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Dear Students and Young Researchers,

We are delighted to address you—the brilliant minds driving innovation and intellectual exploration. Your unwavering commitment to advancing knowledge and pushing the boundaries of research is truly inspiring.

As emerging researchers, you are not merely scholars; you are pioneers. This is your moment to challenge the status quo, embrace bold ideas, and forge new paths. Approach this opportunity with enthusiasm, as it is through your creativity and courage that the horizons of human understanding are expanded.

Remember, you are not alone on this journey. A vibrant community of researchers and mentors stands ready to support and guide you. Seek their wisdom, engage in meaningful discussions, and embrace collaboration. The essence of academia lies not only in individual achievements but also in the collective synergy of ideas that drives progress.

As you embark on this exciting journey, hold onto your curiosity, question assumptions, and never cease to explore. The world eagerly awaits your discoveries, and your work has the potential to create a lasting impact.

With profound admiration for your dedication to knowledge and innovation,

NYCSEA Co-Editors-In-Chief

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Evaluation of Therapeutics to Target Stem Cell Like Prostate Cancer

Evalina Lentini

Absract–*Castration-resistant prostate cancer (CPRC) is the lethal stage of prostate cancer that persists after androgen deprivation therapy. There are four epigenetic subtypes of CRPC including stem cell-like (SCL) which is AR-low/independent and lacks therapeutic options. CRPC-SCL is driven by FOSL1, a transcription factor critical to the survival of this disease subtype. Here, I uncovered that ERK inhibition using small molecules leads to suppression of FOSL1 and decreased viability in CRPC-SCL models. These data suggest that targeting the MAPK-ERK signaling pathway serves as a potential therapeutic strategy for stem cell-like prostate cancer.*

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Water Retention of Small-Scale Green Roofs with Edible Vegetation

Annika Spaet

Abstract: Green roofs (GRs) are typically used to retain stormwater and are increasingly being used to produce food by growing edible vegetation, such as Mad Hatter Peppers (Capsicum baccatum). However, there have been conflicting studies on whether GRs can feasibly produce Capsicum baccatum in GRs compared to in-ground production. To test this, water retention was compared among small-scale models of three different vegetation types: two Sedum setups, two Capsicum baccatum setups, and one bare setup. The models used water storage compartments and moisture retention fabric to increase water retention and to reduce the need for irrigation. There was not a statistically significant difference in water retention between the different vegetation types, and the Capsicum baccatum wilted by the end of the study, so it did not produce food. These results indicate that Sedum should be used in future GRs because they can provide many benefits other than water retention, whereas Capsicum baccatum may not be healthy enough to provide other benefits.

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Study on Metamaterials to Control SPPs in Response to External Lights

Junhyeong Lee

Abstract:Surface Plasmon Polaritons (SPPs) are electromagnetic waves along the boundary between a metal and a dielectric, typically within the infrared or visible light range. These waves are tightly confined to the interface, with their intensity decaying exponentially perpendicular to the surface. SPPs propagate along the metal-dielectric boundary until they lose energy through absorption in the metal or by scattering caused by surface irregularities, which limits their range and intensity. This confinement allows for applications that require high spatial resolution, such as imaging and nanophotonics. Metamaterials, when paired with SPPs, provide advanced control over light-matter interactions, enabling the efficient guidance of plasmonic waves along complex structures. Hyperbolic metamaterials exhibit high anisotropy and can support SPP propagation over longer distances with reduced losses, making them valuable in sensing and imaging technologies. This paper explores active metamaterials to control SPPs dynamically, adjusting plasmonic properties in response to external signals. This study is to pave the way for reconfigurable plasmonic devices and tunable nanophotonic systems, as the combination of SPPs and metamaterials is opening new horizons in nanotechnology. It allows for ultra-compact, efficient, and highly sensitive devices that operate at the edge of conventional light manipulation capabilities.

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exploring how these interactions enable enhanced waveguiding and light control for photonic devices (Phys. Rev. B, 2018)

APS Physics. "Spoof-Surface-Plasmon-Polariton Metawaveguide and Its Application in Frequency-Shift Keying." This study covers the use of spoof SPPs in metamaterials, showing how they mimic optical SPP behavior for radio and microwave frequencies, with applications in waveguiding and telecommunications (Phys. Rev. Applied, 2023)

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AIP Publishing. "Diversiform Hybrid-Polarization Surface Plasmon Polaritons in Metamaterials." This research investigates the effects of combining SPPs with metamaterials for advanced optical applications, particularly in polarization control (AIP, 2024)

IEEE Xplore. "Surface Plasmon Polaritons and Its Applications." A comprehensive review on SPP applications, detailing their uses in super-resolution imaging, SPP-based sensors, and photonic circuits, with insights into the advantages of incorporating metamaterials to reduce energy loss and enhance light control (IEEE Xplore, 2024)

SpringerLink. "Ultrafast Dynamics of Surface Plasmon Polaritons in Plasmonic Metamaterials." This paper examines the interaction of SPPs with ultrafast laser pulses, highlighting the potential for metamaterial-enhanced SPPs in high-speed optical switching and data transmission (SpringerLink, 2023).

