

Abstract: Science and Engineering Fair of Houston

1309

Does Lung Capacity Depend on Height

Omar Gill

Conroe ISD /York Junior High

Category

Medicine and Health

This project aimed to explore the relationship between lung capacity and height and whether or not there is a relationship between the two. The hypothesis was that if lung volume depends on height, then people with greater height will generally have larger lung volumes compared to people with shorter heights. To test this, lung capacity using a spirometer was measured on a set of participants of varying heights. Results obtained were then analyzed to identify a pattern or a relationship between the height and the lung capacity. From these results, a slight correlation occurred, and people with taller height showed a greater lung capacity. There are chances of errors in the experiment; measurement methods and participant conditions may have affected them. More research is needed. In the end, there was partial evidence for the hypothesis to be proven from the study, but additional research is necessary with larger sample sizes and in more controlled conditions.

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 vertebrate animals microorganisms rDNA tissue

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Abstract: Science and Engineering Fair of Houston

1310

What Scrubbing Technique and Soap Brand Cleans The Best

Alexander Ayala

SST - Champions College Prep - MS

Category

Medicine and Health

Have you ever wondered if your dishes are really clean, and if it isn't, what is the preferred soap brand? Well, I have too! The purpose of this research was to explore which Soap Brand and Dishwashing Techniques work best for washing the icky mold/bacteria on our plates after a good meal. My main claim is to find out which soaps and scrubbing methods will help tidy up a dish and according to my data, the circular and ajax did well cleaning. Even though far away it looks like none of them are cleaned. But, ajax stands out as it has no moldy spots, yellow pigmented areas, and not a lot of bacteria. According to our data, using circular motions and ajax will remove most bacteria so me and others can reuse that dish and eat another yummy meal again. In conclusion, the Ajax soap brand cleans the best out of Dawn, Palmolive, and Ajax and overall and the circular motion cleans to shunt the growth of bacteria as well.

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Abstract: Science and Engineering Fair of Houston

1311

The Integration of Machine Learning into ECG data for Analysis

Jed Baidoo

Fort Bend ISD /Quail Valley Middle School

Category

Medicine and Health

This experiment presents a machine learning program designed to analyze and categorize electrocardiogram (ECG) signals into various arrhythmias. The program utilizes Mathwork's classification learner to detect and classify abnormal heart rhythms based on features extracted from ECG waveforms. The methodology involves preprocessing the ECG signals to extract relevant features such as peak heights, intervals, and other characteristics. These features serve as input to a machine learning model, which is trained on a diverse dataset of annotated ECG signals representing different arrhythmias. The dataset used is the MIT-BIH, a commonly utilized and trusted source of ECG signals. The program employs a classification algorithm that learns to differentiate between normal sinus rhythm and various types of arrhythmias, including atrial fibrillation, ventricular tachycardia, bradycardia, and others. The model is evaluated using performance metrics such as accuracy, sensitivity, and specificity to assess its classification capabilities. Results demonstrate the program's effectiveness in accurately sorting ECG signals into distinct arrhythmia categories, enabling for the eventual rapid and automated diagnosis of cardiac abnormalities.

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Abstract: Science and Engineering Fair of Houston

1312

Reading Into the Light

Manuel Herz

All Nations Community School - MS

Category

Medicine and Health

This project will see which light is the best for increasing reading speed. This project was chosen because I love reading. The project's goal is to aid those who love reading by answering the question: Which light temperature causes a person to read the fastest between lights of 2700 (yellow light), 3500 (neutral light) and 5000 Kelvin (white light)? The hypothesis was that white light would cause subjects to read the fastest. This project was tested on 20 people. The analysis showed that white light caused subjects to read the fastest, with an average words per minute of 6.2055. Yellow light had the second highest average wpm, 6.1757. Yellow light also had the highest overall words per minute of 18.35. This project was concluded with the hypothesis being correct. Future projects may include comparing yellow light to white light in the context of reading a longer versus shorter passage.

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Abstract: Science and Engineering Fair of Houston

1313

Aerobic Activity and Heart Rate in Adults

Asher Perez

Houston ISD /BCM Academy at James D Ryan - MS

Category

Medicine and Health

Ever wondered how different exercises affect your heart? This experiment explored the impact of walking, running, biking, and swimming on heart rate in adults, aiming to understand which activity results in the greatest cardiovascular response. The hypothesis was that the exercise that uses the most body movement is the one that will result in the highest heart rate. Participants performed each activity for 30 minutes at 60–80% intensity, with heart rates measured before and after the 30 minutes. Each type of exercise engaged the cardiovascular system, and was monitored to see which body movement exercise led to the highest heart rate. The result was that running and swimming increased heart rate greater than activities like walking or biking. Although most of the body was utilized to swim, running resulted in the greatest cardiovascular response (highest heart rate).

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Abstract: Science and Engineering Fair of Houston

1314

Lead Paint In Our Home?

Adelyn Olvera
Emma Contreras
Weis Middle School

Category

Medicine and Health

Our purpose for this experiment was to prove that some paint still have lead in them and that is it really harmful to people. That's why we used trusted lead swabs to see which paint at the store had the most lead out of the three paints we got. We found out that Valspar had the most out of the three home paints we got.

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Abstract: Science and Engineering Fair of Houston

1315

Which Antacid Neutralizes Stomach Acid the Fastest?

Brison James Dondonay
Weis Middle School

Category

Medicine and Health

This project aims to figure out which antacid can treat stomach acid the best. I am doing this experiment because I wanted to see which antacid helps the best when you have a stomachache. Antacids neutralize stomach acids when the acid and the antacid combines. I tested four different antacids (Tums, Pepcid, Gaviscon, and Mylanta) by mixing them with lemon juice (acid) and measured the pH after addition of each tablet or teaspoon of antacid. After 3 tablets of Tums, the pH of lemon juice was 5; after 3 tablets of Pepcid, the pH was 5.5, after 3 tablets of Gaviscon, the pH was 3, and after 3 teaspoons of Mylanta, the pH was 3.5. In conclusion, Pepcid was the best to treat stomach acid and Gaviscon was the least strongest to treat stomach acid. Pepcid had 800 mg of calcium carbonate and 165 mg of magnesium hydroxide, and both calcium carbonate and magnesium hydroxide help with neutralizing stomach acid/acid by turning acid to water and soluble salts. Gaviscon only had 105 mg of magnesium carbonate, that's why Gaviscon was the least strongest.

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Abstract: Science and Engineering Fair of Houston

1316

11-Year-Olds Versus Fast Food

Zoey Scott

Weis Middle School

Category

Medicine and Health

11 Year Olds VS Fast Food This project studies how healthy the average 11-year-old eats, how much fast food they eat, and how bad is fast food for them, based on the USDA recommended diet. My hypothesis is that the eating habits of the average 11-year-old do not match the recommended diet of the USDA. Procedure- 1: Make/post a survey for my peers to complete. 2: The most frequented restaurants will be chosen from the survey results, along with the most commonly ordered foods from such restaurants. 3: Compare the nutrients of that food to the recommended diet from the USDA. 4: Compare the average times 11-year-olds go to a fast food restaurant per week to the recommended USDA times. Results: The USDA recommends that children at the age of 11 should limit their fast food consumption to no more than once a week. In my project they averagely eat fast food 2-3 times a week. I am going to compare the nutrition of the most popular item to the USDA recommended diet for an 11 year old. 1. The Big Mac: Mcdonalds 2. Pepperoni pizza: pizza places 3. The 3 Chicken Finger Combo: Raising Cane's 4. The Strawberry Creme Frappuccino: Starbucks 5. Original Hot Wings: WingStop 6. The Whopper: Burger King 7. Chicken Nuggets: Wendy's 8. Orange Chicken: Panda Express 9. The Original Chicken Sandwich: Chick-fil-A 10. Popcorn Chicken: Jack in the Box 11. The Original Recipe Chicken Bucket: KFC 12. Double Meat Whataburger: Whataburger 13. Butterfly Shrimp: Golden Corral 14. Chicken Burrito Bowl: Chipotle Conclusion: My hypothesis was correct, the eating habits of the average 11 year old do not match the recommended diet of the USDA. These eating habits are bad for them.

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Abstract: Science and Engineering Fair of Houston

1317

CO2mparing Lung Sizes of Different Athletes

Addison Dimmick

Clear Creek ISD /Seabrook Intermediate School

Category

Medicine and Health

This project was designed to test the impact of age and activity levels on lung size, capacity and health as well as carbon dioxide exhalation rates. An understanding of this is crucial for space exploration and mission control planning as mission planning must account for carbon dioxide increases and the need for adequate oxygen in the spaceship. The hypothesis was that individuals with greater lung size and activity levels will produce more CO₂. To test this, participants blew into a cup of water and changes in pH were recorded to determine CO₂ production rates. In addition, participants were tested for lung strength and health by measuring peak flow and flow rate using a spirometer. Participants completed a short survey about activity levels to correlate data on lung health with physical activity. The data on peak flow indicated that active people in most age groups are able to exhale more air from their lungs than similarly aged people who are not active. Similarly, active participants typically have greater lung capacity and function. Interestingly, comparing peak flow rate and liters per minute by days active showed that the results for lung capacity do not seem to vary drastically based on how many days a participant was active. The pH test did not indicate a big difference between active and inactive participants suggesting that CO₂ production rates do not differ by lung capacity.

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Abstract: Science and Engineering Fair of Houston

1318

Air It Out

Micah Freeman
Central Middle School

Category

Medicine and Health

Vaping has been proven to have harmful affects on the body, I wanted to test it myself to see if vaping affects lung capacity. I believe that vaping affects lung capacity and lessens it. We tested 10 people, 5 who vape, and 5 who don't vape using a spirometer to measure the lung capacity of the people, and we made sure for safety to sanitize the spirometer. We tested 3 times on each person and added it up to find the average. The results didn't seem to differ from each other, but the vapers tests seem to largely vary more between the tests.

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Abstract: Science and Engineering Fair of Houston

1319

Tandem Repeat Analysis and Visualization Atlas (TRAVA)

Adel Sisy

Manvel Junior High - MS

Category

Medicine and Health

The Tandem Repeat Analysis and Visualization Atlas (TRAVA) is an innovative bioinformatics platform designed to address the critical challenges in curing genetic diseases at a large scale by linking them to tandem repeats and single nucleotide polymorphisms (SNPs). TRAVA establishes comprehensive connections between genomic variations and 10,812 pathogenic genetic diseases by analyzing over 128 million tandem repeats and 1.1 billion SNPs across 187,175 genes, then visualizing 34 million tandem repeats and 194,687 pathogenic SNPs across 5,753 genes. TRAVA uses advanced algorithms to identify tandem repeats in gene sequences, map SNPs onto the tandem repeats, and find the exact nucleotides in each of the genes that are linked to each of the 10,812 genetic diseases. These disease to gene to SNP to tandem repeat mappings reveal the exact percentage of tandem repeats in each gene's sequence and 55,090 SNPs located in 43,725 tandem repeats, further enhancing our understanding of the genomic causes of these genetic diseases. Additionally, the use of user-friendly visualization tools provides an accessible, interactive approach for researchers and clinicians to explore the analyzed genetic data. TRAVA performs all of these analyses and visualizations with high efficiency and accuracy, even on vast genetic datasets. All of these discoveries can lead to advancements in precision medicine, offering targets for gene editing therapies, predictive models, and early diagnosis tools. As a next step, TRAVA's scope will expand to analyze and visualize amino acid sequences and their mutations as well as incorporate large language models for new proteins and drug discoveries.

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Abstract: Science and Engineering Fair of Houston

1320

Rhythms of the Heart

Victoria Cheng
Kylie Tran
Alief ISD

Category

Medicine and Health

The experiment results conclude that music affects heart rate in many ways such as increasing and decreasing based on the speed and type of music. Music like rock, can increase your heart rate because of the fast paced rhythms. Classical music can actually do the opposite by decreasing the heart rate because of its calm, slow rhythms. Slow and calming music can make people less stressed. On the other hand, fast music can make the person more stressed which can cause an increase in the heart rate.

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Abstract: Science and Engineering Fair of Houston

1321

Lies in matters of the heart

Hayden Vaval

Houston ISD /BCM Biotech Academy at Rusk - MS

Category

Medicine and Health

I tested how the severity of a lie affects the by bringing my subject into a separate room before putting a pulse oximeter on their finger. First I asked them a small question like how old are you to get their base heart rate. For the next series of questions I asked them to tell a lie for all the questions I was going to ask them to answer. I started asking small lie questions like " whats your favorite color ?" .I wrote down their heart rate from the pulse oximeter when asked the question. I asked about 4 of these questions before going into more depth questions like " have you ever physically hurt someone ?" I also asked about 4 of these questions while writing what their heart rate was off the pulse oximeter as they replied to the question. I calculated the averages of these heart rates once I was done. I separated my averages into two different tables from adult to child as shown in the graph. I also did an EKG on one of the subject by using a heart monitor to track her heart rate as I asked the questions. I asked the subject to lie for one of the rounds of the EKG and one round where I asked her to tell a lie the whole time.

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Abstract: Science and Engineering Fair of Houston

1322

how different types of mask work against illnesses

Aaron Menjivar

shelby mason

Michael Gomez

School of Science and Technology, Houston - MS

Category

Medicine and Health

The purpose of my project is to find out if masks really do have an affect against illnesses and if maybe they can come up with a number. Procedure: Step 1: Cut the mask at a 90 degree angle and make sure the materials in the masks dont fall out. Step 2: touch all the materials feel them without gloves and with them. Step 3: after touching all the materials plac them each in diffrent containers and do steps 1 through 3 again but with the diffrent masks.

