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Dr. Eric Shaw Excellence in Science

Undergraduate Research Poster Abstract Book

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Mechanical Properties of Atlantic Stingray (*Dasyatis sabina*) Skin

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Batoids are dorsoventrally flattened cartilaginous fishes. Their skin has a collagen fiber network where fiber angles are larger than those described in sharks, and like sharks, some batoid species have dermal denticles. Previous research showed batoid skin exhibited anisotropic behavior when tested along different axes of stress. We quantified the mechanical behavior (tensile strain at maximum load (%) and Young's modulus (MPa)) of batoid skin (Atlantic stingrays; *Dasyatis sabina*) containing dermal denticles across disc regions, surfaces, and between testing axes (longitudinal, parallel to body; hoop, perpendicular to body). Due to their dorsoventrally-compressed morphology, we hypothesized that skin in the hoop direction would have greater strain, while skin in the longitudinal direction would be stiffer to facilitate undulating disc movements. We also hypothesized that dermal denticle density would vary by region (anterior and posterior) and surface (dorsal and ventral). We dissected disc skin from six stingrays, divided each into regions, and imaged them for denticle density analysis. To evaluate mechanical properties, regions were cut into 5 pieces (3 longitudinal, 2 hoop) for tensile testing in an Instron E1000 at 3 mm/s strain rate. We found that skin tested longitudinally was more extensible and skin from the outer disc was less stiff and extensible than skin from the inner disc (dorsal and ventral). We also found that denticle density (denticles/mm²) varied among disc regions and surfaces.

Dimensions of Masculine Identify and Social-role Policy: The Role of Threat to Status and Gender Role Disparity Threat

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There are many U.S. policies which grant men power over women, and specific individual differences among men may predict support for such policies. Precarious manhood is the belief that manhood can be won and lost, and adherence to traditional masculine norms is endorsement of male toughness and tradition. We predict that men high in precarious manhood and traditional masculine norms will be especially likely to endorse gendered hierarchies in the domestic and public spheres respectively when they think masculinity is under threat. We expect the effects of traditional masculinity to be explained by status threat and the effects of precarious manhood to be explained by gender role disparity threat. The data consist of 700 men who completed measures of support for gender hierarchy in the public and domestic sphere, support for traditional masculinity, precarious manhood, threat to masculine norms, status threat, and gender role disparity stress. Implications are discussed.

Heterotopic Ossification of the Hip Secondary to Auto Trauma

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A middle aged Male presented for a heterotopic ossification of the right hip. A heterotopic ossification is bone formation that can occur in soft tissues, especially sub musculature in the iliac region of the body. Symptoms associated with a heterotopic ossification: a lower extremity joint are pain, joint effusion, change in gait, and limited range-of-motion of the affected joint. A heterotopic ossification of the hip can be the result of trauma, joint arthroplasty, burns, and major orthopedic surgeries. In this case report, we have an otherwise healthy male who was indicated for a heterotopic ossification on the anterior proximal femur. This patient was involved in an auto collision in 2021. After the patient proceeded with the surgical procedure. An appointment was conducted after surgery the patient reported a 0 out of 10 pain score and was satisfied with the procedure proving the clinical impact of surgical excision targeting heterotopic ossification.

Examining Parental Divorce in Adult Relationship Processes: A Scoping Review

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Emerging research has explored parental divorce's various effects on adult romantic relationships. This scoping review provides a thematic analysis of the current literature on the adult population, specifically focusing on adaptive cognitive behaviors in a romantic context. A systematic search was conducted across Google Scholar, Taylor & Francis Online, and ProQuest using a combination of keywords (e.g., parental divorce, adult children, etc.). The initial search was paired with a reference search and a cross-reference platform. The original search pool yielded 465 articles; after accounting for replicated articles, the initial screening left 86 articles. The remaining articles were rescreened as part of the protocol before data extraction resulting in the articles reviewed herein. Studies revealed various qualitative and quantitative methods to investigate parental divorces. Results include over 76% of studies conducted in the United States. Additionally, out of 68 studies, only 21 found or mentioned any positive outcomes in adult offspring. Due to the lack of adaptive outcomes mentioned in the literature, future research should consider creating new quantitative measures to allow for the assessment of positive outcomes.