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The Effect of Astragalus membranaceus Root Extract on Parkinson Inflicted Caenorhabditis elegans

Jun Lin, Donato Massimo Brogna, Omar Chaudhry

Abstract: The effect of Astragalus membranaceus on Caenorhabditis elegans was assessed in this experiment. Parkinson's Disease directly causes dopamine depletion and other related symptoms. Astragalus contains complex carbohydrates linked to dopamine neuron protection, which could be used to treat Parkinson's. In this experiment, C.elegans inflicted with Parkinson's were treated with different concentrations of Astragalus. C.elegans are free-living nematodes that can be genetically engineered to model or stimulate various diseases caused by genetics, Parkinson's being one of them. The concentrations of astragalus solution were 2 mg/mL, 4 mg/mL, and 8 mg/mL, which were added to the agar that the C.elegans inhabited. Mechanosensory tests included tap reflex and gentle and harsh touch assessment. M9 Buffer was used to inhibit the egg-laying behaviors of C.elegans, and the thrashing rate was assessed for each group. The results indicate that 4 mg/mL is the optimal concentration to treat disease-inflicted C.elegans and had the best results out of the 3 trials. The 4 mg/mL group constantly had the highest tap reflex, gentle, and harsh touch scores that were similar or greater than the wild-type control group. Additionally, the 2 mg/mL also had high scores in trials 2 and 3 in both the gentle and harsh touch assessments. No definite conclusions can be determined from thrashing rate data. The results imply that lower and intermediate concentrations of Astragalus may treat the symptoms of Parkinson's Disease.

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The Role of HGF/c-Met Signaling in the Development of Type 1 Diabetes

Mingpei Li

Abstract: Type 1 Diabetes (T1D) is a challenging autoimmune disease that affects 1 in 10 adults in the United States. It is a lifelong condition caused by T-cell infiltration-induced β-cell apoptosis in islets within the pancreas. Hepatocyte growth factor (HGF)/c-Met signaling is responsible for the activation of transcription factors for cell survival, proliferation and metastasis. It also correlates with increased amounts of myeloid-derived suppressor cells (MDSCs), which inhibit cytotoxic T-cell activation. Therefore, in individuals with T1D, c-Met plays a crucial role in β-cell survival.

To further understand the relationship between HGF/c-Met signaling and the onset of T1D in vivo and in vitro, my study quantified HGF and c-Met at various stages of mice's growth. I extracted islets and immune cells from non-obese diabetic (NOD) mice pancreas and lymph nodes, respectively. I then conducted immunohistochemistry, quantitative polymerase chain reactions (qPCRs) and flow cytometry to quantify HGF and c-Met receptors in relation to islet inflammation and age. I report that c-Met concentration increases as insulitis caused by T-cell infiltration increases. Additionally, there is an inversely proportional relationship between T1D onset and HGF/c-Met signaling. Although it is not clear if c-Met is a driving factor or a response caused by T1D, a clear understanding of the HGF/c-Met signaling pathway could further the development of more therapies for individuals with T1D.

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Reimagining Urban Spaces: The Impact of Remote Work on U.S. and South Korean Real Estate and Economy

Jaeyoon Kim

Abstract: The shift to remote and hybrid work, driven by the COVID-19 pandemic, has transformed workplace needs, urban economies, and real estate in countries like the United States and South Korea. This evolution has required changes in urban planning, economic policy, and design, as reduced office occupancy impacts cities in both nations. In the U.S., the drop in office workers has strained downtown economies, encouraging urban planners to push for policies that repurpose office spaces into residential or mixed-use developments, fostering more resilient city centers. Suburbs are also growing, with new commercial spaces meeting the demand for flexible, accessible workspaces aligned with hybrid models. South Korea's tech-focused approach combines government support for central business districts with smart building technologies and tax incentives to sustain office demand. Simultaneously, suburban hubs offer more affordable alternatives to city offices, leveraging advanced tech infrastructure to support remote work. Both countries' responses highlight a reimagining of urban and suburban spaces that accommodates a post-pandemic need for flexibility, sustainability, and economic diversity in work and living environments.

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Enhanced Presence of Inflammatory Mediators MAG Lipase and COX-2 in Severe Osteoarthritis

Mariam Hassan

Abstract: Osteoarthritis (OA) is the degradation of joint cartilage and bone, resulting from joint overuse and injury. The endocannabinoid system (ECS) is a molecular system that regulates bodily functions, including pain, inflammatory responses, and immune responses. Within the ECS, cyclooxygenase-1 (COX-1), cyclooxygenase-2 (COX-2), and monoacylglycerol lipase (MAGL) function within a pathway that produces prostaglandins to signal pain. This study observed the differences in the amount of pain signaling proteins of interest (CGRP, MAGL, COX-1, and COX-2) present in knee samples of differing OA severity. It was hypothesized that OA samples that were assigned a higher grade of arthritic severity based on the Kellgren-Lawrence scale would have greater levels of these proteins, indicative of more pain being relayed in more severe cases of arthritis. Knee OA samples were collected and analyzed from patients receiving knee replacements (n=10) from June to August 2022. Immunohistochemistry techniques were used to identify and score proteins of interest (COX-1, COX-2, MAGL, and CGRP) within fixed tissue samples. When the presence of pain-signaling proteins were compared between samples of moderate to severe OA degradation, significantly more COX-2 and MAGL were found in more severe arthritic samples, leading to the hypothesis being supported. It was observed that drastic differences in protein levels based on arthritic severity were seen in the superficial cartilage of the sample.