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Abstract: Science and Engineering Fair of Houston

1323

Stress-Induced Ocular Discomfort: The Impact of Stress on Dry-Eye Symptoms in Adolescents

Caitlyn Wijatno

Fort Bend ISD /Sartartia Middle School

Category

Medicine and Health

Through personal experiences with dry eyes and the challenges it caused, in addition to my interest in optometry, I wanted to explore one of the possible rudimentary causes of dry eyes, which is profoundly present in many adolescents: stress. I hypothesized that if an individual is in a stressful environment or condition, tear production will decrease, resulting in the development of dry-eye symptoms. To test this, data was collected from peers via surveys that measured stress levels, sleep patterns (hours of sleep received from the previous night and typical amount of sleep), blinking rates, and self-reported dry-eye symptoms in each eye, such as itchiness, redness, and gritty/scratchy sensations. The results revealed that higher stress levels correlate with a higher severity of these symptoms and can be explained by increased cortisol levels, a byproduct of stress. Cortisol, a stress hormone, causes inflammation throughout the body and can affect the lacrimal apparatus, causing the eyes to dry. Additionally, insufficient sleep and changes to one's blinking rate, common results of stress, can amplify dry-eye symptoms. These findings reveal that a correlation exists between stress and dry eyes due to a decrease in tear production, highlighting the importance of stress management through simple lifestyle changes and adequate sleep when it comes to ocular health.

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Abstract: Science and Engineering Fair of Houston

1324

How different drinks affect your teeth

Zara-Mae Brown

Elizabeth Brown

Ivanna Ortega

School of Science and Technology, Houston - MS

Category

Medicine and Health

Our project is called "Sip and Smile" and the purpose, or objective of this project is to test how different beverages can affect our teeth differently. We will use a selection of different beverages and put an egg in each drink. This is how we plan to test our hypothesis, which is, "drinks with darker colors or higher sugars are most likely to cause the most effects on teeth." The egg in the project serves as the teeth, since both eggs and teeth include enamel and calcium.

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Abstract: Science and Engineering Fair of Houston

1325

Does running everyday increase your stamina?

Kendrick Stevens

School of Science and Technology, Houston - MS

Category

Medicine and Health

Did you know that people who run have a boosted immune system, which makes them overall have a longer life. My project was created to highlight the effects of running and see if running everyday increases your overall stamina. The way I conducted this experiment was a ran a distance as many laps as I could as many times as I could. The results showed that I was able to run 2 more laps each day I ran, proving that my stamina increased each day.

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Abstract: Science and Engineering Fair of Houston

1326

Testing the Effectiveness of Sanitizer

Enzo Rivas

Houston ISD /BCM Academy at James D Ryan - MS

Category

Medicine and Health

The main objective of this project is to see does changing the brand affect how much bacteria is killed. My question is does changing the brand of sanitizer affect how much bacteria is killed by both of the sanitizers, my hypothesis is that both of the brands of sanitizers will kill the same amount of bacteria. The trial one with sample one using the "purell" sanitizer had 8 colonies of microorganism, the sample two without sanitizer had about 20 colonies of microorganisms. The trial two with sample one using the "hempz" sanitizer had about 9 colonies of bacteria, and the sample two without sanitizer had 14 colonies.

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Abstract: Science and Engineering Fair of Houston

1327

Microwaving Plastics Helpful or Harmful

Dhir Gandhi

Clear Creek ISD /Brookside Intermediate School

Category

Medicine and Health

(Before project take proper safety cautions) The purpose of this experiment was to investigate what the effect of microwaving different types of plastic containers is on the amount of microplastics in the water. Twelve samples were put in the microwave for 1 minute each. The types of plastics were Polypropylene, High-Density Polyethylene, Polyethylene and a glass container as the constant. After that the samples were vacuumed filtered and put under microscopy and the FTIR. The results showed that there were no microplastics discovered. There was only a slight mass difference in 2A Polyethylene which could have been a mistake. There were matches to other materials but no match to the respective plastic. This experiment rejects the hypothesis that the High-Density Polyethylene had the most microplastics considering that there were no microplastics that were seen in any of the other samples using the microscopy or the FTIR. Doing this project again with changing multiple things like using distilled water and doing it on a larger scale could prove helpful to the human society. After, experiment microplastics were disposed of in the trash per E. Lynn Shirey II.

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- yes no



Abstract: Science and Engineering Fair of Houston

1328

StRoVe – Stroke Recovery through Vascular Regeneration

Inba Vinothkumar

Conroe ISD /Knox Junior High

Category

Medicine and Health

Stroke, a leading cause of morbidity and mortality, occurs in ischemic and hemorrhagic forms, with the latter involving brain bleeding. Affecting over 795,000 people annually in the United States, stroke lacks effective prevention and treatment options. This study examines the role of Integrin alpha 6 (Itga6), a cell adhesion molecule expressed in endothelial cells, in neurovascular development and its therapeutic potential in stroke. Mutations and polymorphisms in the human ITGA6 gene are associated with cerebral hemorrhages, highlighting its importance in vascular integrity. Using zebrafish models, stroke was induced by genetically altering the Itga6 gene. Homozygous mutants (Itga6^{-/-}) showed significant neurovascular defects, including reduced Central arteries (CtAs) and malformed Basilar artery (BA) and Primordial Hindbrain Channels (PHBC), which were corrected by injecting wild-type Itga6 RNA. Transgenic zebrafish expressing fluorescent markers demonstrated that human Integrin $\alpha 6p$ ($\alpha 6p$), the extracellular domain of the ITGA6 protein, significantly reduced vascular defects and hemorrhages in Itga6^{-/-} mutants. Injection of $\alpha 6p$ corrected vascular deficits in 80% of the mutants, underscoring its therapeutic potential. These findings underscore the critical role of Itga6 in neurovascular integrity and suggest that $\alpha 6p$ could be a promising treatment for hemorrhagic stroke and other cerebrovascular conditions linked to ITGA6 mutations, providing new avenues for clinical intervention.

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

human participants

potentially hazardous biological agents

vertebrate animals

microorganisms

rDNA

tissue

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yes

no

3. I/We worked or used equipment in a regulated research institution or industrial setting.

yes

no

4. This project is a continuation of previous research.

yes

no

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Abstract: Science and Engineering Fair of Houston

1329

How dangerous a sweet drink can be

Christian De La cruz

Conroe ISD /Moorhead Junior High

Category

Medicine and Health

My science project goes into the medicine and health category. I am focusing on what drinks stain and cause tooth decay. First, I observed which drinks would erode the eggshells the most. I wanted to do this project to learn more about what drinks cause teeth stains and decay. During my experiment, I emptied eggs and placed each egg in a different cup. After separating each egg, I poured a different drink into each cup. Lastly, I tested which drinks stained and decayed my eggs the fastest. I learned that almost all drinks have chemicals that cause teeth stains. I also found new information that sodas cause the most tooth decay. I wanted to learn about this because having yellow and decayed teeth may also cause bad breath. Who wants bad breath?

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 vertebrate animals microorganisms rDNA tissue

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Abstract: Science and Engineering Fair of Houston

1330

Weaponizing Nutrition: Examining Middle School Diets to Fight Cancer

Tori Sturkey

Houston ISD /BCM Academy at James D Ryan - MS

Category

Medicine and Health

What if the food you eat today could play a critical role in preventing cancer tomorrow? This study seeks to explore the relationship between diet and cancer. By investigating how specific foods influence NK cell function which are natural cells in the body that fight off cancer, we can uncover whether nutrition might serve as a natural defense against cancer. The research will focus on middle school students, gathering data on their dietary habits to determine whether they are consuming foods that support cancer prevention. The primary question guiding this research is whether the typical diet of middle school students provides sufficient nutrition to reduce their cancer risk. I found in my research that many students often gravitate towards processed snacks and skip meals, this adds to my hypothesis that students are not eating in a way that reduces cancer risk. To test this, I distributed a survey to students that asks about their daily food choices, including their intake of fruits, vegetables, and whole grains. By pinpointing gaps in their diets, we can gain a better understanding of how making small dietary changes could reduce their risk of developing cancer in the future. This research could be the first step in promoting healthier eating habits that support cancer prevention.

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Abstract: Science and Engineering Fair of Houston

1331

Electrolysis for life support

William Johnson

Clear Creek ISD /League City Intermediate School

Category

Medicine and Health

Everybody needs air, it's a fundamental part of life. It is especially important in space or water exploration and the need for more portable life support systems will become more essential. In this project we are researching and testing if a human can survive for thirty minutes with generated oxygen using electrolysis with a portable power source like a battery. The project has an electrolysis apparatus with an electric current and when turned on the water will turn into hydrogen and oxygen. The gases will go into test tubes then we will measure the change of the water and compare if a human could survive for thirty minutes with the apparatus and the amount of current. We found out that we needed a lot more current to produce enough oxygen to keep a human alive with 250 ML of oxygen per minute for thirty minutes. In conclusion, we cannot generate enough oxygen to keep a human living for thirty minutes. For future research I think that if we had bigger electrodes for electrolysis we would be able to make more oxygen which might be able to keep a human alive for thirty minutes.

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Abstract: Science and Engineering Fair of Houston

1332

TERTing the Tide: Repurposing FDA-Approved Therapeutics for Cancer Treatment

Jairam Susarla

THE HONOR ROLL SCHOOL - MS

Category

Medicine and Health

Telomeres are repeating DNA sequences at the ends of chromosomes that preserve their integrity. Although Telomerase Reverse Transcriptase (TERT), the enzyme that lengthens telomeres, is typically inactive in somatic cells, it is highly expressed in cancer cells. Inhibiting TERT could prevent uncontrolled cell division in cancer cells and is a promising strategy for cancer therapy. FDA-approved drug repurposing could shorten the time and cost involved in conventional drug discovery by reducing the need for safety and toxicity testing. After extensive literature research, BIBR1532, a non-FDA-approved drug was identified as an experimental TERT inhibitor, but there are concerns about its toxicity to healthy cells. This project aims to identify drugs that inhibit TERT with comparable or superior effectiveness to BIBR1532, by computationally analyzing chemical properties and docking potential. FDA-approved drug selection was performed using pharmacophore modeling of BIBR1532. The molecule most chemically similar to BIBR1532 was selected based on RMSD score, and the antibiotic Latamoxef was identified as the FDA-approved drug most similar to BIBR1532 (RMSD = .491). Molecular docking of Latamoxef and BIBR1532 to TERT was carried out through Attracting Cavities to compare inhibitory effects of both drugs on TERT, and their estimated binding affinities were evaluated with Param Score. The Param Score of Latamoxef was -8.93 kcal/mol while BIBR1532's was -8.35 kcal/mol, meaning that Latamoxef had a better binding affinity to TERT compared to BIBR1532. These results show a promising direction for the further evaluation of Latamoxef as a potential TERT inhibitor validated by testing in cell lines.

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Abstract: Science and Engineering Fair of Houston

1333

Sugar Side Up

Kingsley Davies
Weis Middle School

Category

Medicine and Health

I did this to see which egg was healthier. The procedures a were crack egg in bowl, mix yolk and egg whites, load the glucose reader, put egg in glucose reader, and collect the data. The basic white eggs had the least glucose. The organic had 241 glucose, the cage free had 223 glucose, basic white egg had 164.5 glucose.

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Abstract: Science and Engineering Fair of Houston

1334

Pillzilas vs Acid Monster

Ibtisam Tahir
Abdulhaleem Ahmed
Alief ISD

Category

Medicine and Health

The student conducted an experiment to determine whether generic pills or branded pills dissolve faster in hydrochloric acid, a compound that mimics the acidic conditions of the human stomach. This experiment sought to evaluate if the composition of generic pills, which are less modified and often contain fewer additives, would allow them to dissolve more quickly than their branded counterparts. The hypothesis was that generic pills would dissolve faster, as their composition is closer to the pure form of the active ingredient, without the extra layers or coatings often added to branded medications for extended-release or other purposes. During the experiment, the student monitored the dissolution rates of both pill types under controlled conditions, ensuring that variables such as temperature, acid concentration, and pill size were consistent. Results justified the hypothesis, showing that generic pills dissolved at an average time of 16.20 minutes, faster than branded pills, which dissolved more slowly due to their added modifications. This finding is significant because it highlights the potential for faster absorption of active ingredients in generic medications, which could influence their effectiveness in real-world use. Furthermore, the results encourage further exploration into the cost-effectiveness and efficiency of generic pills compared to branded ones. By conducting this experiment, the student gained a deeper understanding of how the composition of medications impacts their dissolution rates and, potentially, their bioavailability in the body. This knowledge is valuable for both consumers and medical professionals when considering treatment options.

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Abstract: Science and Engineering Fair of Houston

1335

COVID-19 Pandemic and its Impact on Cardiovascular Disease

Dev Sathyan
Homeschool

Category

Medicine and Health

Background: Social isolation (SI) has been linked to a 30% increase in the risk of cardiovascular diseases (CVDs). Individuals experiencing SI are often physically inactive and make unhealthy lifestyle choices. The genetic mechanism by which SI and cardiovascular disease are interconnected is unknown this review explores the relationship between the genetic mechanism common in SI and cardiovascular disease. Objective: This study aims to summarize the current literature on the association between SI during the COVID-19 pandemic and CVDs. Understanding the impact of SI on CVDs will help in considering preventative measures and early interventions to mitigate the risk of CVDs. Methods: A literature review was conducted using PubMed with key search terms: ACE, social isolation, COVID-19, loneliness, cardiovascular diseases, and physical inactivity. Literature reviews, systematic reviews, and studies before 1995 were excluded. Included were studies on COVID-19, CVDs, social isolation, loneliness, ACE, and physical inactivity. Results: During the pandemic, SI was prevalent due to the fear of contracting COVID-19. In 2020, a survey of young men in Poland revealed that 20.48% experienced mild SI, 36.87% experienced moderate SI, and 42.63% experienced severe SI. This led to physical inactivity and unhealthy habits, such as smoking, resulting in a higher risk of developing CVDs. SI can upregulate several pathways one of the key pathways seems to be the angiotensin-converting enzyme (ACE) gene, which cleaves the bradykinin protein, leading to its dormancy. Without the bradykinin protein, blood pressure increases, and the ACE gene is associated with a higher risk of developing CVDs. SI and depression increased the presence of ACE genes, a significant risk factor for developing CVD. Discussion: The pandemic-induced SI increased the risk of developing CVD. Anxiety about contracting COVID-19 also rose, deterring individuals from seeking treatment for CVDs.