The Role of Action Identification in Reactions to Romantic Partner Transgressions

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According to Action Identification Theory, individuals tend to think about their actions in terms of low-level concrete detail or high-level abstract thought. Action Identification has been previously examined within the context of romantic relationships, specifically with acceptance of false feedback on the qualities of an individual's relationship (Cope, 2021). However, Action Identification has not been examined within relational transgressions, and individuals' reactions to the transgression may depend on how they are thinking about the issue - specifically if they are construing scenarios at high or low levels. The current study investigates how the situational level of action identification could impact psychological reactions to transgression scenarios with a romantic partner. All participants were recruited on CloudResearch Connect and had to be in a current romantic relationship (N=240). Results demonstrated experimental effects on participant responses to transgressions on reactions to the proposed transgressions (e.g., rumination, distress, blame, and forgiveness).

How Fast is Too Fast? — Studying B-Hairpin Peptide Degradation by Enzymatic Proteolysis

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B-hairpins have recently emerged as proteinomimetic scaffolds that hold much significance in drug discovery campaigns as novel and effective protein-protein interaction (PPI) inhibitors. These structures have been of particular interest for miniaturizing monoclonal antibody drugs into smaller hairpins that can inhibit the binding of lymphocyte programmed cell death-1 (PD-1) receptors to their cognate ligand (PD-L1). This has proven efficient to restore an immune response against a number of tumor types with promising biological activity (IC₅₀ of 50-300 nM). However, data about the susceptibility of PD-1/PD-L1 immune checkpoint inhibitor hairpins to proteolytic degradation is currently quite sparse despite it being a necessary obstacle to overcome when developing potential drugs. Here we report a method for quantitatively assessing the degradation of various synthetic B-hairpins peptides using protease assays monitored by reverse-phase high-performance liquid chromatography (RP-HPLC).

Quantification of COVID-19-specific Memory Cells Generated in Vaccinated Individuals

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Effective vaccines provide long-lasting immunity by protecting the vaccinated individuals and preventing the spread of disease. During the COVID-19 pandemic, new mRNA vaccines were developed to protect vaccinated individuals and prevent viral transmission. Although this vaccine and its boosters reduce the risk of serious outcomes such as hospitalization and death, it does not fully protect vaccinated individuals against breakthrough infection. In this pilot study, we correlated vaccine effectiveness by measuring the frequency of COVID-19-specific immune memory cells in the peripheral blood of vaccinated compared to unvaccinated and unexposed individuals. We used flow cytometry to assess the effector cells generated following in vitro polyclonal and SARS-CoV-2 S protein-specific stimulation of isolated peripheral blood mononuclear cells (PBMC). We also used ELISA assay to quantify baseline serum levels of COVID-19-specific immunoglobulin as well as immunoglobulin and cytokines secreted in supernatants of the cultured effector cells. We show that blood samples from vaccinated individuals had a significant increase in antibody-secreting plasma cells, but not in IFN- γ -producing effector CD4 and CD8 T cells in response to recall vaccine antigen. Our preliminary data suggests the breakthrough infection rate observed in vaccinated individuals could be due to insufficient generation of memory T cells needed to sustain long-lasting memory B cells.

Creation of a Microbial Resource Collection for the Formulation of Soil Amendment Products

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The increasing use of inorganic fertilizers in agriculture to meet the demand for food and plant products is unsustainable, causing nitrogen pollution in waterways and remarkably damaging the environment. Also, pathogens have impacted plant yield with Citrus production declining in recent years because of citrus greening disease. In this study, plant growth-promoting microbes will be isolated and screened from a variety of plant rhizosphere and roots to create a Microbe library to serve as eco-friendly alternatives to fertilizers. Using differential selective media, all purpose, enriched culture protocols and 16S/18S rRNA sequencing, the microbes will be identified and characterized into four categories: hormone-producing, nitrogen-fixing, phosphate solubilizing, and biocontrol agents. The isolates will be stored in Cryopreservation beads and listed on a searchable database to enable customized bioinoculant formulations for

specific plants. Microbe libraries are a valuable and underutilized climate-smart tool that is sustainable and eco-friendly while boosting plant health and resilience.