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Developing a Hydroponics System with the Incorporation of an Arduino Uno-Powered pH Sensor

Sofia Maciel-Seidman

Abstract: From 2005 to 2050, crop demands will increase by 100% to 110% and 50% of land will not be suitable for agriculture (Monsees, 2019). To address this issue, we developed a cost-efficient hydroponic system. In phase 1 of our project, we compared the growth of plants in a long, shallow system and a deep, short system. All p-values were over 0.05, indicating that there is no difference in plant growth between the two different tub sizes.. During phase 1 we faced problems with consistently measuring the pH which led to the wilting and deaths of some plants due to over absorption of nutrients. We decided to focus on pH in our phase 2 project with two main goals: to design a cost-efficient hydroponic system that is sustainable to grow fresh basil and to develop a pH sensor with the use of Arduino Uno that provides accurate, instant readings. The sensor monitors and records the system's pH, notifying users when the pH is not in its optimal range of 5.500-6.500. The sensor was connected to a spreadsheet and LED lights outside of the hydroponic system that lit up when the pH was too high or too low, allowing for modifications to be made. This system offers an alternative method of monitoring of pH, while still being financially accessible.

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Associating Blood Lead Concentration and Gray Matter Volume in the Brain Across the United States, as a Model for Flint, Michigan

Shira Lichter

Abstract: In 2015, Flint Michigan changed water sources from Lake Huron to the Flint River, which had water lead levels [15], correlated with blood lead levels [17]. Lead is highly neurotoxic [19], lowering grey matter volume [5]. Due to a lack of data from Flint, fMRI scans (after 2015) from Los Angeles, New York City, and Philadelphia were analyzed with voxel-based morphometry in spm12. Grey matter volumes were stratified by gender. Significant differences were found between average grey matter and water lead levels ($p<0.00001$). Philadelphia, with the highest lead levels (3.0 ppb), had significantly lower grey matter volume than all other cities. All locations had significantly lower volume than the control, demonstrating the impact of water lead. There were significant differences between cities of varied water lead concentrations. Philadelphia and Flint had the highest water lead levels, at 3.0 ppb, allowing Philadelphia to be used as a possible model for Flint.

Keywords: Flint, lead, water lead, blood lead, blood-brain barrier, grey matter volume, fMRI, spm12, voxel-based morphometry, model, toxicity

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The Effect of Microplastics on the Chlorophyll Content of Solanum lycopersicum L

Rosina Wickham

Abstract: Approximately 107,000-730,000 tons of microplastics are dumped into agricultural soil yearly. It has recently been reported that microplastics change the chlorophyll content of pumpkins, decrease root and shoot growth, and decrease the leaf number. There is a great deal of information on microplastics causing harm to the environment, including negatively impacting crops grown in contaminated soil. However, there is very little research on how microplastics in the soil may alter the chlorophyll levels of Solanum lysopersicum L., the tomato plant. This is a research study designed to investigate the effect that microplastics have on Solanum lycopersicum L.'s chlorophyll content. Upon planting, tomato seeds were exposed to 0.1% microplastics in the soil, 0.2% microplastics in the soil, or no microplastics (control). Day of germination, the height of the plant, and leaf number were recorded daily for 39 days. On day 39, the plants were harvested and the root length and chlorophyll content was measured. The results of the experiment concluded that plants exposed to 0.2% of microplastics had an overall decrease in chlorophyll, leaves, delayed germination, height, and mass. These results agreed with the study that evaluated the chlorophyll contents of pumpkins exposed to microplastics. In conclusion, microplastics are a rising threat to the environment. The higher percentage of microplastics found in the environment, the worse agriculture will become. For future research, increased concentrations of microplastics could be used or the effects of different types of plastic could be assessed.

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The Effect of Apis mellifera Propolis on the Growth of Tumors on Solanum lycopersicum

Dwight Evans Jr.

Abstract: Plants are an integral part of human life. Crops, especially fruits and vegetables, provide humans with energy and nutrients. What would happen if we didn't have these foods at all? The aim for this research study was to determine if the plant ridding disease, Tobacco Mosaic Virus

(TMV), could be mitigated if treated with propolis; a substance collected from Apis mellifera (honey bees) when they pollinate flowers. The plant selected for this study was Solanum lycopersicum (tomato plant) due to its commonality with the virus itself. Due to the hardships of germination, the plants were bought and not grown and only the leaf count was measured. The plants were split into two groups, control and experimental. TMV was applied to both groups, but only the experimental group was treated with Apis mellifera propolis. Several days later, the experimental group received the propolis. With the control group, about 6 leaves were destroyed and wrinkle while in the experimental group only 2 leaves were shriveled and destroyed. The control group plant had a tilt as the stem was weakening, while the experimental group was upright. The colors didn't change all too much in either except for the leaf color. In the control group, the leaves looked black and brown, while in the experimental it looked slightly brown

rather than black. According to the data collected, the plant-ridden disease of the Tobacco Mosaic Virus can be rid of with the propolis of Apis mellifera.

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Gender-Specific Sentiment and Lexical Patterns in Teenage Communication

Christian Draven Chung

Abstract: This study examined lexical and sentiment patterns in about 1,000 recent Reddit posts, focusing on gender-based and thematic variations. Sentiment analysis employed polarity scores, where positive values indicated positivity and negative values reflected negativity, to classify posts as positive, neutral, or negative. Posts linked to males showed slightly higher average sentiment polarity compared to those linked to females. Sentiment trends also varied significantly by theme, with categories like “Discussion” and “Social” displaying relatively neutral tones, while flairs such as “Music” and “Meme” leaned toward more polarized extremes, highlighting distinct emotional dynamics.

Gender-based analysis uncovered subtle differences in sentiment expression. Male-linked posts tended to reflect slightly positive average sentiments, whereas female-linked posts leaned more toward neutrality. Overall, males demonstrated more positive emotional tones compared to females. These findings underscore how emotional and linguistic differences among teenagers are shaped by gender. The study also explored sentiment distribution by gender, revealing that both groups had neutral median sentiments. However, males exhibited slightly less variability, while both genders showed outliers, indicating instances of heightened emotional expression in specific contexts.