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Abstract: Science and Engineering Fair of Houston

1336

Moisturizer Mysteries

Camdyn Martin

Conroe ISD /Peet Junior High

Category

Medicine and Health

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Abstract: Science and Engineering Fair of Houston

1337

Protein Showdown

Olivia Trask

SST - Champions College Prep - MS

Category

Medicine and Health

The purpose of my project is to measure the amount of protein in the plant based milk to compare if the plant based milk has as much protein as dairy milk. First I pour the plant based milks in a cup. Next, I put the protein strips in the cups of milks. After that I took the strips out after 1-2 minutes and Observe the color of the strip. (blue is the most protein and yellow is the least) I found out that coconut and oat had the most protein besides dairy milk. I conclude that some plant based milks have more proteins.

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Abstract: Science and Engineering Fair of Houston

1338

Impact of Training Data on Machine Learning for Renal Cancer Detection in CT Scans

Rishabh Bathala
Reyansh Arora
Sahisnu Adhikari
Houston ISD /T. H. Rogers MS

Category

Medicine and Health

The rise of Machine Learning in daily life has led to significant advancements in research being done on machine learning models. Optimizing EHR systems, accelerating discoveries in drugs, and detecting risks in treatment. With the increase in people suffering from renal carcinoma, the questions regarding its applications in saving lives have become more prevalent. Therefore, our question was how to make a trainable machine learning (ML) model to analyze CT scans of RC patients. In this study, we trained a model with 100 images and achieved an accuracy of 42% then we trained another model with 300 images and achieved an accuracy of 64% and finally we trained another model with 500 images and achieved an accuracy of 68%. We did the same method but increased the epochs (Going through samples in a training dataset to the amount of times the user puts the number at) value for model 300 and 500. With this data we concluded our machine learning model is trained to read renal carcinomas through increasing Epochs, and our findings indicate that the number of images does have a strong positive correlation with the accuracy of the machine learning model. This can impact the future of radiologist jobs and the patients, by reducing the time it takes to get the medicine prescribed and diagnose a patient.

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Abstract: Science and Engineering Fair of Houston

1339

How does blood pressure vary throughout the day in different age groups?

Athena Philip
Stafford STEM Magnet Academy

Category

Medicine and Health

This study investigates the fluctuation of blood pressure throughout the day in different age groups. Blood pressure is a parameter that fluctuates in response to different factors, including time of day, age, and lifestyle. Understanding these patterns is crucial for the management and prevention of hypertension, a significant health concern. The research aims to explore how blood pressure changes across age groups, identify significant variations, and contribute to an understanding of the relationship between age and blood pressure fluctuations. By analyzing data collected through blood pressure monitoring, this study aims to provide valuable insights for healthcare professionals and all those working in the field of cardiovascular health.

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Abstract: Science and Engineering Fair of Houston

1340

How Does Music Affect The Brain?

Ethan Debolt

Conroe ISD /McCullough Junior High

Category

Medicine and Health

For my experiment on, "How Does Music Affect The Brain?". I play the piano, I play music at the retirement homes around the Woodlands since I was 10 years old. I wanted to know how music can benefit people such as the seniors. I got in contact with the owner of the facility, and she said that I was able to do my experiment there. In order to identify the results, I conducted a survey called "PANAS", which stands for Positive And Negative Affect Schedule. That type of survey can help me see the before and after emotion of the performance. On the day that I am going to perform, I planned to play 11 songs (Swan Lake, Nocturne in E Flat, Fur Elise, Claire de Lune, Air on the G String, Canon in D, The Entertainer, Through The Years, Beauty and The Beast, Perfect and How Great Is Our God), and I created a list of what I'm going to perform. When I got to the retirement home, 1st, I introduced myself to the seniors. Next, I gave them the surveys and list for them to answer how they feel before and after the performance. 3rd, I got myself ready to perform, adjusted the chair and the piano. 4th, I gathered all the surveys and list after I performed. 5th, I said bye to them. When I put all the responses and results of the seniors emotions, I saw that before the performance. They were all in a negative mood, and the range was really high. But after the performance, all of that negative mood decrease. And the positive mood increased a lot. If I listening to or playing music, then music can improve peoples feelings and emotions. Which having important emotions, is beneficial to your health.

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Abstract: Science and Engineering Fair of Houston

1341

Testing the Effect of Extra Virgin Olive Oil on Wound Healing, using Brown Planaria as a Model.

Amira Oueini

Clear Creek ISD /Westbrook Intermediate School

Category

Medicine and Health

The purpose of this experiment was to test whether the extra virgin olive oil accelerates the regeneration of amputated planaria, and thus can be considered wound healing accelerator. The extra virgin olive oil (EVOO) contains oleic acid, which has anti-inflammatory, antioxidant, antiviral, and anti-bacterial properties. In this experiment, the effect of extra virgin olive oil was compared to that of Neosporin, using bisected planaria as a model. I hypothesized that the EVOO will help the amputated planaria regenerate faster than the control and Neosporin. 15 planaria were amputated below their head, and each was randomly placed in a separate petri dish containing either control, EVOO, or Neosporin. To track the regeneration stages of planaria, a photo of each planarian was taken every 24 hours with the iPhone camera. The photos were visually inspected, and the development stage was recorded. Also, the length of each planarian was measured every three days for fifteen days using the ImageJ software. The data was analyzed using the statistical functions of Excel. The one-way ANOVA test was also performed followed by the post-hoc Tukey test to identify which groups are truly significant from each other. Findings suggest that the EVOO accelerates the regeneration process of planaria more than the control and Neosporin. Therefore, the hypothesis was accepted. The results could add to the body of knowledge about the important benefit of EVOO on skin healing after a wound cut and its potential to be considered as an alternative to chemical base wound healing treatments.

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Abstract: Science and Engineering Fair of Houston

1342

Food Perception

Darvin Fuentes

Fernando Medrano

Steven Mendez

SST - Champions College Prep - MS

Category

Medicine and Health

Would you prefer a well done steak or a medium rare steak? In this research that we conducted we found out that people are most likely going to choose the well done steak: this is because people are attracted to darker colored food. Which are more nutritious darker colored foods or lighter colored foods? in our research on this topic was that darker colors foods are more nutritious than lighter due to the antioxidant and vitamins but lighter colored foods are more bitter sour and the opposite for darker colored foods. In our results we found out that the steak that was chosen more was the Well Done instead of Medium Rare, and when we tried the fruits, we saw that more people decided to eat brighter colored foods instead of darker colored foods. And this was also good because brighter colored foods have more nutrients than darker colored foods. Also when we tested a food like broccoli, we saw that the longer you cooked it in water, the darker it got and more nutrients it lost. And when you ate a broccoli without cooking it, the nutrients would be same and wouldn't be lost. In conclusion we found out that darker colored foods were more nutritious than lighter colored foods due to the amount of proteins and nutrients in the foods we tested.

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Abstract: Science and Engineering Fair of Houston

1343

Exploring the Overall Effects of Various Diets

Sophia Perez

Dejha Henry

Oluwajomiloju Folarin

SST - Champions College Prep - MS

Category

Medicine and Health

Are you an individual that gets worked up over finding the best diet? well our research aims to to determine the best diet for an individual is challenging, given the variety of diets and their different impacts based on factors like age, activity level, health conditions, and personal goals. Our project compares three major diets: plant-based, Mediterranean, and animal-based (carnivore), using key studies including the PREDIMED, "Carnivore Diet" study, and EPIC-Oxford study to evaluate their health benefits. The PREDIMED study found the Mediterranean diet reduces the risk of heart disease, diabetes, and other chronic conditions, thanks to its focus on healthy fats, fiber, and antioxidants. The "Carnivore Diet" study showed improvements in physical and mental health for participants, though concerns about long-term sustainability and nutrient balance remain. The EPIC-Oxford study found that a plant-based diet lowers risks of heart disease, diabetes, kidney stones, and possibly some cancers. After reviewing the data, we concluded that the Mediterranean diet is the most balanced and beneficial for overall health. However, no one diet is best for everyone. Individual factors such as age, activity, and health conditions must be considered when choosing the right dietary pattern.

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Abstract: Science and Engineering Fair of Houston

1344

Crime Scene

Devon Dunkel

Berty Tembo

Colton Smith

SST - Champions College Prep - MS

Category

Medicine and Health

For our forensic science project, we'll create a crime scene using a doll, bag, and our comprehensive forensic kit. We'll guide the judges through the entire investigative process, beginning with securing the crime scene in motel room 6 and meticulously collecting evidence such as DNA samples, fingerprints, and a crucial shoe print. Using our DNA kit, we'll demonstrate how investigators extract and analyze genetic material to identify suspects or link multiple cases, explaining the significance of DNA profiling in modern forensics. We'll also delve into fingerprint analysis techniques and show how shoe prints can help narrow down suspect lists. Throughout the experiment, we'll use our poster board to present our findings visually and explain how these various forensic techniques work in concept to solve complex crimes. We'll discuss the challenges investigators face when dealing with a serial killer case, including the pressure to prevent further victims and the need for thorough, careful work. By walking through each step as if we were real investigators, we'll highlight the crucial role of forensic science in modern criminal investigations. We'll conclude by emphasizing how the combination of scientific methods and detective work is essential in bringing perpetrators to justice, especially in challenging cases like the "Hobo Killer" murders that span multiple locations and victims.

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Abstract: Science and Engineering Fair of Houston

1345

Computational Simulations of RNA-Based Aptamers Targeting Epidermal Growth Factor Receptor (EGFR)+ Cells in Glioblastoma

Myreen Ahsan

Friendswood ISD /Friendswood Junior High

Category

Medicine and Health

Glioblastoma is a fast-growing, invasive brain tumor, that originates from glial cells and remains highly resistant to conventional treatments. A key protein on the surface of glioblastoma cells, Epidermal Growth Factor Receptor (EGFR), significantly promotes tumor growth and progression. Aptamers, synthetic single-stranded DNA or RNA molecules, bind to EGFR, serving as a promising tool for precise detection and targeted therapy in glioblastoma treatment. The hypothesis suggests that aptamers interact with EGFR's binding site to inhibit the receptor, thereby killing the cancer cell. To test this, the amino acid sequence data of the EGFR receptor was retrieved from UniProt, and its 3D structure underwent prediction using AlphaFold 3. P2Rank identified the EGFR binding site where aptamers could effectively interact. Docking simulations using the HDock server calculated binding interactions and determined the best fit. Analysis of the protein-aptamer complex with PLIP to identify critical bonds, such as hydrogen bonds and salt bridges. Finally, ChimeraX displayed the 3D interaction model, showcasing potential inhibition effects and finalizing the visual models. Aptamers were selected based on visual inspection and bond interaction analysis. APT-IV, APT-VI, and APT-VII emerged as top candidates, with APT-VI forming the highest number of interactions (28), making it the most suitable aptamer. These aptamers will enable targeted treatment and early diagnosis by detecting EGFR overexpression, leading to faster and more precise treatment options.

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Abstract: Science and Engineering Fair of Houston

1346

DQS Diet Quality Sleep

Analice Espinoza

Conroe ISD /Irons Junior High

Category

Medicine and Health

The objective of this science project is to see if changing your diet to different foods such as balance, junk, and healthy foods and see which one makes you have better quality sleep. The findings of this project will help improve people who have jobs that don't allow them to get much sleep such as doctors, firefighters, and police officers. To see what type of diet is better for getting better quality sleep. The hypothesis stated "If I change the food of a person's diet then it will improve their sleep quality." In order to test the hypothesis the participant had to eat three different diets such as balanced, junk, and healthy food one for each week. Then they used a ring to collect their sleep which was how long they slept and their REM sleep. Lastly, put the data in charts and see what your results are. The data showed that the balanced diet was best for your sleep quality. This correlation means that having a balance of healthy and junk food is the best way to go according to the data. Due to it having the longest sleep time and REM sleep. This study shows that balanced food is the best for your sleep quality.

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Abstract: Science and Engineering Fair of Houston

1347

How Temperature Impacts Batteries

Selebrity Hilliard

Houston ISD /BCM Academy at James D Ryan - MS

Category

Medicine and Health

This project examines how extreme temperatures affect battery performance and capacity. Low temperatures reduce output, while high temperatures cause faster degradation. The goal is to understand how different batteries—lithium, lead-acid, and alkaline—react to temperature changes. It is expected that lithium batteries will perform the best, as they are more resilient to temperature extremes compared to lead-acid batteries. For the experiment, I used alkaline, lithium, and zinc batteries, a multimeter, temperature gun, heating pad, and fridge. I measured the starting voltage of each battery, then exposed them to temperatures of 60°F and 90°F, measuring their voltage at both temperatures. The experiment confirmed that lithium batteries maintained stable voltage, supporting the hypothesis that they perform better in extreme temperatures. Alkaline batteries showed minimal change, while zinc batteries experienced a voltage drop due to faster chemical reactions at higher temperatures. These results align with established knowledge and emphasize the importance of understanding battery performance in varying conditions. Future experiments could benefit from testing more extreme temperature ranges for clearer results.

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Abstract: Science and Engineering Fair of Houston

1348

Genes and Genetic Mutations

Sristi Shetty

Conroe ISD /McCullough Junior High

Category

Medicine and Health

Genetic factors play a significant role in the pathogenesis of diseases such as Sickle Cell Disease (SCD) and Crohn's disease. This project describes the relationship between the positions of some genetic mutations and how these affect the manifestation of a disease. SCD is a monogenic disorder resulting from mutations within the HBB gene, such as rs334, which affects hemoglobin structure. On the other hand, Crohn's disease is a polygenic disorder and involves several genes such as NOD2, ATG16L1, and IL23R. Variants like rs2066844 and rs2241880 disrupt the functioning of the immune system and predispose an individual to diseases. Using public genetic databases like NCBI (National Center for Biotechnology Information) and MedLine Plus, key single nucleotide variants (SNV) were examined for the associated diseases. The SNVs have been outlined in tables showing changes in DNA and amino acid sequences and their impacts on protein functionality. This study shows how the mutation of regions may modify the structure of proteins, create or stop codons, or interfere with a regulatory pathway that leads to the development of diseases. The findings highlight that the place of mutations within genes is important in determining the risk of disease. In SCD, mutations of the HBB gene result in faulty hemoglobin, while in Crohn's, mutations of immune-related genes affect immune regulation. These insights provide evidence of the need to understand the role of genetic mutation in disease development for better diagnosis, treatment, and management of genetic disorders.