Mucin-Type O-Glycosylation Affects APP Processing and Aggregation Fate

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Alzheimer's disease (AD) is one of the most common neurodegenerative disorders linked to aging. New evidence continues to emerge supporting the idea that deficiencies in amyloid- β precursor protein (APP) trafficking and clearance of A β peptides are the initiating events of AD pathogenic processes. Efforts to understand the role of APP proteolytic cleavage by α -, β -, and γ -secretases into the toxic amyloidogenic pathway have sparked interest in the role of MUC-type O-glycosylation in the production and clearance of A β peptides. With this goal in mind, we have synthesized native and Swedish-mutated (Lys670Asn/Met671Leu) (glyco)peptides with O-GalNAc moiety on Tyr681, Thr663 and/or Ser667 to explore the role of glycosylation on conformation, secretase activity, and aggregation kinetics of A β ₄₀. The chosen peptide sequences incorporate the β -secretase (BACE-1) (M671~D672 or L671~D672) and/or α -secretase (ADAM-10) (K687~L688) cleavage sites, located near and within the A β ₄₀ domain, respectively. CD analysis was carried out in four solvent systems to evaluate the peptide environment and O-glycosylation-induced conformational changes. Atomic force microscopy was used to image the morphology of the A β ₄₀ aggregates formed without or in the presence of APP (glyco)peptides. The Swedish mutation and O-glycosylation were the key factors driving conformational changes. Furthermore, the level of β -secretase activity significantly increases for the glycopeptides containing the Swedish mutation compared to their nonglycosylated and native counterparts. Lastly, the glycopeptides impact the kinetics of A β ₄₀ aggregation by significantly increasing the lag phase and delaying aggregation onset; however, this effect is less pronounced for its Swedish-mutated counterparts.

Grow with the Flow: Variation in Shark Vertebral Morphology across Body Regions and Ontogeny

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To swim, sharks produce thrust via lateral oscillations of the main body axis, the vertebral column, which is comprised of mineralized cartilage. As sharks grow, more thrust is required to propel a larger mass through the water. The internal vertebral morphology may vary along the column to withstand increased loading forces as the shark grows. Here, we examined vertebral morphology across ontogeny and body regions in sharks from Order Carcharhiniformes. Using computed tomography imaging, we quantified 3D structure across vertebral regions (anterior, middle, and posterior) and three body sizes in four species of shark (*Carcharhinus brevipinna*, *Carcharhinus limbatus*, *Carcharhinus obscurus*, and *Prionace glauca*). We measured angles for dorsal, lateral, and ventral wedges of mineralized cartilage and found that middle and posterior vertebrae were more similar compared to anterior vertebral morphology. This study improves our understanding of the form-function relationship in mineralized cartilage during growth.

Species Shakedown: A Phylogenetic Analysis of Carcharhiniform Shark Vertebral Morphology

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Sharks are a group of cartilaginous fish (subclass Elasmobranchii) that use lateral oscillations of their mineralized vertebral column to swim. The largest order of sharks, Carcharhiniformes, occupy diverse habitats, and are known to exhibit various hunting styles. Previous research found that the vertebral morphology in carcharhiniform sharks varies across species, however, it is unknown if these changes reflect the different hunting styles and habitat preferences. Here, we examined variation in vertebral morphology in a phylogenetic context. We used computed tomography imaging to quantify the 3D internal morphology of vertebrae across 13 species from 5 genera of carcharhiniform sharks. We measured mineralized wedges (dorsal, ventral, and lateral) within vertebrae and found that dorsal and lateral wedges were similar in more closely related genera. A broader understanding of vertebral morphology in a phylogenetic context can shed light on the adaptation of mineralized cartilage in carcharhiniform sharks.

Prevalence of Legionella Species in Portable Water Systems in a University Campus using the CDC Elite Protocol & Molecular Identification

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The focus of this research is to compare the reliability, and accuracy of the current CDC standardized test for Legionella in potable water systems and molecular detection protocols. A secondary aim was to address the prevalence of Legionella in Florida Atlantic University water systems, identify the genomic diversities, and to recommend an improved protocol for Legionella detection. Ten water samples from the gym and residential hostels were collected and tested for the presence of Legionella species using the CDC Elite culture methods and serology tests. Molecular assays employed Sanger sequencing of 16S rRNA for isolates to identify groups indistinguishable by the CDC methods. Combining the CDC Elite with molecular confirmatory tests present the most sensitive and rapid testing methods.