By integrating sentiment and lexical analysis, the study offers a nuanced perspective on teenage communication on Reddit. Males and females displayed distinct emotional expressions, with males favoring humor and discussions, while females leaned toward relational and socially oriented topics. Additionally, flair-specific word usage emphasized topic-driven linguistic styles. Together, these insights enhance our understanding of teenage online behavior, illuminating the interplay between lan-

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guage, emotion, and engagement in digital communities.

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Efficacy of Mask Use in Reducing Sars-Cov2 Infection Rates

Sabrina Guo

Abstract: SARS-CoV-2, a novel coronavirus also known as COVID-19, has caused a global pandemic, claiming the lives of over 3 million people, and counting. Governments and local polities have implemented public health mandates to reduce the spread, including mask-wearing, a policy that remains controversial. The aim of this study was to examine how effective strict enforcement of mask-wearing policies is in reducing COVID-19 infection rates. A total of 30 countries and subnational political jurisdictions were selected using Text Finder's random choice generator, then sorted into three categories of mask enforcement: strict, moderate, and lax, characterized by punishments, non-enforcement, or lack of precautions. The percent changes in cases were recorded over a 3-month period prior to and after the declaration of mask mandates for each locality, then analyzed using the Kruskal-Wallis test to rank the three categories. The mean rankings from greatest to least were: lax (24.90), moderate (12.90), and strict (8.70). The Kruskal-Wallis test result was H(2)= 18.240, P=.000. Locations with stricter mask policies had lower infection rates. Therefore, it was concluded that strictly enforced mask policies were most effective in limiting COVID-19 transmission. Confounding variables include political agendas, the sway of public opinions, and a transient lack of data on COVID. Future research could analyze the effectiveness of mask enforcement in locations with different COVID-19 variants.

Keywords: SARS-CoV-2, masks, infection rates, mask enforcement, Kruskal-Wallis test

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A Novel Fe-Doped Metal Oxide Electrode Material For High Energy

Arya Gurumukhi

Abstract: The current lithium-ion battery technology is expensive and not environmentally sustainable. Supercapacitors are an alternative; however, they have low energy densities, making them impractical to use. Therefore, this project aimed to create an energy source that solved all the problems batteries had while improving upon the super-capacitor. Hence, this project synthesized a novel electrode material. Manganese oxide (MnO_2) was used and was synthesized with the sol-gel process to create 1D nano-rods. It was then doped with Fe to weaken the hydrogen bonds in the MnO_2 to create oxygen vacancies. The novel electrode was combined with the binder solution and current collector to make the final pseudo-super-capacitor. This not only allowed for the overall capacitance to be higher than commercial products with a capacitance of 0.90F but also allowed for the energy density to be 5x higher with around 5.337 (Wh/kg). The power density was also not compromised, being 2456.163 (W/kg). The prototype has the potential to store 900 watts at the mere cost of $10.03. With a power source as potent as this, many science fields will gain flexibility, and low-income communities can gain access to a reliable power source. This prototype will have a transformative impact on society.

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The Economic Impact and Multifaceted Role of Sports Management in the United States

Richard Dongyun Jang

Abstract: The sports management industry in the United States has evolved into a powerhouse sector, intertwined with the broader economy and impacting areas far beyond the sports field. Valued in the billions, this industry supports and manages various functions across professional leagues, such as the NFL, NBA, and MLB, as well as collegiate and amateur sports programs, positioning it as one of the country's major economic drivers. Sports management includes diverse responsibilities—marketing, finance, operations, legal, and facilities management—crucial for sustaining the high demand for sports and entertainment. These functions ensure that teams, events, and facilities run smoothly, efficiently, and in a way that meets operational needs and fan expectations.

The sports management business has multiple roles and strategic goals, from enhancing fan engagement and increasing revenue to managing player contracts and securing sponsorships. Marketing strategies profoundly affect the fan experience as they connect with audiences and drive viewership and participation. Financial planning and sponsorship acquisition are essential for teams and events to thrive, allowing organizations to maintain and grow their facilities and services. Legal professionals within sports management handle everything from contract negotiation to intellectual property rights, safeguarding the integrity and business interests of sports organizations.

This paper explores the various facets of sports management, focusing on the objectives and contributions of professionals who strive to make sporting events and organizations successful. By examining these aspects, we can better understand how sports management fuels the U.S. economy, shapes sports culture, and supports the passions of millions of fans. As the demand for skilled sports managers rises, so does the industry's influence on sports and the American economic landscape. In summary, this paper focuses on sports management, which encompasses the planning, supervising, and organizing of various sporting activities.

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Securing Future Food: Addressing Land Degradation, Water Scarcity, and Sustainable Agriculture

Sudani García Galindo

Abstract: According to the UN, 95% of the agricultural land will be degraded and twice as much water will be needed to produce food in the future. One-quarter part of world's agriculture is located in regions with water scarcity, which has led to the irrigation of crops with the sewage. This has become usual, causing serious health problems due to the consumption of vegetables grown in those conditions. Hidalgo's environmental problem is largely caused due to the residual water that comes from Mexico City and flows into Tula de Allende´s region. This contains hydrocarbons, cyanide, lead, pesticides, herbicides and have led to the increase in diseases that go from stomachache to cancer. Every day, 4,890,240 liters of residual water arrive to Hidalgo and 62,200 hectares of crops, belonging to 46,511 producers in the Mezquital Valley, are irrigated. Technological advances to improve human nutrition and quality of life in the future depend on solving the main problem: agricultural food production and irrigation of crops with sewage in the region of Tula de Allende; for this reason, it was decided to innovate the application of SMART FARMING and create a space to develop sustainable agriculture at home and thus have fresher, healthier and more nutritious cultivated foods that are quick to consume, irrigated with clean (drinking water) and reusable water (rain water). SMARTFARMING-HOME works with digital smart sensors that measure humidity using LOD technology and renewable energy for growing vegetables inside home.

