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April 10th 2021



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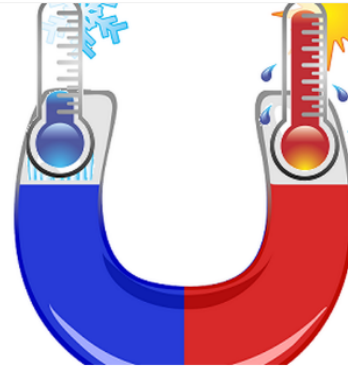
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Junior Interdisciplinary

Honourable Mentions

Emma Kao



REPORT

What is the effect of temperature on magnetic strength?

Did you know magnetism is widely used in our daily lives from MRI machines, electric cars and even refrigerator doors? Since these products are used all over the world, how can engineers make sure the magnetism will still function under different ranges of temperature?

Well, by the time you are finished reading my project, you will know the answer!

I did this experiment because it is important to understand the effects of temperatures on magnetic strength so we can design and manage better applications of magnets.

05/15/2020

Isabella Furu



REPORT

Water Pollution and Rate of Photosynthesis in Aquatic Plants

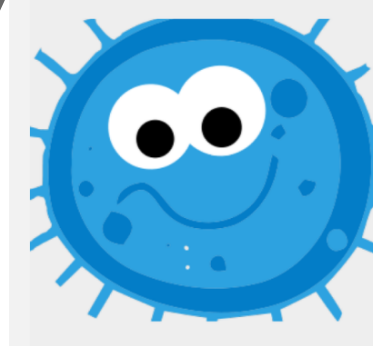
Hi, and welcome to my science fair project! My science fair question is, "If an aquatic plant is placed in water contaminated by plastic, bleach, or motor oil, will the rate of photosynthesis decrease, and if so, which pollutant will most affect the rate of photosynthesis?".

The project is meant to give people a better understanding of freshwater pollution and how it affects plant photosynthesis, which has a major impact on the health of the environment and life around it.

I chose three common household types of pollution: plastic, oil, and bleach. Then, I took an aquatic plant called a hornwort, and placed it upside down in a beaker full of water, and shone a light on it. Bubbles started popping out of the stem, which are bubbles of oxygen that indicate that the plant is photosynthesizing. I compared the number of bubbles released by the plant across the different conditions (clean water vs each of the 3 types of polluted water).

My results showed that adding the pollutants had a negative effect on the rate of photosynthesis, and that bleach nearly stopped photosynthesis with a 91% decrease. These results are important because they give us an insight into exactly how much pollution is affecting plant life in the water, and if there is anything we can do about it. Results suggest it is especially important to keep bleach out of our freshwater environments. On a positive note, findings also suggest that a quick clean-up of plastic and oil can be beneficial in reducing harm and protecting aquatic plants. Please take a look at my slides for more information!

Kayla Tran



REPORT

Let's BE Germ FREE!

Did you know that people all around the world are dealing with which bacteria solution is the cheapest and most efficient in their homes especially because of the global pandemic? This project is determining which solution is the best for killing bacteria in your home. The project includes using homemade petri dishes out of nutrient agar to grow the bacteria, as well as using seven different types of solutions to kill it. The nutrient agar works only on the household bacteria and it will grow faster as opposed to using normal gelatin. To acquire the bacteria, cotton swabs will be rubbed on any chosen surface, and transferred to the petri dish. There will be four different types of surfaces that will be tested such as someone's mouth. The mouth test is representing the droplets of saliva from the mouth. The purpose is to determine which of the seven solutions will kill the bacterias on each surface the best. This project will also be detecting any household bacteria and identify them under a microscope.

Sarah Di Silvestro



REPORT

Sugar High!

4 Different sweeteners (honey, maple syrup, molasses, and sugar) were combined with yeast and warm water in a plastic 500ml bottle with a balloon attached to the neck of the bottle. Every 10 minutes for up to an hour the balloon's circumference was measured in order to see which sweetener created the most gas. This experiment was conducted for a purpose of finding the best sweetener to use when making bread. Furthermore, with this knowledge, it may improve future bread recipes for bakers.

SEE LESS ^

TEAM

William Trainor



REPORT

Making Composite Materials out of Household Items

This project focused on composite materials. Composite materials can replace traditional building materials. To better understand just how strong some materials are, I ran a series of controlled experiments in my kitchen with spaghetti and a variety of bonding agents. By exploring the structural integrity of composites, I determined how much force spaghetti can take before it fails. I had my control set of spaghetti then I had multiple sets of spaghetti made into composite materials with various types of bonding agents. I applied a downward force to each test subject and in all cases the composite spaghetti beams were better than the control. This told me that composite materials often do better than traditional building materials. Spaghetti would never be used to build anything in real life but using these principles, new and recyclable material could be designed to build lightweight objects, like airframes or furniture.

