



Project ID: 551
Junior Division
Biomedical/Health Sciences and Biomedical Engineering



Aliza Abadi
San Diego Hebrew Day School
Gr. 8

The Effect of Blue Light on Sleep

The goal of this project was to find out if blue light affects sleep. This led to the hypothesis, which was if subjects used blue light 30 minutes before bed then they would not sleep deeply because having screen brightness would affect them. Subjects were given a watch to wear a total of 4 nights. Two of them where they used blue light (phones) for 30 minutes before going to sleep, and the other two where they withdrew from using electronics before going to sleep. Every other day was blue light or no blue light.

The outcome of the project was that blue light affects sleep. When subjects withdrew from using blue light 30 minutes before bed, the subject slept on average 13.25 more minutes than when using blue light. Results also showed that deep sleep percentages were higher by 1.5 percent when not using blue light. In conclusion the project concluded that blue light affects sleep in more than one way and if one uses blue light more than 30 minutes before bed it can affect them even more.



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Omar Abdulaziz
Thurgood Marshall Middle School
Gr. 8

Anabia Ehsan
Thurgood Marshall Middle School
Gr. 7

Early Detection of Bradykinesia and Tremors in Parkinson's Disease Using a Wearable Inertial-Measurement-Unit

AWARDS:

Grand Award Runner Up - Junior Division Life Sciences

Thermo Fisher Scientific "Advancing Equity Through Innovation" Award

CSEF Qualified

Thermo Fisher Scientific Junior Innovators Challenge Nominee

Parkinson's disease (PD) is the second most common neurodegenerative disorder diagnosed in individuals aged over 50. However, 5 - 10% of cases involve young-onset PD, aged under 50. Unfortunately, 1 in 4 patients experience misdiagnosis in the initial stages, often due to subjective neurologist assessment.

This project proposes a low-cost, wearable device for earlier detection and telemonitoring of PD, particularly for those with limited medical resources. The prototype uses Arduino Nano 33 BLE Sense Rev2 board with 3-axis accelerometer and gyroscope inertial measurement unit (IMU). This setup gathers comprehensive motion data, including three-dimensional orientation, linear and angular velocities, and transmits it wirelessly via Bluetooth-Low Energy (BLE) as raw data to smart device app. This app uses sophisticated Python algorithms to extract tremor, arm swing frequency, and amplitude in real-time.

The success criteria of this prototype were to detect frequency peaks in 3-6 Hz range of resting hand tremor (affected side) and decreased amplitude of



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Emily Diep
Connect Academy Poway Unified
Gr. 8



A Single Case Pilot Study of an AI-driven Speech Therapy Game for Children with Articulation Challenges Using a Smart Bracelet

AWARDS:

Association for Women in Science - Winner
CSEF Qualified

Treatment for children with articulation challenges is critical to reduce their risk of learning disabilities along with other social and emotional issues. How can they improve their speech articulation?

The goal of this project was to create a Smart Bracelet that continuously listens to human speech, recognizes keywords and displays a reward for every new word pronounced correctly by the user. In this project, an AI model for keyword detection was first designed, iteratively tuned and deployed onto a microcontroller. Then, the circuitry for this microcontroller and other bracelet components was tested. Next, 3D models were designed to create the bracelet frame for keeping all components connected together. This frame was iteratively redesigned to make the bracelet wearable. The AI model was integrated with the buttons and display screen to create the AI-driven speech therapy game.

This Smart Bracelet was tested by two elementary school students who were enrolled in speech therapy. In this longitudinal study, my participants were assessed for articulation accuracy before and after the trial using the same set of R words. During the trial, each participant wore this bracelet for 15 minutes per session over one month. Post-assessment results showed that my first participant improved his speech articulation accuracy from 70% to 90% for all R words, and my second participant improved from 15% to 50%.

This bracelet has encouraged my participants to practice their speech. I hope to make it accessible to other children with speech disorders for improving speech articulations.