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The Effect of Age on Short-Term Memory: In-Person and Online

Grace Kuriakose

Abstract: Memory is in the hippocampus, the center for learning. With increasing age, the hippocampus has fewer neuronal connections leading to weaker memory. 65% of adults 65+ suffer with memory. 1% progress onto serious impairments. Previous studies suggest age hinders memory, however, it's not well understood how short-term memory assessment methods (i.e. in-person vs. online) varies across age. This study investigated whether age affected short-term memory in an in-person versus an online setting. This study gathered 10 individuals across three age groups, ages 12-15 (n=5), 42-52 (n=3), and 72-76 (n=2). To assess short-term memory, an in-person and online exam were conducted. The in-person exam was a matching game where 20 matching pairs were laid in front of participants. Participants had 20 seconds to memorize the card's location, until flipped over. The participants had to find the most pairs in 30 seconds. The online test analyzed working memory through remembering numbers. The 12-15 age group had an average of 3.7 cards remembered on the in-person exam, compared to averages of 2.1 and 2.7 cards from the middle and older groups, respectively. The 42-52 age group had an average of 100.3 on the online exam compared to averages of 94.6 and 66.5 points from the younger and older groups, respectively. These findings suggest younger people have better visual memory, but middle-aged people have better working memory. This data could lead to a better understanding of neurological conditions across all ages such as Dementia.

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Economic Indicators and Election Year Correlations in the United States

Dylan Song

Abstract: In the United States, presidential elections are very important events and typically have widespread implications on many things in society. The economy is no exception, with the economy often being a highly central topic in the campaign of any primary or presidential candidate. They often promote their intended economic policies and attack their opponents' proposed policies or track records about the economy. Political analysts and economists frequently use economic indicators to forecast election results, acknowledging that while economic conditions significantly impact voter behavior, they are not the sole determinant. Social issues, foreign policy, and candidates' appeals also play vital roles in shaping electoral choices. Still, combining multiple economic indicators offers a strong framework for predicting election outcomes, making economic performance a focal point during campaigns. These insights reveal that robust economic performance often bolsters incumbents' chances, whereas economic downturns create opportunities for opposition parties to gain momentum and challenge the status quo. The primary objective of this paper is to explore and analyze the correlations between various economic indicators and the years in which presidential elections are held in the United States. Specifically, this paper aims to: (1) Identify significant economic indicators that show notable changes during presidential election years. (2) Analyze patterns and trends in these economic indicators across multiple election cycles. (3) Discuss the potential reasons behind these correlations and their implications for policymakers and the electorate.

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The Effect of Stainless Steel, Glass Ceramics, Wood, Plastic, Aluminum, and Acrylic Glass on Wifi Signal Attenuation

Sharath Venkatesan

Abstract: Wifi serves as a vital tool to connect people around the world. This experiment was done to test different materials and their effect on wifi signals. It was hypothesized that the conductors of electricity will attenuate wifi signals more than the insulators of electricity. I gathered common household materials that were used as obstructions, placed them over the router, and used a 3-Axis Radio Frequency Strength Meter to measure the amount of radio frequencies in mW/ m2. The results were gathered as an average of three trials per obstruction and were compared to a control result of obstruction over the router. A Ceramic Pot attenuated the wifi signal the greatest, bringing the signal down 1683.8 mW/ m2 from the control, while wood wood only attenuated 138.6 mW/ m2. However, Aluminum foil attenuated 1655 mW/ m2. The research demonstrated that conductors do attenuate wifi signals more effectively than insulators, however ceramics was an outlier. In the future, the health effects caused by Radio Frequencies can be explored. The effect of these materials on download and upload speeds can also be expanded upon.

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The Effect of Cold-Inducible Rna-Binding Protein (Cirp) on Phosphorylated Camkii Downregulation

Hannah Joseph

Abstract: Alzheimer's Disease (AD) is an irreversible neurodegenerative disease which affects more than six million Americans. Although the etiology of AD is unclear, studies suggest alcohol consumption as a risk factor for dementia requiring neurologists' aid. The prevalence of binge drinking worldwide is 16%. Research demonstrates binge drinking can release CIRP, a stress protein, from immune cells such as the microglia, to promote inflammation and inhibit neurological function. One essential function is synaptic plasticity. Synaptic plasticity, an important process of brain network development, relies on the activation of n-methyl-d-aspartate (NMDA) receptors. Activation of NMDA receptors results in calcium influx, most abundantly Calcium kinase II (CaMKII). Thus, this study measured phosphorylated CaMKII as an indicator of synaptic plasticity in HT-22 neuronal cell lines to determine CIRP's effects on phosphorylated CaMKII downregulation. HT-22 cell lines were differentiated and separated into control, CIRP, CIRP + NMDA 10', and CIRP + NMDA 30' treatment groups. A NMDA control consisted of a control, NMDA 10', NMDA 20', and NMDA 30' groups. These time intervals determined the ideal time of CIRP activation. Each CIRP treatment group was initially treated with CIRP and after four hours, designated groups were treated with NMDA in time intervals. After, tissue lysates were used for phosphorylated CaMKII protein quantification and western blot. The results demonstrate that CIRP did not significantly decrease phosphorylated CaMKII ($p = 0.9781$). This suggests CIRP did not effectively downregulate synaptic plasticity which would likely induce AD. Future studies can use cells that exhibit neuronal properties to clearly identify CIRP's effects.

