(s): **Dr. Cynthia Machado**
Poster: **33**

The growing trend of food upcycling addresses food waste by minimizing the food by-products sent to a landfill destination and by using low-value food items to create commercial food products. The first objective is to determine the effect of five different enzyme treatments at various concentrations on bread made with upcycled

flours. The second objective is to determine the effect of two enzymes on the viscosity of apple puree. The third objective is to determine the effect of two enzymes on carrot juice yield. Testing protocols and methods were designed by referencing research done on similar products and using guidance from Novozymes on enzyme applications. In the first objective, the firmness of the pieces of bread were tested using a texture analyzer. In the second objective, the viscosity of apple puree was measured using a Brookfield viscometer. Lastly, total Brix and total dissolved solids in carrot juice were measured using a refractometer. Preliminary results show that treatments with Fungamyl 20, and PLG on bread samples made with oat flour increased bread volume by 5-7.8%. Bread samples made with soy flour showed an increase in volume when treated with Fungamyl 20 and PLG by 3-6%. These results will be used to represent the effectiveness of enzyme applications on food by-products for commercial use. This research verifies that enzymes can be used as processing tools to improve physical qualities, nutritional value while reducing food waste and promoting sustainability.

Designing Lineage- and Species-Specific LAMP Assay to Detect P. ramorum and P. kernoviae In Rhododendron

Author(s): **Helen Nocito**
Mentor(s): **Dr. Amanda Mainello**
Poster: **34**

Phytophthora ramorum and P. kernoviae are plant pathogens that cause similar disease symptoms on trees and shrubs in forests and nurseries. Phytophthora ramorum causes devastation in Europe and North America, while P. kernoviae has only been found in Europe. In the US alone, management and crop loss from P. ramorum infections cost tens of millions of dollars each year. Identifying plants infected with P. ramorum and/or P. kernoviae is the first step towards reducing spread. Three of the four main lineages (NA1, NA2, and EU1) of P. ramorum are present in the US and vary in distribution and virulence. Traditional methods of identifying each species and lineage are time consuming and require specialized equipment making it challenging to rapidly detect these pathogens. This experiment aims to detect P. kernoviae, P. ramorum and the NA1 lineage using isothermal loop amplification (LAMP), a much faster and more precise assay. LAMP assays previously designed to detect P. ramorum and P. kernoviae were evaluated for specificity and found effective in distinguishing P. ramorum and P. kernoviae from other Phytophthora spp. Additionally, a separate LAMP assay was designed and determined capable of distinguishing NA1 from other P. ramorum lineages. These LAMP assays will be a starting point for quick and easy identification of P. ramorum and P. kernoviae in the field. The novel NA1 assay shows the feasibility of identifying all P. ramorum lineages using LAMP, allowing for faster and more accurate tracking of the lineages throughout the US.

Exposure to Environmental Cyanotoxins Alters Motor Function Consistent with Neurodegeneration in Zebrafish Larvae

Author(s): **Rachael Bieler**
Mentor(s): **Dr. Kurt Marsden**
Poster: **35**

Harmful algal blooms are a growing problem as the warming climate increases their frequency. The cyanobacteria that compose these blooms produce cyanotoxins, which have been linked to a plethora of health issues. One such condition is the progressive neurodegenerative disease Amyotrophic Lateral Sclerosis (ALS), caused by motor neuron death. In this study we explored the effects of cyanotoxin exposure on neurological function using a zebrafish model. We exposed larval zebrafish to two of the most prevalent environmental cyanotoxins, β-methylamino-l-alanine (BMAA) and microcystin leucine and arginine (MCLR), both individually and as a mixture for 6 days. We then conducted high-throughput behavior assays to test motor function in the larvae. These revealed that the toxins caused hyperresponsiveness to acoustic stimuli, a result consistent with ALS pathology. The next part of our study will be to analyze the behavior of the same fish as adults to evaluate the long-term effects of cyanotoxin exposure, as ALS traditionally manifests over the course of many years. We will test general locomotion, startle sensitivity, and swim endurance. If motor function is significantly hindered in toxin-exposed fish, this likely would be the result of damage to motor neurons, as in ALS pathology. If there is no significant difference in adult behavior, this could indicate that the 6-day exposure was too short to cause long-lasting changes and that more chronic exposures drive neurodegeneration. This project will bring awareness to health risks posed by climate change and highlight the need for additional research investigating the environment's role in neurodegenerative disease.