Development of a Stable and Highly Bioavailable Emulsified Docosahexaenoic Acid Triglyceride Treatment for Sickle Cell Disease using Natural Emulsifying Technology (NET)[™]

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It has been reported in the scientific literature that certain fatty acids decrease the destruction of red blood cells in mammals. Small human clinical trials showed that certain fatty acids could reduce pain episodes in sickle cell patients. Other studies have shown that these fatty acids can increase hemoglobin levels and reduce pain episodes, vaso-occlusive episodes, anemia, organ damage and other disease complications in sickle cell patients. In work done by the Sancilio team and others, it was found that sickle cell patients have abnormal fatty acid levels in red blood cells, white blood cells, platelets and plasma. These findings led us to the hypothesis that certain fatty acids, if replenished at a rate faster than their destruction, may allow RBCs to remain fluid and as a result mitigate the harmful nature of HgSS and delay or reduce VOCs. Additionally, n-3 long chain fatty acids have been associated with anti-inflammatory action and may have antioxidant properties as well.

Metagenomic Analysis of the 16S rRNA Gene of Androgenic Alopecia in Nonbalding and Balding Scalps

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Within the existing market for hair growth and hair care treatments, a patient's scalp core microbiome stability and whether bacterial dysbiosis is present on their scalp is rarely examined. Most of the existing treatments focus on implanting new hair into the scalp rather than nourishing the area to stimulate renewed growth or even as a preventative measure. Given previous analyses using qPCR to determine the total bacteria and potential biomarkers present in both balding and non-balding subjects, data has shown a strong connection between the dysbiosis of the subject's occipital and parietal scalp regions and androgenic alopecia. For the analysis of key biomarkers, a 16s amplicon sequencing for the microbiomes was evaluated, specifically focusing on the V3-V4 hypervariable regions of the 16S rRNA gene. This report describes the genomic differences between the balding and nonbalding microbiomes with the goal of identifying statistically significant differences between the two sample sets and a control consistency within the balding subject set.

How Integration of Past Relationship Affects Current Relationship

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In romantic relationships, partners tend to include others in the self to form a sense of interpersonal interconnectedness. As the relationship dissolves, partners lose their sense of self as they can no longer include their partner in their identity. The current study investigated whether identity integration with a previous romantic partner affects current relationship outcomes. We recruited 300 participants who were currently in a relationship and had experienced a breakup in the last five years to complete self and relationship measures in an online survey. Results demonstrated that identity integration with ex-partner is significantly correlated with current relationship commitment and couple identity clarity.

Effects of Sulforaphane on the Community Structure of the Gut Microbiome of Mice Exposed to Microcystin Toxicity

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Humans are constantly exposed to environmental toxins, such as the cyanotoxin microcystin (MCN). The role of the gut microbiome engineered with beneficial food supplements in building resilience to these toxins is only beginning to be understood. Our research aims to determine the effect of sulforaphane (SFN, a compound found in cruciferous vegetables) as a potential prebiotic molecule and define the gut microbiome dynamics associated with its beneficial roles. Previous research in this lab revealed that mice treated with MCN suffered a drastic decline in cultivable microbiota diversity, while mice that were treated with both MCN and SFN showed a 4-fold increase in morphotypes. In this study, remaining fecal materials from our previous study will be analyzed using 16S amplicon metagenomics to obtain a comprehensive response of non-cultivable and cultivable microbiota to SFN treatment. This study underscores the need for integrating metagenomics with classic microbiology assays in evaluating gut microbiota function.

Highs and Lows of Relationship Behaviors: Constructing a Relationship-Specific Behavior Identification Form

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The aim of the current study is to construct and evaluate a novel scale assessing romantic relationship evaluations using an approach similar to the Behavior Identification Form (BIF). The BIF measures individual differences in the level at which one tends to identify actions, either by meaning (high level) or by detail (low level). Previous research demonstrated that BIF scores correlated with relationship outcomes such as relationship satisfaction, relationship uncertainty, and partner identity clarity. However, the BIF is not specific to relationships, and therefore does not adequately measure action identification level for relationship actions. The current study applies the approach used to develop the BIF to a romantic relationship context through the construction, refining, and testing of a relationship BIF that is specific to actions within romantic relationships. We will explore the associative effects of the novel relationship BIF on relationship outcomes (e.g., relationship satisfaction).