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Ecofriendly Organic Solar Cells(OSCs): Electron Donor and Acceptor in the Photoactive Layers

Sarah Yang, Kahyung Ko, An-jae Kim, Nayeon Kim

Abstract: Organic photovoltaics (OPVs) are a solar cell technology that utilizes organic materials, such as polymers or small molecules, to generate electricity from sunlight. Unlike conventional silicon-based solar panels, OPVs are constructed from carbon-based materials. These solar cells consist of layers of organic molecules or polymers that function as semiconductors. Within these layers, an electron donor and an electron acceptor work together to produce and direct electrical charges when exposed to sunlight. A notable advantage of OPVs is their flexibility and lightweight design. However, the efficiency of OPVs is currently lower than silicon-based photovoltaics. Typical OPV efficiencies range from 10-15%, compared to the 20-25% achieved by the best silicon panels. Researchers are focusing on enhancing the efficiency and lifespan of OPVs while further reducing their environmental impact. This study utilized computational methods to design and analyze composite materials, focusing on their thermodynamic and electrical efficiencies. Theoretical calculations and simulations enabled the systematic exploration of a wide range of material combinations and configurations, a process that would be impractical using experimental techniques alone. By investigating various geometries, the study identified optimized structures that improve charge carrier mobility. Additionally, the analysis of stereochemical and thermodynamic properties offered valuable insights into the behavior of these materials under different conditions. This understanding is essential for ensuring their stability and optimizing their performance in real-world applications.

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Human Hepatic Liver Stellate Cells And Hepatocytes

Kate Bondarenko and Marta Melis

Abstract: Vitamin A, not naturally produced by the body, undergoes a series of metabolic steps to become retinyl esters, which are then stored and activated in the liver. Before being stored as retinyl ester in HSCs (hepatic stellate cells), though, the liver receives retinol bound to chylomicrons from the intestine and transported through the blood.

It is known that retinol is first released in hepatocytes, but there is not a consensus on what reactions occur in hepatocytes and in HSCs. Mechanistically, the final product of retinol is retinoic acid (RA), the natural ligand for the retinoic acid receptors (RARα, β, and γ) that drive the transcription of target genes. In order to test what processes happen in HSCs and hepatocytes, gene expression of the RARs was tested in response to RA, and AC261066 (AC), a RARb2 agonist, using gel electrophoresis. It was reported that RARβ is essential to maintain lipid homeostasis, so this was tested in both stellate cells and hepatocytes using oleic and palmitic acids with dye-fold change, then quantified.

In addition, fibrosis-related genes were tested in stellate cells, because it is known that they produce scar tissue in the liver. Overall, RA did not affect the expression of the RARs in the HSCs and hepatocytes. For the lipid accumulation experiments, RA and AC were both extremely effective in reducing fat levels, especially in the hepatocytes. In conclusion, hepatocytes are more affected by RA and AC, especially in regards to lipid accumulation, though further testing at different concentrations and time points needs to be done.

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The Effect of Environmental Awareness and Education on Motivations in High School Students to Counteract Climate Change

Susanna Denny

Abstract: Ever since the scientific community has identified increasing levels of global warming, the necessity for public education and awareness has become apparent. While individual efforts to mitigate climate change may seem fruitless, they are a crucial parameter to measure interest in and compassion for the environment, and they prove influential in global carbon emissions and energy usage. Previous research has supported the notion that one's sustainable behaviors are correlated with one's knowledge of ecological concerns. The present study administered environmental awareness surveys, in which high school participants' knowledge was compared to their behaviors. Additionally, optional interviews provided a deeper insight into the perspectives of the causes, impacts, and implications of climate change. The departing survey furthered an exploration of the impact that education has on individuals' views of climate change. While a causational relationship was not determined between environmental knowledge and behavior, both qualitative and quantitative data collected support a correlation between the two. Implications for future research include investigating the link between knowledge of sustainable behaviors and one's motivation to engage in sustainable behaviors, as well as the connection between environmental knowledge and eco-anxiety. Ultimately, this research aids the discussion about strengthening environmental education, including education on sustainability practices.

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Improving the Effectiveness of Neosporin on Escherichia coli by Supplementation with Resveratrol

Carissa Spencer

Abstract: Approximately 95,000 cases of E. coli related food poisoning are reported in the U.S. each year. The purpose of this study is to improve the effectiveness of the antibiotic Neosporin against bacteria by supplementing it with the polyphenol resveratrol. There is a great deal of information about the impact of polyphenols on the function of topoisomerase and the development of resistance to standard antibiotics. However, there is very little research on the impact of the polyphenol resveratrol combined with the standard antibiotic, neosporin, on the growth of Escherichia coli. This study was designed to investigate the effect of the common antibiotic neosporin enhanced with the polyphenol resveratrol on Escherichia coli. This study was completed by combining the neosporin with resveratrol and examining the zones of inhibition versus the control (water) using a Kirby-Bauer assay. Two different trials were conducted over the course of 4 days. The results of the Kirby-Bauer assay showed that, as hypothesized, the neosporin and resveratrol combined had the largest zones of inhibition. Thus, this novel combination could be a promising new method to address antibiotic resistance.