The Effects of Biodiversity Loss

Author(s): **Dylan Hawkins**
Mentor(s): **Dr. Erin McKenney**
Poster: **36**

As of 2020, at least 35,765 species are faced with extinction. While the true number is unknown, it is likely much higher, and this number continues to rise due to anthropogenic impacts on the environment. This causes some scientists to suggest that we are heading towards another mass extinction event where over 75% of species are rapidly lost. Despite these grim statistics, previous mass extinctions have been caused by catastrophic events such as volcano eruptions, meteor strikes, and rapid ocean acidification. Fortunately, these current trends of climate change have been mostly caused by humans and remain within our ability to repair, through the implementation of methods such as protected areas, captive breeding/

reintroduction, and comprehensive legislation. To accomplish this goal, we conducted an extensive literature review to examine this issue from diverse perspectives. With human intervention groups have found success in bringing back species that were on the verge of extinction. Without these efforts, millions of years of evolutionary history would've been lost. In the last decade alone nearly 30 species of birds and mammals have been saved from the brink of extinction.

The Value of the Endangered Red Wolf (Canis Rufus)

Author(s): **Lauren Rooney & Justin Boehm**
Mentor(s): **Dr. Erin McKenney**
Poster: **37**

According to the U.S. Fish and Wildlife Service, red wolves, which have been named "America's wolf", are also the most endangered wolf in the world. Historic populations were decimated by intense predator eradication programs and habitat fragmentation. Recently, their small populations have dwindled further due to hybridization with coyotes, hunting, vehicle collisions, and other factors related to human interference. Currently, there are fewer than 20 red wolves left in the wild and roughly 240 in captivity. However, revising and continuing conservation efforts could lead to the revitalization of this unique species. The goal of our project is to synthesize the current conservation status and ecological importance of the red wolf, and to promote increased public outreach and education. To accomplish this, we conducted an extensive literature review to examine this issue from diverse perspectives. By explaining red wolves' unique taxonomic status, their specific ecological importance as a keystone species, and the ways in which humans have devastated them, we hope to invoke pathos and create a sense of responsibility and urge to act. The recovery of the red wolf population would provide a conservation hallmark in the southeastern United States, and a model for recovering other species close to extinction.

Examination of Arcuate Kisspeptin Neurons Following Saporin-Mediated Ablation During Realimentation in Ovariectomized Female Lambs.

Author(s): **Melina Kanelos**
Mentor(s): **Dr. Casey Nestor**
Poster: **38**

Undernutrition suppresses GnRH/LH secretion through inhibition of neurons in the arcuate nucleus (ARC) of the hypothalamus which co-express kisspeptin, neurokinin B (NKB), and dynorphin (KNDy neurons). Realimentation has been shown to reverse nutritionally-induced inhibition of GnRH/LH secretion. Since the majority of KNDy neurons express the NKB receptor, neurokinin 3 receptor (NK3R), we used a saporin-mediated method of neuronal ablation (NK3-SAP) to ablate KNDy neurons

prior to realimentation. We hypothesized that the injection of NK3-SAP into the ARC of ovariectomized ewes would result in fewer activated kisspeptin neurons during realimentation compared to controls. Fourteen prepubertal, ovariectomized ewes received bilateral injections of either NK3-SAP (n=7) or Blank-SAP (control; n=7). Feed was adjusted weekly to achieve 20% weight loss by week 13. Following restriction, animals were re-fed (1 kg/day/sheep) for two weeks with blood samples collected to determine LH concentrations. Animals were euthanized, brain tissue was perfused with 4% paraformaldehyde, and hypothalamic tissue was collected and submerged in 20% sucrose, then sectioned at 50 µm and stored in cryopreservative. Mean LH concentrations were lower in NK3-SAP animals (15.9 + 3.9 ng/ml) than controls (22.9 + 3.5 ng/ml). Using ARC sections (n=3/animal), we conducted immunofluorescence with primary antisera for kisspeptin and cFOS (a common marker of neuronal activation). While analysis is still ongoing, we have observed that NK3-SAP injected animals (n=2) have fewer cFOS expressing kisspeptin neurons than controls (n=2). In conclusion, use of NK3-SAP appears to reduce the number of activated ARC kisspeptin neurons and blunt the return of LH secretion during realimentation.