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Veera Kalakota
Oak Valley Middle School
Gr. 8



4S Ranch Awareness of Probiotics and Their Role in Promoting Gut Health

AWARDS:

BD "Advancing the World of Health" - Junior Division 3rd Place

The significance of this project lies in the rising prevalence of the Western diet, characterized by frequent consumption of processed foods, which in turn contributes to dysbiosis within the gut microbiome. Frequent consumption of the western diet may lead to chronic inflammation, diabetes and cardiovascular diseases. To help the body in eradicating these diseases, one can consume probiotics. Probiotics, as direct supplements contain live bacteria, that helps in restoration of microbial equilibrium within the gastrointestinal tract. This project holds paramount importance in promoting awareness about gut- health and its impact on overall well-being amidst the influence of the Western diet.

The research methodology involved the primary data collection with a questionnaire which was subsequently analyzed for hypothesis testing, descriptive statistics and a regression modeling. In hypothesis testing, it was ascertained that 79% of the community was aware of probiotics, 37% knew about the gut microbiome, and 76% knew the effect of probiotics has on the gut microbiome. For the regression, the model contained an adjusted R^2 of 17%. Descriptive statistics revealed potential associations between the independent variable, probiotic awareness, and several dependent variables including age, dietary patterns, frequency of probiotic intake, and overall consumption habits. Since only 64% of the community consume probiotics, this suggests there may be a knowledge gap between consumption of probiotic foods and awareness of probiotics. The findings were notably unexpected, also highlighting a disparity between awareness of probiotics and actual consumption behavior among surveyed individuals.



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Sidhaarth Parthiban
The Cambridge School
Gr. 8



Mechanisms of Monocyte Cell Death in Nicotine Exposure

The results from my previous project revealed that nicotine increased monocyte cell death in a dose-dependent manner. The next key question was to understand why cells died due to exposure to nicotine. I hypothesize that nicotine causes cell death by increasing the transcriptional expression of genes involved in the apoptosis (programmed cell death) process, such as caspase 3, and decreasing the expression of protective genes, such as Bcl2.

For this experiment, RNA was extracted from cell pellets of Nicotine-treated monocytes and reverse transcribed to cDNA. Real time PCR was then performed for Caspase 3, Bcl2 and GAPDH (housekeeping).

The results indicate the fold change for caspase 3 and Bcl2 expression ranged from 0.01 to 0.1 and 0.02 to 0.1, respectively, in a dose dependent manner.

These results support the hypothesis that pro-apoptosis caspase 3 expression increased by nicotine. However, different from what we predicted, the protective Bcl2 was also increased by nicotine at higher doses. Yet, the ratio of caspase 3 to Bcl2 expression ranged from 0.15 to 1.15 indicating caspase 3 expression was much stronger than Bcl2, likely favoring cell death. This result confirms the role of nicotine in apoptosis of monocyte immune cells. This knowledge can enhance understanding among youth and people who are considering smoking nicotine cigarettes, and its harmful effects on our immune system. Future experiments could test the effect of nicotine on other genes (both pro-apoptotic genes and protective genes) and include additional cell types.



Project ID: 556
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Munirah Sahardiid
Bright Horizon Academy
Gr. 7



HealthBand

This project aims to create an affordable health band that can predict and prevent heart attacks, strokes, and cardiac arrest, especially for people with limited resources. Detecting issues like high blood pressure or irregular heartbeats early is crucial for preventing strokes, which are a major cause of death and health problems. The band checks vital signs like body temperature, blood pressure, and heart rate, using an app to warn about any problems. If something's wrong, it sends a message to your phone. We tested it on 10 people, and it was accurate 95% of the time, just like an Apple Watch. Plus, it costs less than thirty-five dollars, making it accessible to more people and potentially saving lives



Project ID: 557
Junior Division
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Hudson Siegel
The Children's School
Gr. 8