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Abstract: Science and Engineering Fair of Houston

1349

Is the weight of the world on your shoulders?

Laila Serag
Maggie Rodriguez
Central Middle School

Category

Medicine and Health

Carrying heavy school backpacks can negatively affect the backs of students. This study aimed to identify and assess teacher and student knowledge of the effects of students' heavy backpacks on their backs in Central Middle School, Galveston, Texas. We designed two surveys to collect information from 1) students: including student information, body weight, knowledge about the problem and its hazards, and possible solutions, and 2) teachers: including teacher information, knowledge about the problem and its hazards, and possible solutions. In addition, we weighed students' backpacks. Our results showed that 76% of students have backpacks weighing >10% of their body weight. Girls and 8th graders carried significantly heavier backpacks compared to boys and 7th graders. Both students and teachers are aware of the problem and its hazards. Suggested solutions included access to lockers and limiting school supplies. In conclusion, $\frac{3}{4}$ of middle school students carry heavy backpacks that may affect their back health. Suggested solutions should be considered to improve their conditions.

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Abstract: Science and Engineering Fair of Houston

1350

Early Detection of Neurological Disorders

Aarvi Thota

Fort Bend ISD /Sartartia Middle School

Category

Medicine and Health

Neurological disorders like Alzheimer's, Parkinson's, and Epilepsy affect many people and often start before symptoms show. A major study from The Lancet Neurology shows that over three billion people around the world have a brain or nerve problem. According to the World Health Organization's (WHO) analysis of data from the Global Burden of Disease study, brain and nerve problems are now the biggest cause of illness and disability around the world. Since 1990, these problems have caused an 18% increase in illness, disability, and early deaths. Catching the symptoms of these diseases early is really important because doctors can treat them sooner, which helps patients. Right now, doctors use EEG tests to look at brain waves, but it takes a long time, and small problems can be missed. This project uses AI (artificial intelligence) to study brain waves from EEG tests and find signs of these diseases earlier than normal methods. The idea is that AI is really good at finding patterns that people might not notice. The goal is to build an AI program that can spot these signs early and test them to see if it works better and faster than what doctors use today. This project is important because it could help patients get treated sooner, make work easier for doctors, and improve healthcare for everyone.

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Abstract: Science and Engineering Fair of Houston

1351

Sugar High or Sugar Die?

Leah Flotte

Conroe ISD /Knox Junior High

Category

Medicine and Health

The purpose of this experiment is to determine which temperature/environment would cause the highest sugar content in various fruits. In this experiment the scientist used three of each of the following fruits: banana, mandarin, orange, apple, pear, plum, grapefruit, strawberry, and kiwi. One of each fruit was then placed in a different temperature environment; these environments consisted of: room temperature, a cold environment and a warm environment. At 24 hours, 48 hours, and 72 hours all fruits were sliced into with a knife and juiced. The juice was then put into the refractometer which calculated the brix (sugar content). The temperature was recorded each time the fruit was cut into. In conclusion the fruits that produce ethylene gas such as bananas, apples, plums, mango, and kiwis all had higher sugar content then the fruits that didn't produce ethylene gas. However factors such as not being able to know how long the fruits sat in the grocery store, and not knowing what stage they were at in the ripening process, and temperature storage conditions, all contributed to some mixed results. Citrus is typically grown in the cold so some fruits such as grapefruit, had a higher sugar content in the cold environment then it did in the warm environment. Overall, the results were mixed. This experiment is applicable to all people that are trying to conserve money because buying fruit weekly can be costly and knowing where to store your fruit to help preserve them, can help lower these costs.

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Abstract: Science and Engineering Fair of Houston

1352

Sorbent solutions: Enhancing hemodialysis

Rayan Rathi

Dhruva Seelam

Stafford STEM Magnet Academy

Category

Medicine and Health

Hemodialysis is a vital treatment for filtering waste from the blood, but its efficacy has been questioned since the 1950s due to reports of fatalities and inadequate purification in patients. We hypothesize that integrating sorbent cartridges into this system can improve the overall performance of hemodialysis. The introduction of sorbent cartridges carries risks, including potential complications and fatalities, particularly with traditional liquid cartridges used in invasive neuromodulation. To mitigate these concerns, we have developed a noninvasive method using solid sorbent cartridges integrated into blood return pipes, which effectively filters the blood while enhancing patient safety and maintaining effective neuromodulation. Although we have not yet conducted the project, we plan to illustrate the relationship between the number of sorbent cartridges and blood quality through a graph, with the experiment scheduled between November 1st and November 17th. In summary, our findings indicate that sorbent cartridges, using layers of activated carbon for effective neuromodulation and blood filtration, inspired the creation of Sorbent Solutions: Enhancing Hemodialysis, which we believe could save countless lives by delivering clean, untainted blood.

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Abstract: Science and Engineering Fair of Houston

1353

Wrinkles Vs Moisture

Victoria Vera Linares
Gloria Medina
Weis Middle School

Category

Medicine and Health

Yes

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Abstract: Science and Engineering Fair of Houston

1354

Blood pressure vs Exercise

Melanie Villagomez

Houston ISD /BCM Academy at James D Ryan - MS

Category

Medicine and Health

My project is about blood pressure and what type of exercise will affect blood. Studies show a drop from 4 to 12 mm Hg diastolic and 3 to 6 mm Hg systolic. Higher weight and weight gain raise the risk of high blood pressure. The original blood pressure for systolic is less than 120 and for Diastolic it's less than 80. I want to learn about blood pressure and exercise because I want to know if running, cycling or burpees raises my blood pressure the most. My testable question is: Does changing the types of exercise affect your blood pressure? My hypothesis is: I predict that running will increase blood pressure the most because running increases your breathing and heart beat more than cycling and burpees. Before and after each exercise I will measure their blood pressure. Also, there will be a 3 - minute break between each exercise they do. They will do every exercise only 3 times. I wanna learn about blood pressure because I notice that when I run my heart is going fast and my breathing is going fast. In conclusion, my hypothesis was correct. I predicted that running would increase blood pressure the most and after my experiments and research i discovered that running increased blood pressure the most.

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Abstract: Science and Engineering Fair of Houston

1355

How does music speed and genre affect maintaining a steady exercise pace?

Kara Meier

Conroe ISD /McCullough Junior High

Category

Medicine and Health

In this project I tested "how does music speed and genre affect Maintaining a steady exercise pace?" I tested this by having 5 participants do exercises including: -two eight counts of jumping jacks -two eight counts of aerobic twists -two eight counts of burpees -two eight counts of windmill toe touches to twelve 30 second clips of songs in various speeds and genres. Participants would continue the exercise routine over and over again two minutes at a time. I then played back the footage and took of how many time the participants were off-beat in each song. According to my research jazz is the best genre, and music speed set at 60-80 beats per minute is the best for maintaining a steady exercise pace.

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Abstract: Science and Engineering Fair of Houston

1356

Safety in the Sun

Addison Vice

Clear Creek ISD /Seabrook Intermediate School

Category

Medicine and Health

It's estimated that 3.6 million people are diagnosed with skin cancer every year. There are many different SPF textures on the market, but it was wondered which one protects the best. What is the effect of sunscreen textures on UV protection? The sunscreens tested were stick, spray, lotion, oil, and whip and they were all SPF 30. The hypothesis was that if different sunscreen textures were tested, then the lotion will protect the best. Two cups were placed a foot apart from each other with the UV sensor in between. One of the sunscreens was rubbed into a plastic sheet and the sheet was placed on top of the two cups. A UV light was placed on top of the plastic sheet and turned on. The UV sensor would measure how much UV light was getting through. After all the data collection it was found that the stick sunscreen performed the worst at reducing the UV index with an average of 10.3 UV. Both the cream with UV index of 0.8 and whip sunscreen with a UV index of 0.65 performed very well in blocking UV rays. The hypothesis was proven wrong with the whip sunscreen blocking the most UV instead of the lotion. A possible source of error was that there was a very little amount of stick sunscreen on the plastic sheet so the UV light could have gone around the sunscreen. Skin cancer is the most common form of cancer that's why it is so important to be protected while out in the sun.

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Abstract: Science and Engineering Fair of Houston

3300

The Effects of Herbal Teas on Lipid-Rich Artificial Atherosclerotic Plaque

Lizabeth Er

Conroe ISD /AST: Academy of Science and Technology

Category

Medicine and Health

Lipid-rich plaque build-up in arterial walls is an indicator of atherosclerosis, the leading cause of coronary artery disease. Evidence suggests that herbal teas exhibit anti-inflammatory, antioxidant, and antihyperlipidemic properties in blood plasma. To date, there have been limited or no direct studies that examined the effects of herbal tea on existing atherosclerotic plaques. The aim of this study was to investigate if herbal teas could displace lipids in atherosclerotic plaque. To accomplish this, synthetic gelatin/hydrogel-based atherosclerotic plaques were fabricated to mimic type IV plaque, which is rich in lipid build up. Plaques were soaked in six types of herbal tea (Green Tea, Hibiscus Tea, Ginger Tea, Echinacea Plus Elderberry Tea, Cholesterol Health Herbal Tea and Lemon Tea) for 48 hours. The results revealed that Hibiscus tea ($p < 0.001$) and Echinacea Plus Elderberry tea ($p < 0.05$) showed a significant percentage of mean mass loss in plaques compared to the control group. The results of this study suggest that these teas may be effective in displacing lipids in artificial atherosclerotic plaque. On the other hand, green tea appears to form deposits as indicated by the increased plaques' mass ($p < 0.001$). This novel experimental design provides a fast method to evaluate samples for their lipid displacement potential in artificial plaques. The identification and isolation of the compounds in herbal tea that are able to displace or dissolve lipids could serve as a natural drug used within nanocarriers or stents as targeted drug delivery to slow the progression of atherosclerosis.

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Abstract: Science and Engineering Fair of Houston

3301

Eyes as Windows to Health: Integrating Efficient, Generalizable AI Models into a "Simple Mobile AI Retina Tracker (SMART)" to Revolutionize Ocular and Systemic Healthcare

Ramya Elangovan

Ph.D. Student

Category

Medicine and Health

INTRODUCTION: Globally, 2.2 billion people suffer from visual impairment due to ocular and systemic diseases. Eyes offer unique non-invasive diagnostic windows to health. The emerging field of ophthalmics powered by artificial intelligence (AI) represents the pinnacle of precision medicine and personalized healthcare. **AIM:** To develop a computationally efficient, highly accurate, AI-powered ophthalmics model, integrated into a "Simple Mobile AI Retina Tracker (SMART)" for precise detection, classification, and staging of ocular and systemic diseases. **METHODOLOGY:** State-of-the-art deep learning architectures, including EfficientNets and ResNets, were rigorously evaluated on diverse retinal imaging datasets (APTOS, Glaucoma Fundus, JSIEC, IDRiD, MESSIDOR, EyePACS, ODIR) for classification of multiple diseases like Diabetic Retinopathy, Glaucoma, Cataract, Hypertension, Macular Degeneration. The most optimal model, EfficientNetB0, was integrated into our SMART application, "OculAI" and evaluated. **RESULTS:** ResNet and EfficientNet models excelled in accuracy (>97%) for multi-disease, multi-stage classification. EfficientNetB0 outperformed other deep learning models in computational efficiency (<60% runtime). Integrated into "OculAI", EfficientNetB0 demonstrated >99% accuracy at <1 second/image processing speed for classification across diverse datasets from populations spanning six continents, maintaining robust generalization, scalability, transferability, and transportability. **CONCLUSIONS:** This study establishes a paradigm shift in biomedical AI: "Less is MORE". EfficientNetB0 sets new benchmarks for accuracy and efficiency in AI-driven ocular diagnostics. Its seamless integration into our universally accessible SMART platform, "OculAI", ensures privacy and scalability for real-world applications. **APPLICATIONS:** OculAI's transformative potential as a diagnostic tool for ocular and systemic diseases can screen billions of eyes and improve billions of lives, revolutionizing global eyecare and healthcare.

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Abstract: Science and Engineering Fair of Houston

3302

Possible Ligand Inhibitors to Progerin in Hutchinson Gilford Progeria Syndrome

An Hoang
Tien Hoang
Clear Creek ISD /Clear Brook High School

Category

Medicine and Health

Hutchinson-Gilford Progeria Syndrome (HGPS) is a rare and devastating genetic disorder caused by a mutation in the LMNA gene. This mutation produces progerin, a defective version of lamin A, which disrupts the nuclear structure and accelerates aging at the cellular level. To address this, our research focuses on identifying ligands that can selectively inhibit progerin without interfering with normal lamin A. Using computational tools like PyMOL and DOCKY, we analyzed the binding affinity, ligand efficiency, and structural alignment of various ligands. Special attention was given to interactions such as hydrophobic bonding, hydrogen bonds, and salt bridges. Promising ligands with high specificity and efficiency were identified, paving the way for future laboratory testing. This study aims to advance the search for targeted therapies, offering hope for treating HGPS and related conditions.

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Abstract: Science and Engineering Fair of Houston

3303

Investigating the Role of Folate in Reducing Heart Rate Variability Associated with TANGO2 Deficiency Disorder to Improve Heart Health Outcomes

Lamson Tran

Houston ISD /Carnegie Vanguard HS

Category

Medicine and Health

TANGO2 deficiency disorder (TDD) is a genetic condition caused by mutations in the TANGO2 gene. TANGO2 encodes a protein essential for intracellular transport, and its deficiency leads to diverse health issues. TDD often causes developmental delay, intellectual disability, seizures, ataxia, and hypothyroidism. A critical aspect of the disorder is the occurrence of life-threatening metabolic crises, including rhabdomyolysis, cardiac arrhythmias, and hypoglycemia. No cure exists for TDD. Management focuses on symptom control and the prevention of complications through medications for seizures, arrhythmias, and thyroid dysfunction, as well as physical and occupational therapies. Dietary modifications are used to avert metabolic crises, and heart transplantation may be considered in cases. Prognosis varies from mild symptoms to significant disability and shortened lifespans. Early diagnosis and intervention are critical for improving outcomes, with early genetic testing being recommended. Research investigates cardiac arrhythmias in TANGO2-deficient mice. Using telemetry, data are collected to assess physiological changes in TANGO2-knockout versus wild-type mice under regular, fasting, and vitamin B9-treatment conditions. The protocol includes five days of a vitamin-B-deficient diet, followed by 10 hours of fasting, and then 14 hours on the same diet supplemented with B9 water (10 mg/L). Data are downloaded, preprocessed in Excel, and analyzed in MATLAB to create Poincaré plots. Convex hull areas are used to quantify heart rate variability. All procedures are conducted using sterile, minimally invasive methods. By elucidating the cardiac manifestations of TDD, this research aims to inform the development of improved treatments and outcomes for individuals affected by the disorder.