Regulation of a novel phosphate responsive transcript in Arabidopsis thaliana

Author(s): **Jeanette Pfeiffer**
Mentor(s): **Dr. Imara Perera**
Poster: **39**

Phosphate is an important macronutrient required by all living cells for vital function. In plants, phosphate is taken up from the soil by roots, and the productivity of modern agriculture is dependent on the application of phosphate fertilizers. However, phosphate is poorly bioavailable in soils and run-off from phosphatic fertilizers into surface waters and contaminate fresh and marine waterways causing severe ecological damage.
In response to low phosphate conditions, plant cells undergo broad cellular reprogramming modulated by the master transcription factor PHR1 which initiates a phosphate starvation response including changes to root system architecture, phosphate uptake, usage, and storage. Specific to this response, PHR1 binds to the conserved genomic motif P1BS, present in the promoter sequences of targeted genes.
We have identified a novel transcript expressed in the root tissues of Arabidopsis thaliana which is upregulated under phosphate stress. Interestingly, a conserved P1BS element was identified upstream of the coding sequence. To query the mechanism of this upregulation, the putative promoter region of this gene has been cloned by PCR and introduced into a luciferase based luminescence reporter construct. Site directed mutagenesis was employed to alter the sequence of the identified P1BS element.

Reporter constructs were introduced into Col-0 Arabidopsis via Agrobacterium mediated floral-dip transformation. T0 plants were screened for transgenic insertion and subsequent generations have yielded homozygous T3 lines.

Using these homozygous lines, we will monitor gene expression via the reporter protein luciferase. These experiments intend to characterize a key regulation of the phosphate stress response.

Do Arabidopsis sgr5 and frs2 Mutants Have Altered Tropic Responses?

Author(s): **Emily Schoendorf**
Mentor(s): **Dr. Imara Perera**
Poster: **40**

Gravitropism and phototropism are directional plant growth responses to gravity or light, respectively. This directed growth is mediated by plant hormones, such as auxin, that affect cell division and elongation resulting in curvature towards a stimulus. On earth, plant growth is affected by both light and gravity; however, in spaceflight, the effect of light can be studied in the absence of gravity. Previous work from our lab showed that several genes involved in light and auxin signaling (including FRS2 and SGR5) were upregulated in Arabidopsis thaliana grown in microgravity. The goal of this study is to investigate the role of these genes in plant tropisms. Mutant seed lines frs2 and sgr5 were obtained from the Arabidopsis stock center and their genotype was confirmed by PCR. For the gravitropism experiments, 6 day old wild type and mutant seedlings grown vertically on plates were gravistimulated in either the light or dark by rotating the plate by 90°. For phototropism experiments, seedlings were placed in a dark box with a unidirectional blue light source. Plates were imaged before, during, and after stimulation. We quantified root and shoot growth from scanned images of the plants, and will compare the growth of wild-type to mutant plants. These results will help inform the choice of mutant plants for future gravitropism and phototropism experiments and could identify key players in light and gravity signaling.

CRISPR/Cas9-Mediated pycr1b Mutations in Zebrafish as a Model of Human Microcephaly

Author(s): **Karl Hill**
Mentor(s): **Dr. Antonio Planchart**
Poster: **41**

Microcephaly is a devastating and debilitating craniofacial developmental disorder. Familial studies in humans have found a correlation between homozygous PYCR2 (which encodes a protein involved in proline biosynthesis) mutations and incidence of the disorder. Previous experiments in zebrafish (Danio rerio) utilizing morpholino