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A Comparison Between Eugenia caryophyllata Extracted From Syzygium aromaticum Buds and Prepared Syzygium aromaticum Essential Oil on the Antimicrobial Resistance of Escherichia coli

Ronan Higgins

Abstract: Pathogens that can develop resistance to antimicrobial treatments has become a phenomenon extensively recorded over the last few years. Pathogens including Escherichia coli are dangerous to humans and are capable of resisting a variety of treatments. Treatments using clove (Syzygium aromaticum) essential oil and eugenol extracted from clove buds have been shown to deactivate Escherichia coli strains and to prevent the development of antimicrobial resistance. As pathogens such as Escherichia coli have concerned the medical world, it is crucial to attempt to find the most effective treatment, a comparison on the performance of these two treatments would be beneficial in finding this. Samples of clove oil and eugenol were applied to antibiotic disks and placed in agar plates inoculated with Escherichia coli. Plates with ampicillin and no treatment were prepared as well. These plates were stored in an incubator and taken out once three days each, the areas of the zones of inhibition were recorded and their averages were calculated, visual observations were written down as well. The eugenol plate demonstrated dense Escherichia coli growth and small zones of inhibition while the essential oil plate featured sparse growth, this could suggest that clove essential oil is more capable of inhibiting Escherichia coli growth, though it was theorized that the oil may have been thin enough to diffuse across its plate.

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The Effect of Wood Ash on the Developmental Rate of Artemia salina

Katelyn Agtuca

Abstract: Approximately 17 million animals die each year because of wildfires and those that survive are heavily affected by them. These fires release very fine ash particles into the air which are the most impactful on an animalâ€™s health, such as breathing. The effect of ash on freshwater plants was recently studied and showed the ash negatively impacted their development . There is a great deal of information on the negative impacts wildfires can directly have on terrestrial organisms. However, there is very minimal research on the effect ash has on the development of aquatic species such as Artemia salina, commonly known as brine shrimp. This study was designed to investigate the effect of frequent exposure to wildfire ash had on the developmental rate of Artemia salina. The brine shrimp were divided into four groups, control, and three experimental groups with ash concentrations of 25%, 50%, and 75%. All groups were evaluated for their development and survival and four pictures were taken of each separate group evaluation for 10 days over a 12 day period. The results concluded that exposure to ash had a negative impact on the development of the brine shrimp. These results support previous research performed using aquatic plants. Thus, this study shows it is important to consider the impact of wildfires on the aquatic ecosystem as well.

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MOF-Based Semiconductors for Electronic and Energy Applications

Seyeon Lee

Abstract: MOF-5 and other metal-organic frameworks (MOFs) exhibit semiconductor behavior, particularly when exposed to light, leading to charge separation between electrons and holes. This property makes MOFs promising materials for applications in optoelectronics, photocatalysis, and superconducting materials. A more developed form of MOFs, such as UiO-66-BDC-NH2, have massive surface area and high porosity, which enhance their electrical conductivity and charge transport efficiency. These characteristics make them highly effective as electron carriers in superconducting and energy-harvesting applications. Unlike conventional semiconductors, MOFs offer structural flexibility, allowing for the tunable synthesis of different compositions, shapes, sizes, and chemical functionalities, making them adaptable to various electronic applications. The charge/discharge profiles, cyclic voltammetry (CV) curves, and cycling performance of nanoscale metal-organic frameworks (nMOFs) exhibit behaviors similar to traditional supercapacitors, but with distinct electrochemical advantages. The structural diversity and functional attributes of MOFs play a crucial role in charge transport and energy storage, influencing their semiconductor behavior. Depending on their chemical composition, certain nMOFs undergo redox reactions, enhancing their capacitance beyond benchmark materials. These properties make nMOFs highly effective for electronic and optoelectronic applications, particularly in supercapacitors and semiconductor-based energy storage systems.

In this study, molecular editing and computatir onal modeling were used to design and optimi- ze the semiconductor properties of metal-orga- nic frameworks (MOFs). The stereochemical and thermodynamic properties of MOFs were analyzed using theoretical calculations and simulations to evaluate their electronic activity and stability. To assess the stability of MOFs as semiconductors, we analyzed their optimized configuration energies. The stability of a MOF compound is determined by the energy required to reach an optimized state—lower stabilization energy indicates higher structural stability. The ability to engineer MOFs with specific electronic properties through rational design of functional groups and linkers presents opportunities for their integration into emerging semiconductor technologies.

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The Effect of Distance From Route 25A on Water Quality

Jessica Wojnicki

Abstract: The Long Island Sound is a tidal estuary between Long Island and Connecticut in the United States (Long, n.d). It houses 9 million people and provides around 200,000 jobs with an estimated value of $17-37 billion dollars a year (Gabrielle, 2022; Neiwpcc, n.d.). The purpose of this experiment is to see if the distance from Route 25A, a major road on Long Island, to the testing site has an effect on the water quality. It is hypothesized that the distance from Route 25A will have an effect on the nitrates, nitrites, ammonia or pH of the water. The testing took place at Cedarmere, North Hempstead Beach, Bay Walk, and Sunset. At each location, a bottle was filled with water from the tides and were brought home, where the pH, ammonia, nitrate and nitrite levels were tested for with an API saltwater testing kit and logged into a notebook. It was found that distance from Route 25A has no effect on pH or ammonia, but it has an effect on the nitrate levels. This means car engine emissions may have an impact on the local ecosystem, and may lead to eutrophication occurring, which can kill off marine organisms. Future research may want to increase the testing locations and use automatic sensors to increase accuracy and ease of testing.