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Abstract: Science and Engineering Fair of Houston

3304

Restoring Balance: An Inquiry into Novel, Small-Molecule Drugs for Treating Lewy Body Diseases

Aditya Mandke
Spring Branch ISD

Category

Medicine and Health

Goal: My goal for this project is to develop 7 potential drugs that could be used in treating Lewy body disorders. Materials: For my project, I used softwares such as PyMOL, a molecular visualizer, SwissADME, a druglikeness analysis tool, and Dockey, a protein-ligand docking analysis tool. Results: I found that drug 6 had the strongest binding to the target protein, followed by drugs 4 and 5. Conclusion: Using this process, it is possible to develop drugs that can be used to treat neurodegenerative diseases such as Parkinson's disease, Lewy body dementia, and multiple system atrophy.

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Abstract: Science and Engineering Fair of Houston

3305

Roots of Resistance: Exploring Plant Essences as Antibiotic Alternatives

Norma Kean

Max Norman

Evan Baker

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Medicine and Health

Antibiotic resistance is a growing problem, and finding natural alternatives is more important than ever. This study tested the antibacterial effects of three plant extracts Cranberry Cotoneaster, Clove, and Jambolan on two resistant bacteria *E. coli* and *Pseudomonas aeruginosa*. The goal was to see if these extracts could work as well as common antibiotics like Ampicillin and Gentamicin. Plant solutions were prepared in small discs soaked in them, and discs were placed on bacteria-covered plates. By measuring the bacteria-free zones around the discs, the effectiveness of the plant extracts compared to the antibiotics was evaluated.

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Abstract: Science and Engineering Fair of Houston

3306

mRNA-HIV-TC: A Simulation-Optimized mRNA Vaccine Targeting HIV with Broad T-Cell Immunity

Srijan Mashetty

Houston ISD /DEBAKEY HIGH SCHOOL FOR HEALTH PROFESSIONS - HS

Category

Medicine and Health

This study describes mRNA-HIV-TC, an mRNA-based vaccine designed to stimulate a robust T-cell and B-cell-mediated immune response against HIV infection. It contains highly conserved epitopes from the Gag, Pol, and Env proteins of HIV, chosen for their ability to induce a thorough immune response to avoid viral evasion. Optimization of mRNA codon sequences was performed using a two-step computational method; the first simulation predicts the most suitable codons to maximize mRNA stability and translation efficiency, while the second simulation screens these sequences for compatibility with the host ribosomal machinery and increased antigen expression. Finalized mRNA sequences are encased in optimized lipid nanoparticles (LNPs) to ensure efficient cellular uptake, endosomal escape, and targeted delivery to antigen-presenting cells. Computational modeling predicts robust antigen presentation, followed by activation of cytotoxic CD8+, central memory (which facilitate long-term immunity), and helper CD4+ T cells with complex cytokine profiles, constituting the secretion of the IFN- γ , TNF- α , and IL-2 cytokines. Furthermore, the inclusion of computationally designed broadly neutralizing antibodies (bNAbs) serves to prevent HIV from entering T-cells by targeting key conserved regions of the virus, protecting immune cells. This multi-layered immune response prevents T-cell infection and sustains a defense against HIV. Additionally, the vaccine activates B cells to produce neutralizing antibodies, which destroys HIV prior to entry into healthy cells and promotes long-term immunity. Preclinical simulations show high expression efficiency and antigen stability of optimized codons with the LNP system, thus justifying this unique approach. Hence, this solution may serve as inspiration for future HIV treatment options.

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Abstract: Science and Engineering Fair of Houston

3307

The Effects of Different Liquids on Tooth Decay and Stain

Laura Hong

Fort Bend ISD /Hightower High School

Category

Medicine and Health

Tooth decay and discoloration are common dental issues influenced by dietary habits, particularly the consumption of certain beverages. This study examines the effects of different drinks on dental health, focusing on teeth decay and staining. Acidic drinks, such as sodas and lemonade, contribute significantly to enamel demineralization, promoting tooth decay. Similarly, beverages like coffee and orange soda contain chromogens and tannins that adhere to enamel, causing extrinsic staining. Understanding these impacts can guide better oral hygiene practices and dietary choices to maintain optimal dental health.

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Abstract: Science and Engineering Fair of Houston

3308

A Comparison of the Damaging Effects of Ammonia vs Monoethanolamine in Hair Dye on Human Hair

Giselle Ashford

Conroe ISD /AST: Academy of Science and Technology

Category

Medicine and Health

Ammonia has traditionally been used as an alkalinizing agent in hair dyes, but it can have harmful effects. Many “ammonia-free” hair dyes are now available with ammonia being replaced by monoethanolamine (MEA). However, it has been theorized that MEA could also have damaging effects on hair. The purpose of this experiment was to find out if ammonia hair dye or MEA hair dye is more damaging to hair. It was hypothesized that MEA hair dye would be more damaging. Both types of dyes were applied to brown and white hairs. The tensile strength of these hairs was measured to assess the amount of damage. Each hair was attached to a pencil and plastic bag suspended between two stools. Weights in grams were placed into the bag until the hair strand broke. For both brown and white hairs, the mean weight required to break hair strands dyed with MEA hair dye was higher, indicating the possibility the MEA hair dye caused less damage. However, the results were shown not to be statistically significant and the hypothesis could not be disproven. There were limiting factors that could have caused variation in hair strength such as the hair not being taken from the same part of the head and the hairs having differing amounts of past heat exposure. Researching the damage caused by different types of hair dyes can help people decide which type of hair dye is best for them when considering efficacy of the hair dye and potentially harmful effects.

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Abstract: Science and Engineering Fair of Houston

3309

Optimizing Angiopep-2 Nanoparticles for Targeted Glioblastoma Drug Delivery Across the Blood-Brain Barrier

Aarjav Desai
Vishal Surya
Seven Lakes - HS

Category

Medicine and Health

Glioblastoma Multiforme (GBM) is a highly aggressive brain cancer that has increased in incidence globally. A major challenge with therapeutics involves delivery across the blood-brain barrier (BBB) because of the presence of tight junctions. Nanoparticle-based therapeutics conjugating angiopep-2, a peptide targeting the LRP-1 receptor, to liposome nanoparticles were used to overcome this and have shown promise. However, the excessively tight binding between LRP-1 and angiopep-2 can potentially lead to re-binding and efflux, reducing therapeutic efficacy. This study investigates the impact of targeted mutations in the glycine-9 residue of angiopep-2 and its binding to LRP-1 alongside the molecule's functional flexibility and structure. We hypothesize that substituting glycine-9 with residues of varying properties, such as aromatic tyrosine and charged arginine, will decrease binding efficiency, reducing interactions with efflux pumps and enhancing drug diffusion within the tumor microenvironment. To test this hypothesis, we utilized computational tools, including AlphaFold and PEPFOLD, to predict the 3D structure of wild-type and mutated angiopep-2 peptides. We performed molecular docking experiments with Autodock4 to assess binding energy, while diffusion through the tumor microenvironment was modeled using a modified form of Fick's Law incorporating efflux rate. Preliminary results suggest that mutations in glycine-9 can decrease the peptide's binding affinity, insinuating glycine-9's role in forming a critical flexible bend in the wild-type angiopep-2 structure. Future directions include optimizing these mutations for enhanced BBB penetration and investigating broader applications in other neurological therapies. This research provides a framework for advancing nanoparticle-based drug delivery systems by optimizing peptide flexibility.

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Abstract: Science and Engineering Fair of Houston

3310

What materials would stop my calluses from growing when playing the Marimba.

Samantha Moreno
Pasadena Memorial High School

Category

Medicine and Health

My project is going to focus on the comfortability of students around the world and protect their comfortability and pain when playing the musical instrument marimba. The marimba is a very competitive instrument that uses two mallets per hand using mainly the Stevens grip. When playing the marimba the wooden yarn mallet used continues to rub against your fingers making it blister and callus. This loved instrument around the world still does not have one protective material that can ensure the prevention of calluses from worsening on the hand. So project is to create a protective product by finding materials that can protect four mallet players when playing the marimba. The calluses tested are about 12.7 millimeters on each contestant in this experiment. I want to push for the idea that calluses blistering, worsening, and swelling is not a normal part of life and should be continued to push for resolutions that could make the comfortability of playing a loved instrument from around the world lovable still. My invention of the finger wrappings are going to soon evolve into gloves as I expand beyond this project but attacking the biggest calluses is the main goal of any four mallet players. This project tested the materials that make marimba players comfortable by preventing calluses, blisters, and lowering their pain levels. Finding out that mallet players like durable and thick material compared to thin soft material. Protecting their calluses from rubbing too harshly on the mallet.

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Abstract: Science and Engineering Fair of Houston

3311

DNA Aptamer-Mediated Blood-Brain Barrier Penetration for Targeted Therapeutic Delivery in Glioma

Shriya Khan

Fort Bend ISD /Dulles High School

Category

Medicine and Health

Glioma is one of the most complicated, lethal, and resistant to treatment tumors. A significant problem with Glioma is that the brain is covered with a protective sheet called the blood-brain barrier (BBB), a barrier of protective cells surrounding the brain. It prevents harmful substances such as toxins and germs from entering and allows nutrients such as oxygen and glucose to enter. However, this prevents essential drugs that may eliminate brain diseases from entering, which can be resolved through aptamers. Aptamers are short RNA/DNA strands that bind targets, enabling drug delivery across the BBB. I hypothesize that the aptamer binds to the transferrin binding site in the receptor and gets transported across the BBB. AlphaFold3, a software that allows the 3d prediction of a protein's DNA, determined the prediction for a transferrin receptor. Aptamer modeling using UNAFold and FARFAR 2 allows for accurate prediction of aptamer structures. Aptamer docking on the transferrin receptor (TfR) using HDock facilitates the identification of optimal binding interactions, aiding in developing targeted therapies and enhancing our understanding of receptor-ligand dynamics. The binding energy, which reflects the stability of a nucleus and is equivalent to the energy released during its formation, was calculated using the PDA-Pred tool. The results show that the aptamer M2 binds strongly to the protein structure and could be used in the targeted delivery of the glioma. This research seeks to create new treatment strategies that improve the precision and effectiveness of therapies for this challenging type of brain cancer.

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Abstract: Science and Engineering Fair of Houston

3312

Cell membrane-encapsulated biomimetic nanomedicines carrying siRNA for glioblastoma treatment via gene silencing synergistic phototherapy

Lingchuan Wang
The Village School

Category

Medicine and Health

The synergy between phototherapy and gene therapy, which relies on photothermal promotion of siRNA release to achieve regulation of RNA interference genes, has resulted in excellent synergy and high efficacy of combined phototherapy-gene therapy, which has shown great potential in tumor therapy. Here, we synthesized gold nanomaterials (Au NRs) with near-infrared absorption and piggybacked Bcl-2 siRNAs (Bcl-2@Au NPs) on their surfaces using a silver (Ag) template method. In addition, the tumor cell membrane (CM) was modified on the surface to consider the effect of the blood-brain barrier in the brain, which resulted in a higher targeting ability of Bcl-2@Au-CM NPs to the glioblastoma region. Under the irradiation of NIR light, the temperature of Bcl-2@Au-CM NPs accumulated at the tumor site increased to induce apoptosis in tumor cells. The main function of Bcl-2 as an apoptosis inhibitory protein is to protect cells from apoptosis by inhibiting the activity of apoptotic factors, which would hinder the effect of phototherapy on tumor cells. However, Bcl-2 siRNA released from Bcl-2@Au-CM NPs in tumor cells inhibits the overexpression of Bcl-2 in the cytoplasm, which would exacerbate the apoptotic effect of phototherapy. Therefore, the anti-tumor efficacy of the administration therapy of Bcl-2@Au-CM NPs was significantly improved due to the efficient synergistic delivery ability of phototherapy-gene therapy. Phototherapy and gene therapy are synergistic and mutually reinforcing, and have excellent prospects for clinical application in the field of tumor therapy.

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Abstract: Science and Engineering Fair of Houston

3313

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Abstract: Science and Engineering Fair of Houston

3314

Neuroglutide: A Novel Bi-Functional Drug That Acts Upon The Glucagon-Like Peptide-1 (GLP-1) Receptor and Protects Against Neurodegenerative Diseases

Sanjan Sarang

Conroe ISD /AST: Academy of Science and Technology

Category

Medicine and Health

The incidence of type II diabetes (T2D) has quadrupled globally since 1990, affecting approximately 830 million people, half of which is caused by obesity. T2D is associated with neurodegenerative diseases (NDs) impacting approximately 349 million people. Glucagon-like peptide-1 receptor agonists (GLP-1 RAs), such as semaglutide and liraglutide for T2D and obesity, have limitations due to their subcutaneous administration and side effects, thus necessitating orally administrable drugs. However, the large and shallow GLP-1 receptor (GLP-1R) binding site limits small-molecule design; hence, targeting its allosteric site will enhance receptor activity. This research aimed to define molecular mechanisms of GLP-1 RA treatment and identify viable therapeutics for T2D, obesity, and NDs. RNA-sequencing of samples from the arcuate nucleus of the hypothalamus treated with GLP-1 RAs identified 54 pathway and 159 gene changes with statistical significance ($p < 0.05$). Neuroprotection was involved in these changes through heat-shock proteins, mitochondrial stabilization, and glucose homeostasis. Insulin-like Growth Factor-1 (IGF-1), a top-upregulated gene, was selected as a secondary target due to its function in NDs and diabetes. Computational screening of GLP-1R and IGF-1 receptor (IGF-1R) identified 83 GLP-1R allosteric ligands and 29 IGF-1R-binding fragments. Combining these structures and lead optimization yielded three lead candidates; the most promising candidate exhibited binding affinities of -7.07 kcal/mol for GLP-1R and -5.72 kcal/mol for IGF-1R. Pharmacokinetics and drug-likeness indicated favorable oral drug properties. These discoveries culminated in Neuroglutide, a first-in-class bi-functional drug for T2D, obesity, and NDs.