knockdowns of pycr1b, an ortholog of PYCR2, recapitulated the microcephaly phenotype. As off-target effects from morpholinos cannot be ruled out, a knockout is necessary to confirm the relationship. Previous human cell line knockouts of PYCR2 utilizing CRISPR/Cas9 have demonstrated increased rates of apoptosis, showing that cell death resulting from mutant PYCR2 genotypes may contribute to microcephaly. In this project, we leveraged the CRISPR/Cas9 system to generate a knockout of pycr1b. Here we report preliminary data indicating that we have generated novel pycr1b mutant alleles in an F1 population of D. rerio. Of particular interest is an allele with a deletion of a 5' intron splice site, which may result in skip splicing that eliminates the start site of translation. The continuation of this project will consist of the breeding of homozygous mutant pycr1b populations that we predict will present a high incidence of microcephaly. Results from these experiments may further support the connection of PYCR2 to human microcephaly and create a line of mutant D. rerio to serve as a model for further microcephaly and associated pathways.

The Long Isoform of AT1G31540 NLR from Arabidopsis Accession Pla-1 Specifically Confers Resistance to Geminivirus Infection

Author(s): **Adam Sumner**
Mentor(s): **Dr. Wei Shen**
Poster: **42**

Geminiviruses are ssDNA viruses that have been the focus of much genetic research in recent years to eliminate their severe effects on plants around the world. A resistance gene, AT1G31540, in the Pla-1 accession of Arabidopsis was identified to provide resistance against geminiviruses. This research endeavor strived to test the short isoform of the Pla-1 AT1G31540 NLR as well as the NLR allele from Col-0 by overexpressing the genes in Col-0, a susceptible accession. Infection analysis of the T2 generation of transgenic plants demonstrated the ineffectiveness of the overexpression of the Pla-1 NLR short isoform and the Col-0 long isoform to confer resistance. The results suggested the need for future studies into the specificity of the Pla-1 NLR allele through mutagenesis and domain swapping.

Understanding the role of Upstream Stimulatory Factor (USF) on transcriptional regulation of p53, a universal tumor suppressor

Author(s): **Sam Young**
Mentor(s): **Dr. Michael Sikes**
Poster: **43**

Lymphoma, cancers of infection-fighting B- and T-lymphocytes, arise from DNA mutations caused by aberrant responses to DNA damage. To identify novel immunotherapy targets, we investigated early and reversible activities that occur in

an aberrant B cell DNA damage response (DDR). We identified the stress-response transcription factor, Upstream Stimulatory Factor (USF), as a potential regulator for many proteins involved in DDR, notably the cell cycle inhibitor p53. Preliminary data showed DNA damage modulates B-cell USF activity, and genotoxic exposure resulting in long-term USF depletion reduced DDR-gene expression, including p53. We hypothesized USF regulates p53 expression in B-lymphocytes by directly binding the p53 promoter, and USF binding at p53 is regulated by DNA damage through phosphorylation via DDR kinase, DNA-PK. Chromatin-immunoprecipitation and quantitative-PCR (ChIP-qPCR) showed USF1 and USF2 proteins bind at the p53 promoter under normal conditions in M12 mouse B cell line cultures. 3-days after exposure to a 4-hour sublethal dose of the topoisomerase II inhibitor, etoposide, USF1 and USF2 binding at the p53 promoter was enriched, correlating with an inhibition of p53 RNA levels, which persisted through 7-days. Etoposide treatment with DNA-PK inhibitor (Nu7441) returned USF binding and p53 expression to basal level, suggesting DDR transcription was unaltered. This experiment demonstrated heteromeric binding of USF1 and USF2 at p53 is upregulated in response to DNA damage in a DNA-PK-dependent manner, which correlates with strong repression of p53 transcription. Further exploration into the viability of modulating USF expression in vivo at p53 through DNA-PK-based treatments could yield a novel immunotherapy target.