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Investigating the Physical Mechanism of the Buzz Phenomenon in A Supersonic Intake

Stacey Krivitsky

Abstract: The Long Island Sound is a tidal estuary between Long Island and Connecticut in the United States (Long, n.d). It houses 9 million people and provides around 200,000 jobs with an estimated value of $17-37 billion dollars a year (Gabrielle, 2022; Neiwpcc, n.d.). The purpose of this experiment is to see if the distance from Route 25A, a major road on Long Island, to the testing site has an effect on the water quality. It is hypothesized that the distance from Route 25A will have an effect on the nitrates, nitrites, ammonia or pH of the water. The testing took place at Cedarmere, North Hempstead Beach, Bay Walk, and Sunset. At each location, a bottle was filled with water from the tides and were brought home, where the pH, ammonia, nitrate and nitrite levels were tested for with an API saltwater testing kit and logged into a notebook. It was found that distance from Route 25A has no effect on pH or ammonia, but it has an effect on the nitrate levels. This means car engine emissions may have an impact on the local ecosystem, and may lead to eutrophication occurring, which can kill off marine organisms. Future research may want to increase the testing locations and use automatic sensors to increase accuracy and ease of testing.

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The Effect of Allura red AC on the Motility and Regeneration Rate of Dugesia tigrina

Christie Lauren Arce

Abstract: Red 40 dye has been banned in European countries due to rising health concerns. There is evidence that Red 40, also called Allura red AC, can cause hyperactivity in humans along with negatively affecting the colon and causing Early Onset Colorectal cancer in mice. This study aimed to investigate if doses of 0, 15, 30, and 60 microliters of Allura red AC can contribute to negative effects on the phototaxis rate and the rate of regeneration of Dugesia tigrina. It is hypothesized that if Allura red AC is fed to Dugesia tigrina then, it will increase motility, and slow the rate of regeneration. This study was performed using four groups of Dugesia tigrina with 0 µM, 0.125µM, 0.25µM, and 0.5µM of red 40 and measuring the length of the planaria, and the rate of movement of planaria over the course of 31 days. The results of this study show that an increase in Allura red AC exposure causes a decrease in the regeneration rate, an increase in phototaxis, and an increase in mortality. Future research suggests a conversion in dosage and/or form of dye (powder version). Also, recommendations for future research include using a different type of organism such as Drosophila melanogaster.

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Alleviating Mitochondrial Depolarization With Inhibition of mPTP in Catecholamine-Stimulated White Adipocytes

Serena Chen

Abstract: Obesity, defined with a BMI ≥ 30.0 kg/m2, affects over 40% of U.S. adults. Although dieting or surgery are possible, majority of treatments have consequential side effects. Recent studies have found increased energy expenditure in white adipocytes via lipolysis of fat droplets that may lead to weight loss induced by catecholamines, which are neurotransmitters. However, it is associated with mitochondrial depolarization that is linked to apoptosis, causing lipotoxicity and further complications. Studies have found that curcumin, an antioxidant, can alleviate mitochondrial depolarization through the mitochondrial membrane permeability transition pore (mPTP), a transmembrane protein, but has not been studied in adipocytes. Therefore, this study investigated the role of mPTP opening in membrane depolarization and antioxidant properties of curcumin in catecholamine-stimulated white adipocytes. Preadipocytes isolated from C57Bl/6 wild type male mice were differentiated. Oxygen consumption rate (OCR) and normalized intensity measuring membrane potential were measured using seahorse assays and tetramethylrhodamine methyl ester (TMRM) dye imaging, respectively. Results revealed normalized intensity with addition of mPTP inhibitor cyclosporine A (CSA) was significantly higher than CL-316,243 Control ($p<0.05$), suggesting that inhibition of mPTP can alleviate membrane potential loss. However, addition of CSA still decreased mitochondrial membrane intensity, suggesting mPTP opening only plays a partial role in membrane depolarization. Results also found 24-hour curcumin pretreatment had significantly increased OCR at its peak compared to V Curcumin ($p<0.0001$), suggesting curcumin may increase energy expenditure. However, curcumin did not prevent mitochondrial dysfunction as observed with steady OCR decline.

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Developing the Secretion of the Francisella Tularensis Protein FTL_1123 from Escherichia coli containing the Hemolysin HlyBD Operon

Mehek Sawhney

Abstract: Francisella tularensis, a gram-negative bacterium, is the causative agent of tularemia, a severe zoonotic disease known for its high lethality even with minimal exposure. Recognized by the CDC as a tier one biothreat agent, as it poses a severe potential risk for biological warfare. This resilient bacterium not only establishes a beneficial environment to thrive within macrophage immune cells but also delays apoptosis (natural programmed cell death). Further, Francisella tularensis interferes with the host's signaling system, specifically targeting the MyD88 pathway. This interference hinders the production of cytokines, which play a crucial role in regulating the immune response. Recent studies suggest that this interference in signaling depends on TolC, a protein known for aiding in the release of specific toxins from bacterial cells. BLAST analysis revealed that part of a protein in Francisella tularensis is similar in a pattern (RTX motif) found in FrpC, a protein secreted by Neisseria meningitidis with the help of TolC, characterizing FTL_1123 as a protein of interest. This research investigated the secretion mechanism of the FTL_1123 protein in Francisella tularensis, and found it is secreted through the canonical Type 1 Secretion System (T1SS), located in Escherichia coli. The FTL_1123 protein lacks the complete RTX regions typically associated with T1SS-secreted proteins. This study provides insight into the secretion of FTL_1123 and the role of RTX motifs in T1SS-secreted proteins. These findings enhance our understanding of bacterial virulence and set the way for possible therapeutics that interfere with the bacteria's ability to form its replicative niches.

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