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Abstract: Science and Engineering Fair of Houston

3315

Temporal Attention-Enhanced CNN and CETP Targeting: A Novel & Dual Approach for Early Detection and In Silico Validated Treatment of Coronary Artery Disease

Keshav Balakrishna
Moemal Al-Wishah
Ali Moualla

Category

Medicine and Health

Coronary Artery Disease (CAD) remains one of the leading causes of cardiovascular-related mortality by affecting over 20.5 million people in the United States and approximately 315 million people worldwide in 2022. The progressive nature of CAD, often asymptomatic, presents a great challenge for early diagnosis and timely intervention. Traditional diagnostic methods include angiography and stress tests, which are resource-intensive, time-consuming, and prone to human error. Herein, we propose a novel approach to the diagnosis and treatment of CAD based on a Convolutional Neural Network (CNN) with a temporal attention mechanism. The model will be developed on an architecture that will automatically extract and emphasize critical features from the sequential medical imaging data of coronary angiograms by allowing subtle signs of CAD to be easily spotted (which could not have been detected by convention). The integration of the temporal attention mechanism significantly augments the model's capacity to discern relevant temporal patterns, thereby enhancing sensitivity and robustness in identifying coronary artery disease (CAD) across its various stages. This diagnostic advancement is further strengthened by our innovative therapeutic strategy, which employs advanced simulations through molecular docking software. We focus on the cholesteryl ester transfer protein (CETP), previously underexplored in CAD treatment, proposing genetically modified microorganisms that release a novel drug to inhibit CETP, thereby increasing high-density lipoproteins (HDLs) and lowering low-density lipoproteins (LDLs). In silico validation confirms the efficacy of this dual approach, promising to revolutionize CAD diagnosis and offer a novel avenue for its treatment.

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Abstract: Science and Engineering Fair of Houston

3316

Turn down for what: How Headphones Can Lead to Permanent Hearing Loss.

Alexandra Gardiner

Luciennne Ouedraogo

Noah Cook

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Medicine and Health

Studies have shown that the vast majority of young adults and youth undergo excessive amounts of audio exposure through the use of headphones. It can be speculated that excessive audio exposure above the recommended volume limits can lead to noise-induced hearing loss. If this hypothesis is proven, it can be firmly concluded that by middle age, many individuals of younger generations and future generations will be at risk of hearing impairment. To test this hypothesis, two separate groups are being examined. One group consists of mature participants who will represent the natural loss of hearing that occurs with aging. The second group, consisting of younger participants, experiences high levels of daily audio exposure and will be tested in comparison to the mature group, which is expected to have naturally reduced hearing ability. Using an audiometer, a test has been organized for all 40 individuals to perform—one that someone with substantial hearing would find moderately simple to pass. It is expected that both groups will perform similarly. To conclude, the null hypothesis is rejected, therefore there is a statistical difference between the hearing abilities of adults 40 years and older and a less mature group that experiences daily audio exposure through headphones.

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Abstract: Science and Engineering Fair of Houston

3317

AI Enhanced Capsule Endoscopy: A Novel Paradigm for Real-Time Detection of Gastrointestinal Disorders

Ahaan Thota

Aarav Mehta

Aryan Ganglani

Fort Bend ISD /Dulles High School

Category

Medicine and Health

The small intestine plays an important role in the gastrointestinal (GI) tract by absorbing nutrients from food. Disorders in this area can lead to nutrient deficiencies, developmental issues, and other health problems. Diagnosing conditions such as Crohn's disease and Iron Deficiency Anemia is difficult due to the small intestine's location, which traditional methods like endoscopy and colonoscopy cannot fully access. Capsule Endoscopy (CE) provides a solution by using a pill-sized camera to capture images of the digestive tract, but it still depends on manual analysis, which is time-consuming and subject to human error. This study explores the integration of Artificial Intelligence (AI) into Capsule Endoscopy to address these challenges. The AI system analyzes images captured by the capsule in real-time, efficiently detecting abnormalities like bleeding, polyps, and ulcers. Trained on large datasets of GI images, the AI model improves its ability to recognize patterns and reduce errors. The AI-enhanced Capsule Endoscopy model filters and highlights images that show traces of specific disorders, providing preliminary findings and estimated diagnoses. This approach aims to speed up diagnostics, reduce the workload for medical professionals, and improve the accuracy of detecting GI disorders. The innovation of combining the strengths of AI with Capsule Endoscopy technology has the potential to transform GI diagnostics, enabling earlier detection, better treatment planning, and enhanced patient care.

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Abstract: Science and Engineering Fair of Houston

3318

Chemiexcitation-Mediated Autophagy as a Mechanism for Lipofuscin Catabolism in Age-Related Macular Degeneration

Christopher Dai

Abdullah Goraya

Houston ISD /DEBAKEY HIGH SCHOOL FOR HEALTH PROFESSIONS - HS

Category

Medicine and Health

Age-related macular degeneration (AMD) is a leading cause of vision loss worldwide, characterized by lipofuscin accumulation in retinal pigment epithelial (RPE) cells. This buildup contributes to oxidative stress and impaired cellular function, accelerating disease progression. Current treatments focus primarily on late-stage AMD, and mostly focuses on halting progression rather than general treatment, leaving a gap in early intervention strategies. Our study explores a dual therapeutic approach combining chemiexcitation elements (AMPPD and SIN-1), which modulate the excited state of lipofuscin allow our lysosomal activators (Trehalose and Rapamycin) to enhance autophagic clearance of lipofuscin. Our in vitro experiments with ARPE-19 cells demonstrated that the combination treatment significantly reduced lipofuscin levels and oxidative stress, showing greater efficacy than individual and traditional treatments. Our findings suggest that targeting lipofuscin chemiexcitation alongside lysosomal dysfunction could offer a novel early intervention strategy for AMD, potentially improving patient outcomes and reducing disease burden in not only AMD, but other lipofuscin associated diseases such as cancer, dementia, and other neurodegenerative diseases.

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Abstract: Science and Engineering Fair of Houston

3319

Optimizing Liver Transplant Success: A Data-Driven Approach Incorporating MELD for Accurate Survival Prediction and Equitable Organ Allocation

Nia Shetty
ST. JOHN'S SCHOOL

Category

Medicine and Health

The Model for End-Stage Liver Disease (MELD) score, a widely used tool, predicts 90-day waitlist-mortality but fails to account for post-transplant survival, leading to suboptimal organ allocation and poor long-term outcomes. This research proposes a systematic machine learning pipeline combining feature selection, predictive modeling, and explainability analyses to evaluate the impact of clinical and donor variables on 90-day post-transplant survival in liver transplant recipients. Using data from the United Network for Organ Sharing (UNOS), comprising 341,208 candidates and 22,123 donors, the study trained ML algorithms, including Random Forest, LightGBM, Decision Tree, Hist Gradient Boosting, and XGBoost, on key clinical variables like sodium, bilirubin, creatinine, and cold ischemia time. XGBoost demonstrated superior performance, achieving 96% predictive accuracy and an AUC of 0.85, outperforming MELD's 48% accuracy. Analysis identified critical predictors of survival such as cold ischemia time, donor cause of death, donor ICU stay, and recipient's clinical history, reaffirming the model's reliability to minimize organ wastage and accurately predict risk. While the ML model enhances prediction accuracy, its direct application in clinical settings is limited by complexity. The PRESTO (Predictive Evaluation for Survival and Transplant Outcomes) score and desktop software were developed to address this gap. The system integrates key variables from the ML pipeline into a Cox regression-based scoring model, with MELD for clinical adoption. Combining machine learning precision with PRESTO's practicality, this research delivers an actionable framework that improves survival outcomes, reduces organ wastage, and ensures equitable allocation, with potential applications in other organ transplants.

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- yes no



Abstract: Science and Engineering Fair of Houston

3320

GLIMPSE: Glioblastoma Layered Integration of Multi-Omics for Pathogenesis and Survival Estimation

Kavin Ganeshkumar

Sana Gangopadhyay

Houston ISD /DEBAKEY HIGH SCHOOL FOR HEALTH PROFESSIONS - HS

Category

Medicine and Health

Glioblastoma, also known as glioblastoma multiforme (GBM) is a primary malignant tumor characterized by aggressive cell growth and poor prognosis. It is associated with complex molecular alterations, such as genetic mutations and aberrant signaling pathways, which contribute to its resistance to conventional treatments. Deep comprehension of GBM's molecular pathogenesis is critical for the development of effective therapies. In this study, we utilized a statistical model based on integrated multi-omics data to gain greater insights into the genetic basis and prognosis of GBM. We identified differentially expressed genes (DEGs) and differentially methylated probes (DMPs) in GBM using single-cell RNA sequencing (scRNA-seq), bulk RNA sequencing (bulk RNA-seq), and DNA methylation data from datasets GSE84465, mRNAseq_693, and GSE90496, respectively. In previous research, this data has been investigated independently of each other. This analysis identified 67 DEGs ($\log_2FC > 1$) and 38020 DMPs ($\log_2FC > 0.2$) in GBM. Selected DMPs were then annotated to their nearest gene via genomic coordinates, and this list was overlapped with the 67 DEGs to obtain a subset of 26 genes and their corresponding 72 CpG sites. These features were then used to filter The Cancer Genome Atlas' GBM dataset (TCGA-GBM), a comprehensive dataset of real GBM tumor samples. The filtered dataset was fed into an Elastic Net linear regression model, which quantitatively predicts patient survival in days. Our model's predictions of GBM prognosis closely followed the true values set with a correlation coefficient of 0.9685 and an RMSE value of 96.488 days. The high accuracy of our model suggests that integrating multi-omics data can provide precise insight into patient prognosis. Further research investigating the DEGs and DMPs identified in this study can advance the development of future therapeutics for GBM.

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Abstract: Science and Engineering Fair of Houston

3321

Could polysomnography improve precision treatment of obstructive sleep apnea by identifying and classifying phenotypes?

yujin cho

Tompkins - HS

Category

Medicine and Health

Obstructive Sleep Apnea (OSA) is a highly prevalent sleep disorder which affects over 936 million individuals worldwide. This disorder occurs when a partial or full collapse of the upper airway muscles results in the restriction of airflow to the lungs. Although OSA is linked to serious health risks such as cardiovascular disease, heart disease and stroke, current diagnostic methods are often inadequate. Even more understudied is the realm of precision medicine in OSA treatment. Although OSA has been shown to be a diverse and non heterogeneous disorder, current treatment methods rely on a one size fits all approach. This study aims to create a cost-effective and automated detection algorithm for OSA phenotypes based on polysomnogram readings. The resulting algorithm is the first of its kind in integrating polysomnogram recordings for use in treatment personalization. Time series statistical features were extracted from each polysomnogram channel using the Tsfresh feature extraction library. Three key clusters were identified using a Gaussian Mixture Model classification algorithm. Cluster analysis yielded results closely aligned with existing literature, identifying subgroups with disturbed sleep, minimal symptoms, and excessive sleepiness. A supervised Random Forest classification algorithm was run on the final clusters and a 10-fold cross validation accuracy of 91% was achieved. This study makes two major advances by improving patient outcomes and streamlining precision treatment of OSA using tools commonplace in the industry.

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Abstract: Science and Engineering Fair of Houston

3322

The Impact of the Gut Microbiota on the Transcriptomes of Primary Sensory Neurons

Cathryn Wu

Clear Creek ISD /Clear Lake High School

Category

Medicine and Health

The gut microbiota has about 100 times more genes than human genes. It has been studied and concluded by many scientists recently that the gut microbiota has a profound effect on the primary sensory neurons and most specifically, the dorsal root ganglion (DRG) neurons which comprise the first stage of pain reception. Disruptions of the gut microbiota can cause disease development. While this has been empirically studied, it is still unknown why this pattern appears. More specifically, the change to molecular properties of the DRG neurons is unknown.

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Abstract: Science and Engineering Fair of Houston

3323

Analyzing and Comparing the Socioeconomic, Health, and Pollution Data of Counties where Coal-Fired Power Plants are Nearby, Counties without Coal-Fired Power Plants Nearby, and the United States

Christian Bohn

Source: ISD / AST: Academy of Science and Technology

Category

Medicine and Health

Coal-fired power plants have populated the United States for over 130 years and have dominated the energy sector since their inception. Copious research has been conducted regarding the indirect effects of coal-fired power plants. However, more analysis is needed to determine their direct impact on health, mortality, morbidity, and air pollution. This experiment focused on collecting data in the geographic areas—states and counties—where the coal-fired power plants were or weren't located, rather than linking emissions to casualties and then coal-generated electricity to emissions. This experiment analyzed mortality, morbidity, income, and air pollution data near and away from coal-fired power plants. Many confounders were addressed in this experiment, such as age, income, environmental pollution levels, and bias, through comparisons of age groups toward mortality and morbidity, analysis of PM2.5 pollution, and randomization of chosen areas of coal-fired power plants. The findings of this study show that areas with coal-fired power plants have higher mortality rates in age groups 0-9, 10-19, and 20-74 but lower rates in the age group 75+ when compared to areas without coal-fired power plants. This displays a higher probability of younger deaths when near coal-fired power plants, and longer life expectancy outside of coal-fired power plants. There was a margin of error within the experiment due to income in areas with coal-fired power plants being significantly lower than areas without coal-fired power plants. Disease mortality and air pollution showed no correlation in all cases, leading to the conclusion that other factors must influence this trend.