Examining the Knockdown Expression of RSK3 in relation to UGDH in Prostate Cancer Cells

Author(s): **Jasmine Alleyne**
Mentor(s): **Dr. Melanie Simpson**
Poster: **44**

Prostate cancer is a type of cancer that occurs in the male prostate gland. Our project looks at downstream biochemical pathways that impact androgen levels in prostate cancer, explicitly concerning mechanisms involving an enzyme called UDP-Glucose 6 Dehydrogenase (UGDH). Our previous research showed that UGDH expression is higher in castration-resistant prostate cancer tumor growth, overexpression of UGDH can cause castration resistance, and the knockdown of UGDH restores therapeutic sensitivity. Thus, UGDH is a potential drug target to prevent prostate cancer progression. The ribosomal S6 kinase enzymes (RSK) are a family of serine and threonine kinases that regulate cellular processes that include gene expression and hormone pathways involving UGDH. RSKs phosphorylate substrates are involved in transcription, translation, and cell cycle control. Our lab discovered that UGDH is a novel target for ribosomal S6 kinase A2 (RSK3). To determine the impact of RSK3 on UGDH, we knocked down UGDH levels in prostate cancer cell lines. The parent line, LNCaP 33, is an androgen-dependent prostate cancer line used to derive LNCaP 81, representing castration-resistant prostate cancer. We selected RSK3 shRNA knockdown clones (RSK3 KD) in the LNCaP 33

background and compared them to control lines. Whole-cell lysate samples were analyzed using western blotting. The results confirm the efficacy of RSK3 KD in reducing RSK3 expression. Interestingly, the expression of UGDH was also reduced in these lines. More characterization needs to be done, but these cells provide a proof-of-concept model to examine the relationship between RSK3 and UGDH further.

Characterizing the Role of UGDH Phosphorylation by the AGC Kinase RPS6KA2

Author(s): **Sophie Korenek**
Mentor(s): **Dr. Melanie Simpson**
Poster: **45**

Androgen deprivation therapy (ADT) is a highly effective first-line treatment for prostate cancer. However, over 80% of cases treated with androgen deprivation therapy result in castration resistant prostate cancer (CRPC), a state in which altered metabolic processes allow cancerous cells to survive without androgens. The loss of regulated steroid elimination from prostate tumor cells and an increase in the levels of UDP-glucose dehydrogenase (UGDH) are hallmarks of CRPC. UGDH catalyzes the conversion of UDP-glucose to UDP-glucuronate, which is used for hyaluronan production, steroid elimination, and proteoglycan biosynthesis. We propose that the fate of UDP-glucuronate can be altered to favor oncogenic growth and altered steroid elimination through the phosphorylation of UGDH by the AGC kinase RPS6KA2. We determined the experimental parameters necessary to demonstrate that treatment with PMA leads to the activation of RPS6KA2 and subsequent phosphorylation of S6 in LNCaP cells. We aim to show that UGDH is phosphorylated under these conditions as well. These results provide the basis to confirm our proposed pathway, which is a target for potential therapeutics in the treatment of CRPC.

Assistive Knee Orthosis Powered by Miniature Fiber-Shaped Pneumatic Artificial Muscles

Author(s): **Emily Petersen**
Mentor(s): **Dr. Xiaomeng Fang**
Poster: **46**

Medical technology, or “MedTech,” is a growing industry due to the increasing prevalence of chronic health issues and aging populations worldwide. Advanced knowledge of the human body and its movement mechanics is being utilized to improve physical therapy and rehabilitation methods, enabling patients to live longer, healthier, and more independent lives. One such technology that can be integrated into medical devices is miniature fiber-shaped pneumatic artificial muscles (PAMs) that are advantageous due to the high flexibility and capability to

form assembly. Integration of miniature PAMs into a knee orthosis creates an assistive device that harnesses actuation to produce a force that aids the user in movement. Equipping a knee orthosis with a series of bundled miniature PAMs produces the 600N force necessary to flex the leg 60 degrees. This 60-degree flexion generated from miniature PAMs in the knee orthosis reduces the amount of input force required from the natural muscles of the human body to achieve optimal knee flexion to complete the entire walking gait cycle. This technology could be used to help elderly patients by ensuring active movement of their weakening natural muscles. In addition, due to independent brace construction and control mechanisms, injury rehabilitation could be adjusted to individual demands. Ultimately, this application can be used to further improve patient care and allow for people to continue to produce motion they would not be able to do independently.

Numbers By College

287 Unique Presenters

College of Agriculture and Life Sciences: 95
College of Design: 1
College of Engineering: 63
College of Humanities and Social Sciences: 25
College of Natural Resources: 24
College of Sciences: 71
Poole College of Management: 3
Wilson College of Textiles: 5