New Methods to Discover Naegleria fowleri Using Commercially Used Dye

In this project new methods to discover *Naegleria fowleri* (Brain-Eating Amoeba) using dye were tested. The hypothesis for this project was that the dyes that dissolve better in octanol, which is a nonpolar or greasy solvent, were going to be better at staining the membrane. The procedure consisted of combining octanol and water/buffer into test tubes to mimic the cell membrane (each dye goes in solutions of octanol with either water or buffer). The dyes proved to have different properties by visual analysis comparing the darkness of the color against a white background and separation between the octanol and water. Only 50% of the dyes showed the ability to dissolve selectively in octanol or had good naked eye visibility. Next, I focused on using the best dyes to visualize *Naegleria fowleri* to determine the dyes' efficiency at staining the amoeba. Visualization using a bright field microscope analysis with photography did not allow clear, interpretable results because all the images were black and white and quantification based on the images was not possible because brightness could not be measured. In conclusion, based on the data I found dyes that had promising properties for staining Brain-Eating Amoeba and the staining experiments need to be repeated with a color microscope.



Project ID: 558
Junior Division
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Sara Singer
San Diego Hebrew Day School
Gr. 8



Balance in Dancers vs. Non-Dancers

The purpose of this study was to find out whether dancers have better balance over non dancers. The hypothesis was, if dancers and non dancers spin the same amount, then dancers will have better balance, because they practice balance based exercises often. In order to assess balance, participants were asked to walk along a straight line heel to toe after spinning on a turn board five times. In order to calculate the data and results, a tally method was used to determine if the steps taken were either a perfect step, a slight miss, or a complete miss. While observing the subject, for every step taken, a tally was marked in either the perfect step, slight miss, or complete miss section.

In summary, when it came to measuring correct steps during testing, dancers performed 25% better than non-dancers. Dancers who trained for a longer period of time had a higher percentage of perfect steps compared to those who trained for shorter periods of time or none at all. The outcome was significantly impacted by spotting. The individuals who learned the skill of spotting, whether they were dancers or not, demonstrated better results and a greater proportion of flawless steps in comparison to those who didn't learn this skill. Dancers may have received greater percentages because balance, strength, and spotting are all part of their everyday training.



Project ID: 559
Junior Division
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Brady Sipper
Nazareth School
Gr. 7



Does the Dye in Tinted Sunscreen Affect Its Performance?

Does the dye in tinted sunscreen affect its performance? Based on my research on non-tinted sunscreen versus tinted sunscreen, I believe the tinted sunscreen will perform better than the non-tinted sunscreen. For my project, I put three different sunscreens, two tinted and the control, non-tinted, into three Dixie cups that weighed 2 grams each. I tested each type of sunscreen under the same UV Index reading of 5 and for time periods of 20, 25, and 30 minutes. Once the time period was reached, I took the temperature of each sunscreen.

After testing, I found that I partially supported my hypothesis. The sunscreens performed better or worse during different durations of time. In test #1, when the sunscreens were under the UV light source for 20 minutes, the Neutrogena Mineral UV-Tint (medium) was 36° C, Neutrogena Ultra Sheer (control) was 36.05° C, and the Neutrogena Mineral UV-Tint (deep) was 36.05° C. In test #1, the Neutrogena Mineral UV-Tint (medium) kept the coolest so, therefore, it performed the best. In test #2, when the sunscreens were under the UV light source for 25 minutes, the Neutrogena Mineral UV-Tint (deep) performed the best with a temperature of 35.4° C. For test #3, when the sunscreens were under the UV light source for 30 minutes, however, the sunscreen that performed best was the control with a temperature of 35.8° C.

The sunscreens performed better or worse depending on the duration of time. I was very surprised with my results because I thought my results would have supported my research. My tests were very proficient in getting the results I needed. I was very certain in my hypothesis and in the research that I did, but in the end they proved to be different.