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Abstract: Science and Engineering Fair of Houston

3324

Evaluating Various Herbs and Herbal Combinations for Optimal Growth of Escherichia coli K-12

Sachi Lee

Hana Lee

Conroe ISD /AST: Academy of Science and Technology

Category

Medicine and Health

Pharmaceuticals have become an important part of contemporary medicine, but research has shown that they can be harmful to the body, therefore alternatives for medication such as herbs are being studied as they were a natural remedy used before the development of medicine. The objective of this project was to identify which of the following herbs—ashwagandha, turmeric, or parsley—would most effectively increase the growth of E. coli K-12, either individually or in combination with one another. It was hypothesized that ashwagandha and turmeric, when combined, would increase the bacteria the most. Experimentation was conducted using herbal tinctures that were syringed onto petri dishes and hardened with agar. E. coli K-12 was then serially diluted to the ten-millionth power and micropipetted onto each dish. After incubation, a grid circle was created in order to collect data by calculating bacterial percentage growth. Ashwagandha had the most bacterial growth (88.3 percent), but had an antagonistic effect when combined with other herbs. The second highest averaging petri dish, the parsley and turmeric combination (83.7 percent), had a synergistic effect, as the two herbs performed poorly individually, but were effective when combined together. These findings are important because E. coli, though minimal in the body, plays a large role in maintaining the balance of the gut microbiome, especially in those of phenylketonuria patients. Further testing will allow for a deeper understanding about herbs, their properties, and their impact on different types of bacteria.

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Abstract: Science and Engineering Fair of Houston

3325

The Diverse Responses of Antidepressants

Muhammadjon Tursunbadalov
Abraham Madrid
SST - Champions College Prep - HS

Category

Medicine and Health

The purpose of this research was to explore the diverse factors influencing individual responses to antidepressants, highlighting the critical need for personalized treatment approaches in mental health care. Understanding these variations is essential for improving treatment outcomes for the significant percentage of patients who do not respond to standard medications, ultimately leading to more effective interventions and better quality of life for individuals facing depression. In summary, we have concluded that the reason on why some people respond differently to antidepressants relies on genetic and biological factors, medication types, and psychological influences. After diving into the different ways people respond to antidepressants, we found that the reasons for these variations are quite complex. We concluded that a mix of genetic factors, biological differences, the types of medications prescribed, and individual physiological influences all play significant roles. This complexity sets a foreground the need for more personalized treatment approaches, as recognizing these factors can help us develop more effective strategies for managing depression.

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Abstract: Science and Engineering Fair of Houston

3326

Developing an AI-Based Model for Early Cancer Detection Using Medical Imaging and Machine Learning

Ronak Hiwale
ST. JOHN'S SCHOOL

Category

Medicine and Health

This project focuses on using publicly available medical datasets to train and aid the development of an AI model for early cancer detection by utilizing image classification. By training and rigorously validating the model on this processed data, it aims to deliver high accuracy and reliability. Designed to assist healthcare professionals, the model seeks to enhance the speed, consistency, and accessibility of cancer detection, particularly in resource-limited regions. Through early detection, the project demonstrates the transformative potential of AI in improving healthcare delivery and patient outcomes. My procedure for this experiment will be constantly improving my code until it reaches a good accuracy and improving my app.

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Abstract: Science and Engineering Fair of Houston

3327

Biodegradable Medical Materials

Saleha Akram

THE JOHN COOPER SCHOOL - HS

Category

Medicine and Health

Biodegradable sutures are essential in modern medicine, reducing the need for removal and minimizing patient discomfort. This experiment investigates the degradation rates of common suture materials- PGA, Monocryl, PDO- compared to nylon as a non-absorbable control. Sutures of equal length (15 cm) were submerged in a saline solution at 37 degrees Celsius to simulate body conditions, and final length was measured after one week. Results revealed that PGA degraded the fastest, losing 0.24 cm (1.6% of its original length), followed by Monocryl, which lost 0.19 cm (1.3%). PDO exhibited the slowest degradation with a loss of .05 cm (0.3%), while nylon remained unchanged, confirming its non-absorbable nature as a control. These findings support the hypothesis that PGA is suitable for short-term medical applications requiring rapid absorption, while PDO is better for long-term support. This research highlights the importance of selecting appropriate suture materials to optimize surgical outcomes. Future studies could explore degradation in dynamic environments or investigate combinations of these materials to improve patient care.

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Abstract: Science and Engineering Fair of Houston

3328

BRAIN TUMOR ANALYZER - A Novel, Innovative & Non-Invasive Approach to Detect, Predict & Classify Brain Tumors Leveraging Artificial Intelligence & Deep Learning

Vikram Gupta

Friendswood ISD /Friendswood High School

Category

Medicine and Health

Brain tumors are lethal cancers, and their detection is complicated by virtue of their structure, position, and size. My grandfather's brain tumor was detected at an advanced stage, and he could not be saved. Had his brain tumor was detected early on, he could be with us now. It motivated and compelled me to investigate this problem. Surveys reveal that brain cancer patients survive less than 14 months post-diagnosis; therefore, early detection, prognosis and medical intervention are critical for a patient's survival. Several systems have been developed over time, but they failed to deliver results due to extremely complex inherent characteristics of brain tumors making them difficult to detect and predict. Currently, MRI is extensively used to detect brain tumors, however manual MRI scan analysis is overly time-consuming and prone to human errors. My research focuses to expedite detection, prediction & classification of brain tumors from MRI scans, leveraging AI and deep learning techniques, for reliable prognosis. MRI scans are pre-processed to enhance image quality, key features from images extracted and precise image segmentation is accomplished using thresholding techniques & U-Net++ architecture. Thereafter, classification of segmented regions is achieved using deep learning CNN models of VGG-19, Inception, & ResNet-50. The system simulation is executed on a user-friendly front-end interface built using Streamlit with MRI images as input, and tumor prediction & classification as outputs. Back end serves as a powerful computational powerhouse, running complex deep learning models, to predict and classify tumors. It is built using Anaconda OSS, Python & Spyder IDE.

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Abstract: Science and Engineering Fair of Houston

3329

Battle of the Diagnostics: Determining Whether Less Invasive Diagnostic Tests Can Be Substitutes for Endoscopies and Biopsies in the Diagnosis of Eosinophilic Esophagitis

Leyna Phan

Category

Medicine and Health

The traditional method of diagnosing Eosinophilic Esophagitis (EoE), a chronic medical condition caused by an excess number of eosinophils in the esophagus, includes conducting biopsies through endoscopy procedures. However, this procedure is invasive as it can cause tears in the tissue lining of the esophagus and is also expensive for the responsible party. There is a diagnostic tool underway for diagnosing EoE called the esophageal string test (EST), a minimally invasive procedure that is less costly than the conventional endoscopy procedure. To address whether the EST could be a preferable method of diagnosing EoE, our team gathered data from a variety of sources, from peer-reviewed academic journals found on the Internet to professional advice from doctors through social media and networking. Literature sources via the Internet were performed using keyword combinations including eosinophilic esophagitis, esophageal string test survey results, and the accuracy of endoscopies versus minimally invasive tools. From our analysis, we found that although there were surveys that shared positive patient opinions regarding EST, there was not sufficient evidence to support the claim that less invasive tests can substitute the endoscopy procedures. The lack of research made it difficult to draw a conclusion that could carefully assess the social and medical advantages and disadvantages of less invasive diagnosis methods. While the research available now proves that endoscopies have a higher rate of detection, it is crucial that ongoing research regarding less invasive procedures occurs so that patients can have the option to choose which is suitable for their needs.

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Abstract: Science and Engineering Fair of Houston

3330

Eat Right, Lose Right: The Role of Macros in Sustainable Weight Loss

Deirdra Acklin

Gabrielle Perez

Chloe Holbert

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Medicine and Health

More than 2 in 5 adults suffer from obesity and the sad fact is the United States is the 12th most obese country worldwide. The big question that arises in the weight loss community is what the most effective diet is, but with the industry being worth \$29.66 billion it becomes hard to find new updated results. The average obese American diet consists of many carbs, fats, and calories. This project researches what diet is the best and most manageable for the majority. A pattern was noticed that at around 3 months the people on the carbohydrate diet had the most weight loss. As the 6 month mark was checked they had all evened out between the fat, carb, and protein diet. When the 12 month period checks were analyzed it was clear that a diet high in protein and low in fats and carbohydrates should be followed for optimal weight loss. This includes having about 25% of your total energy intake coming from protein as the people on this diet lost on average 10kg. When a follow up done by certain participants in the articles it was more evident that a high protein diet is most favorable for weight loss and easiest to manage.

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vertebrate animals

microorganisms

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tissue

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no



Abstract: Science and Engineering Fair of Houston

3331

The Hygiene Experiment: The Health Risks of a High Schooler

Anna Schustereder
Ava Rogers
Rebecca Whitnell
Klein Oak - HS

Category

Medicine and Health

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Abstract: Science and Engineering Fair of Houston

3332

The Role of Folic Acid in Preventing Neural Tube Defects

Ishnita Agarwal
Cypress Ranch - HS

Category

Medicine and Health

Neural tube defects, caused by improper closure of the neural tube, are one of the world's deadliest and most preventable birth defects. Folic acid has been proven in hundreds of studies to reduce neural tube defects by as much as 70%. However, despite global implementation, we don't know how folic acid impacts the genes, proteins, and signaling pathways associated with primary neurulation. Recent discoveries in bioinformatics, using computer technology to collect, store, and analyze biological data, give us a unique opportunity to extensively study the impact of folic acid on signaling pathways and development. This study plans to use bioinformatics to assess specific signaling pathways and genes affected by activated folate receptors, developing our understanding on the impact of folic acid on neural tube closure. I plan on using computer modeling and statistical analysis tools such as KEGG, Reactome, Excel, and GraphPad to introduce data and create simulations that will help us analyze the impact of folic acid on gene expression and signaling pathway efficiency. Some signaling pathways this study aims to target are the Wnt, Shh, Notch, PCP, BMP, retinoid, FGF, TGF- β^2 , ROR, Pax6, and inositol metabolic pathways. A dose-response analysis will determine the concentration-dependent effects of folic acid on these pathways, while genes will be tested for expression in exposed and non-exposed experiments. This study will provide a deeper understanding of how folic acid impacts cellular signaling during neural tube formation and closure and could have immense implications for future studies in neural tube development.

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Abstract: Science and Engineering Fair of Houston

3333

Ulcer Walk- A solution to Diabetic forefoot ulcerations.

David Lim

Carter Kaasjager

Conroe ISD /ASHP: Academy for Science and Health Prof

Category

Medicine and Health

Type 2 diabetes has become a growing epidemic within developed nations; it is associated with several major complications, which include neuropathy which could lead to diabetic foot ulcers on the forefoot: the most common area. Untreated ulceration may further lead to infections leading to amputation. A current solution is called a football wrap which is a wrap that allows patients to walk leading to a similar quality of life. The football wrap works by cushioning the forefoot using cotton and redistributes pressure from the forefoot to the heel or the arch. The football wrap however does not allow for active wound care because the wrap is rewrapped weekly with doctor's consultation and between consultation the wound's condition is unknown. The project was to create a device similar to the football wrap that allows for the wound to be checked upon without a consultation. The device's critical feature was made from silicon which distributed the pressure from the forefoot to the arch or heel. Comparing the wrap and device the pressure distributions was calculated using a pedobarographic software and device which showed the device redistributed the pressure of the forefoot to the heel or arch matching similar results with the football wrap.

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Abstract: Science and Engineering Fair of Houston

3334

The correlation between Conductivity, Sugar Level, Calories, and its benefits for Athletes and Diabetics.

Liam Trevino

Clear Creek ISD /Clear Creek High School

Category

Medicine and Health

Looking deeper into the health of athletes and diabetic people, the study performed is the correlation between conductivity, sugar levels, and calories in different fruit. The results will help benefit athletes and diabetic people eat healthier foods. There are critical health conditions for diabetic people and athletes whenever they are not taking care of their bodies. The studies shown will help these people eat fruits that are better for them. To complete this experiment, put the fruits in a juicer. When measuring the calories, use the FDA fruit chart. Weigh the fruits before every trial. Create a ratio to the FDA chart to calculate to calories for the fruit. Put the juice in the circuit connected to the multimeter and measure two settings. Then you will put a drop of the liquid on the refractometer and hold it to light. Record measurements and do this 5 times for each fruit. Oranges had the highest conductivity of 0.007094 S/m. Strawberries had the lowest Brix % and calories. Grapes had the highest Brix% at 18.2%. The hypothesis was proven wrong by the low sugar level in oranges with a high conductivity rate. Oranges is the best fruit for athletes. Strawberries are the best fruit for diabetic people. The studies done relate to the health of athletes and diabetic people.

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Abstract: Science and Engineering Fair of Houston

3335

Measuring the UV Protection of Varying Sunscreen Types

Emmeline Courtier

Conroe ISD /ACES: Academy for Careers in Engineering and Scien

Category

Medicine and Health

This project investigates the effectiveness of sunscreens containing different oils and active ingredients in blocking ultraviolet radiation. It compares mineral based sunscreens, such as those containing zinc oxide with oil-based sunscreens. This includes those with coconut and avocado oils, as well as chemical sunscreens like oxybenzone. The UV protection of each sunscreen was assessed by measuring the UV light intensity passing through a single layer of sunscreen applied to the petri dishes. UV transmission percentages were recorded and Sun Protection Factor (SPF) estimates were calculated based on the level of UV blockage. The results demonstrated that mineral sunscreens provided the highest level of UV protection, with an SPF estimate of 20. Oil-based sunscreens, the coconut oil and avocado oil, allowed significantly more UV radiation to pass through, yielding SPF estimates of 5 and 6. Chemical sunscreen with oxybenzone offered moderate protection, with an SPF estimate of 10. This supports the hypothesis that mineral sunscreens offer ultimately the greatest protection against UV radiation in comparison to oil-based and chemical alternatives. This research shows the importance of selecting sunscreens with mineral ingredients for the most effectiveness in blocking UV defense. Especially, for reducing the risk of skin damage and skin cancer. In the future, studies should address potential experimental limitations, such as sunscreen thickness and environmental conditions, to further refine the understanding of sunscreen efficiency.

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Abstract: Science and Engineering Fair of Houston

3336

Telomere Shortening as a Novel Contributor to Inflammatory Bowel Disease: Findings from Population-Level and Wet Lab Analyses

Kendall Wu

Fort Bend ISD /Dulles High School

Category

Medicine and Health

Inflammatory Bowel Disease (IBD) is a chronic, lifelong gastrointestinal (GI) condition affecting an estimated 5 million people annually. Despite its significant disease burden, the causes of IBD remain unknown. I drew from case studies of severe GI illness in patients with telomere disorders and hypothesized that, just as telomere shortening leads to dysfunction in other organs (e.g., bone marrow failure, nail/skin defects) through repeated cell divisions, it may also play a role in IBD development by compromising intestinal epithelium integrity. To test this, I assessed associations between estimated telomere lengths and IBD prevalence in the national All-of-Us patient database (n=5186). Accounting for demographics and lifestyle factors in logistic regressions, an inverse relationship between telomere lengths and IBD prevalence was found. Odds ratios (95% CI) for IBD across estimated telomere length quartiles, from shortest to longest, were: 1.00, 0.86, 0.71, and 0.60. Subgroup analyses on C-reactive protein levels revealed inflammation severity was greatest in patients with the shortest telomeres. These population-level assessments were further explored through wet lab analysis of intestinal tissue from telomerase-knockout mice (TKO). Immunohistochemistry and RNA analysis showed that, compared to WT tissue, TKO villi exhibited expanded, structurally aberrant tips with upregulation of proliferation and protein synthesis genes, and down-regulation of nutrient transport and cytoskeletal microvillus genes. These results pointed to cellular defects in enterocyte differentiation that contribute to abnormal nutrient absorption, incomplete pathogen defense, and eventually IBD. Given these findings, telomere shortening may be a novel contributor to IBD.

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Abstract: Science and Engineering Fair of Houston

3337

Computational Modeling of PROTAC-Induced Targeted Degradation of Tau Protein in Alzheimer's Disease

Akhil Chamarti

Fort Bend ISD /Dulles High School

Category

Medicine and Health

Alzheimer's disease is a progressive disease that destroys memory and other mental functions. It is a type of dementia primarily affecting older adults, causing a decline in cognitive abilities, behavior, and social skills severe enough to interfere with daily life. Tau is a protein that plays a key role in Alzheimer's disease by forming abnormal clumps called neurofibrillary tangles inside brain cells when it becomes misfolded and accumulates, which disrupts the normal function of neurons and contributes significantly to the cognitive decline associated with the disease. PROTAC is a small molecule that degrades harmful proteins by binding to a target protein, recruiting E3 Ubiquitin Ligase, labeling the protein with a ubiquitin tag, and then degrading the protein. I hypothesize that a chemical alteration in the PROTAC 3D structure could make a stronger binding PROTAC. PROTAC binds to both the tau protein and the E3 Ubiquitin Ligase, disintegrating the fibrils. The HDock web server allowed protein and protein-DNA/RNA docking based on a hybrid strategy. Two molecular docking simulations were performed to understand the interactions between the fibril-PROTAC and E3 Ligase-PROTAC. Finally, the complete Fibril-PROTAC-E3 Ligase complex was formed. To understand interactions formed between the PROTAC and protein (tau and E3 Ligase), a PLIP interaction analysis was performed. Finally, based on the docking analysis, the PROTAC was chemically modified to obtain a PROTAC with higher binding affinity. The application of PROTAC research for Alzheimer's lies in developing targeted therapies to degrade disease-related proteins, potentially improving treatment outcomes.

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Abstract: Science and Engineering Fair of Houston

3338

Thermoclense: A novel method to Eradicate Anti-Microbial Resisting Bacterial Diseases

Ryan Berger

EMERY WEINER JEWISH SCHOOL

Category

Medicine and Health

Thousands of people around the world are dying from anti-microbial-resistant bacterial diseases. When treated with current technology most patients die or survive with lasting side effects. My project was created to ensure the safe survival of those affected. I am attempting to heat the molecule indocyanine green to a temperature that can kill bacteria which is 23 degrees Celsius after calculations. I hypothesized that when presented with light from my infrared flashlight, indocyanine green would heat 23 degrees Celsius in under 45 minutes for all tissue models except the 50% 2cm model. I tested this by mixing indocyanine green with water at a high concentration, placing it on top of a neutral surface with a layer of model tissue above, shining infrared light at 780nm in wavelength onto the mixture, measuring the temperature at different time points, and then repeating for tissues models representing; no tissue, 50% water, 1 and 2cm thick, 25%, 1 and 2cm, and 10%, 1, and 2cm. The success of my project's experimentation led me to the following conclusion. When presented with light from my infrared flashlight covered by varying densities and thicknesses of tissue the indocyanine green heated up to 23 degrees Celsius or showed trends reaching 23 degrees Celsius at a later time. My goal is that for treatment, the indocyanine green can be put into the body by injection, then activated in vivo by the infrared flashlight I created, eradicating the bacteria colonies, and treating the patient accurately and safely.

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Abstract: Science and Engineering Fair of Houston

3339

Machine Learning Models for early Stroke detection

Aditi Vadassery

Fort Bend ISD /Clements High School

Category

Medicine and Health

About 795,000 Americans experience strokes annually, with 80% being preventable. My project explores whether an AI system can efficiently predict stroke risk based on parameters like gender, age, diseases, and smoking status. Using the public Kaggle Stroke Prediction dataset, which includes 5,110 patients with 12 attributes such as age, BMI, smoking status, and history of heart conditions, I analyzed trends and correlations with stroke likelihood. I employed Python to develop and test models, including K-Nearest Neighbors (KNN), neural networks, and random forest classifiers. The study focused on determining the speed and effectiveness of these models in low-computing environments. Results showed that random forest classifiers were the fastest and most effective in such conditions while maintaining high accuracy, precision, and recall. Key factors correlated with stroke risk included hypertension, smoking status, and age. To assess reliability, I analyzed model accuracy and used visualizations, such as scatter plots, to illustrate correlations and results.

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Abstract: Science and Engineering Fair of Houston

3340

How does overnight orthokeratology lens wear influence the magnitude, axis, and distribution of corneal astigmatism in children with myopia, as assessed by corneal topography?

Snehal Srishti

Cornea ISD /Grand Oaks High School

Category

Medicine and Health

Myopia and astigmatism are conditions that are affecting much of the world at an alarming rate, and are particularly concerning for children, whose prescriptions remain unstable. Although orthokeratology, a specialized overnight corneal molding treatment, effectively reduces the progression of myopia, few studies have analyzed its impact on astigmatism in children. This study collected corneal topography maps and astigmatism data from fifteen patients at six intervals (prospective & retrospective studies). The analysis of nine corneal topography charts in this study highlights the nuanced impact of orthokeratology on corneal astigmatism in myopic children. Results indicate that ortho-K lenses are surprisingly effective in reshaping the cornea to reduce myopia and induce temporary changes in astigmatism. However, the effects vary depending on baseline astigmatism levels, with higher initial astigmatism showing greater variability in outcomes. The use of toric ortho-K lenses appears particularly promising for managing higher levels of astigmatism, as they provide more specialized corneal reshaping compared to spherical designs. Moreover, the findings suggest that ortho-K lenses slow myopia progression in younger children, aligning with previous studies demonstrated reductions in refractive error. Future research should explore the long-term stability of these changes with advanced lens designs like toric ortho-K, and investigate relationships between corneal morphology and optical outcomes. The integration of more sophisticated imaging, such as AS-OCT, could further understanding of ortho-K's effects on astigmatism and implications for clinical practice. This research covers a gap in the field and can be used to improve treatments for children globally, especially patients with astigmatism and myopia.

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Abstract: Science and Engineering Fair of Houston

3341

Mathematics of infectious diseases: Old paradigms and new questions

Adela Nicolae

Houston ISD /Carnegie Vanguard HS

Category

Medicine and Health

Epidemiological models use a series of ordinary differential equations to provide a simplified representation of an infection's spread within a population. The data collected from these predictive models can inform public health policymakers on what decisions to make in an effort to contain disease, an example being the social distancing measures implemented during the COVID-19 pandemic. In Matlab, I created a code that represents three differential equations, as is typical of the Susceptible, Infected, Recovered model, the most simple and common epidemiological model. The population is split into these three categories to track the spread of disease from a patient-centric point of view. In my experiment, I altered the variables a (the rate of infection) and b (the rate of recovery) to see how changing each parameter affects the final model. A larger a reflects very low social measures taken to limit the spread of disease, while a smaller a reflects large measures. A larger b reflects progress in medicine that aids in disease recovery, while a smaller b reflects the opposite. I created a code based off of combinations to reflect the interactions between one infected and up to three susceptible individuals (higher order models have little effect on the total behavior). These multiple-interaction models reflect how a disease can create a more devastating result than in a baseline SIR model. While a typical SIR model reflects only one-on-one interactions, multiple-interaction models provide results that are more true-to-life, and can be used to improve the accuracy of current models.

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Abstract: Science and Engineering Fair of Houston

3342

Glasses With Peripheral Vision

Aziz Arifov

Fort Bend ISD /Hightower High School

Category

Medicine and Health

With my ADVANCED GLASSES with peripheral vision people will be able to see sides of the sight in better quality if they eye sight problems. They are designed that way that allows humans to see everything their field of view without blocking any part of it with the frame.

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Abstract: Science and Engineering Fair of Houston

3343

Stem Cell therapy for Sanfilippo Syndrome

Krrish Ladha
Anish Senthil
Arius Nguyen
Cypress Ranch - HS

Category

Medicine and Health

The transplantation of genetically modified donor stem cells (for reduced risk of being attacked by immune cells and to specialize the cells) which are encapsulated in fetal bovine serum (proven to increase the efficiency of the cell and protect) and administered via stereotactic surgery (for the utmost accuracy) into a San Filippo syndrome patient's brain will result in the production of the missing enzymes needed to degrade the accumulated glycosaminoglycans. This will significantly improve the patient's cognitive function and slow the progression of the disease.

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Abstract: Science and Engineering Fair of Houston

3344

Predicting ACL Injuries in Basketball Players Using Machine Learning: An Analysis of Pre-Injury Movements and Collision Factors via Image Capture

Varrun Athis Rajh

Fort Bend ISD /Elkins High School

Category

Medicine and Health

Anterior Cruciate Ligament (ACL) tears are the most common knee injury in basketball players. These injuries often require surgical repair, leading players to undergo several months of rehabilitation to achieve full recovery. Artificial Intelligence (AI) has the potential to offer a proactive approach to injury prevention by detecting and evaluating subtle changes in muscle and joint movements. This study aimed to determine the most effective machine learning algorithms for predicting ACL injuries in basketball and explored the correlation between collisions involving professional basketball players and the likelihood of ACL injuries. The Kinetic Lab AI app was used to analyze videos of National Basketball Association (NBA) players just before and at the time of ACL injury. Then, various algorithms, such as the Support Vector Machine, Decision Tree, and Logistic Regression, were utilized to develop predictive models. A correlation analysis was performed, and it identified that the left leg injury correlated with the opponent's height and weight and the right leg injury correlated with the right leg angle and the opponent's leg angle. The Support Vector Model was the most reliable model in predicting injury to both legs as it had the highest accuracy and precision. The Random Forest model identified games played and opponent leg angle to be significant factors in the right leg injury. The findings of this study have implications for the development of AI algorithms to understand and prevent ACL injuries in sports, as well as for evaluating the impact of player collisions on injury likelihood.

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Abstract: Science and Engineering Fair of Houston

3345

Effect of Different Fats on Spectral Doppler Parameters in a Human Circulatory System Analog

Luke Sammer

Conroe ISD /AST: Academy of Science and Technology

Category

Medicine and Health

This study investigated the immediate effects of different dietary fats on blood flow characteristics using an ultrasound phantom model of the human circulatory system. The simulated vascular system was created using ballistic gelatin with an embedded channel, and blood analogs were prepared by combining a base saline-glycerin solution (control) with various fats added (olive oil, canola oil, lard, and butter). Using spectral Doppler ultrasound, blood flow parameters including Peak Systolic Velocity, End Diastolic Velocity, resistive and pulsatility indices, and waveform patterns (systolic peak duration, peak length, diastolic reversal, and triphasic waveforms) were obtained for all samples (15 total, 3 each per mixture). The study revealed statistically significant changes in waveform patterns, with nearly all lipid samples (11/12) showing loss of triphasic patterns and extended peak durations compared to control. While Doppler indices showed consistent trends toward increased resistance with lipid modification, these changes did not reach statistical significance. Animal fats demonstrated the most noticeable alterations in flow characteristics, with lard showing the greatest changes in spectral width and peak duration, while vegetable oils showed more modest alterations. These findings suggest that dietary fats may influence cardiovascular function through multiple pathways, affecting not just flow resistance but also the overall pattern and quality of blood flow. This research provides insights into the immediate effects of dietary fats on vascular function and could contribute to more personalized dietary recommendations for cardiovascular health management.

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Abstract: Science and Engineering Fair of Houston

3346

NeuroEdge: AI-Driven Innovations in Glioblastoma Resection for Improved Patient Outcomes

Aiden Manoj

Arushsai Kankanala

Aarav Garg

Fort Bend ISD /Dulles High School

Category

Medicine and Health

Glioblastoma (GBM) is one of the most aggressive brain tumors, characterized by its infiltrative growth patterns and indistinct boundaries, which pose significant challenges for surgical resection. Residual tumor cells left behind during surgery are a primary cause of recurrence, while removing excessive healthy brain tissue can lead to severe neurological impairments. This project introduces NeuroEdge, an AI-powered system designed to assist neurosurgeons in achieving precision glioblastoma resection. Leveraging a modified U-Net deep learning architecture, NeuroEdge analyzes multimodal imaging data, including T1-weighted, T2-weighted, and FLAIR MRI sequences, to identify tumor boundaries in real time.

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