Aidan Higo & Orlando Robinson

Une application pour vos besoin? Poo
near you

Patrick Leddy & Kiran Dust



REPORT

Veste solaire: conception et étude des variables affectant le panneau photovoltaïque

Nous avons conçu un prototype 3D d'une veste équipée de panneaux solaires pour pouvoir recharger un téléphone cellulaire. De plus, nous avons fait des expériences avec un panneau solaire pour déterminer l'effet de et l'angle et la direction sur la production d'électricité. Le résultat de ces expériences nous aideront à optimiser le placement des panneaux solaires sur notre veste.

SEE LESS ^

TEAM

Junior Interdisciplinary

Third Place

Safal Kaur Bhullar



REPORT

Student Learning and Technology

Do you learn better when reading from an actual physical book? Or do you prefer reading on a screen for learning? Or perhaps you like listening to an audio book or podcast? - All over the world students have been traditionally learning at schools using paper media. Since last year this has changed, and teachers have been forced to use online text and audio as a medium of instruction.

For this project I evaluated the effectiveness of using each of three medium: paper copy, on screen text and audio file, and their impact on the understanding and learning for middle school students. I studied how our brain works in grasping and retaining information and based on this I set up an experiment and asked all the students in my middle school to participate in it. I prepared three informational articles in each of the three medium and made a challenging quiz for each article. The scores on these quizzes were compared for each medium to see which medium was most effective with surprising results!

The results from the experiment showed that reading from paper copy or on screen text were equally effective for understanding and learning and did better than audio file. Perhaps it's thanks to early exposure to technology that today's middle school children can learn equally well from paper copy or on screen text.

I hope this experiment helps guide teachers in selecting the right medium to use in the classroom. Students can also learn what works best for themselves using this experiment and customize their learning.

Lauren Rasalingam



REPORT

Are Your Hands Really Clean

One year into the coronavirus pandemic hand sanitizers can be found in most households, but just how effective are they in this setting? According to the WHO, hand sanitizers can be used in households the same way as healthcare settings - however, there is minimal evidence to support this.

This study sought to answer the novel question: are hand sanitizers effective in household settings, and if so, which is the most effective? The study also looked at how hand sanitizers are used and whether it can be used on soiled hands.

This was done by swabbing hands pre and post sanitization, growing and counting microorganisms and then calculating percent reduction of colony forming units. Statistical significance was calculated using the student t-test.

The results are clear: hand sanitizers can be used effectively in household settings with the gel hand sanitizer having the highest percentage alcohol proving to be the best.

Olivia Melanson



REPORT

The Tooth Be Told-The Effect of Sugary Drinks on Your Teeth

Problem: which sugary drinks affect the enamel on your teeth the most and which fluoride(Stannous or Sodium) can protect your teeth the most effectively.

Eggs were put into 6 different types of drinks. Eggs either had Stannous, Sodium, or no fluoride toothpaste on them. They sat in the liquid for twelve hours.

Overall, the Stannous Fluoride protected the enamel the most. The worst results were from the control group(no fluoride).

The results of the experiment are important because people deserve to know what their drinking will do to their teeth and what they can do to protect them.

Sadie Hanley



REPORT

Air Trio Takes Flight

I have a dream to move passengers more efficiently through the air by combining three airplanes into one. With the Air Trio concept, airplanes going in the same direction will attach themselves to the "Lead Airplane" at the start of a route. The Lead Airplane tows the other airplanes to their destinations and those airplanes only use their engines to land.

There are obviously many technological challenges with Air Trio and I wanted to investigate one in particular.

For this project, I used magnets, a styrofoam airplane and an elastic launcher to see how the flight of the Lead Airplane could be affected by adding mass to different parts and whether any negative effects could be avoided.

I learned that mass can definitely affect how well an airplane flies, but finding the right spot to distribute the mass and using more energy at launch can make a positive difference.

Grace McDonald



REPORT

Who flushed - Measuring household water usage

I'm using a household water meter to constantly collect water usage during the day. I should be able to measure how much water I'm using because there is a spinner on the water meter and the water meter works with a magnetic field. I test a bunch of sensors, choose the best one then install it and calibrate it. I found out some really cool and wrong things about my water meter and furnace.

SEE LESS

TEAM



Christine Swann



REPORT

Looking for Lead

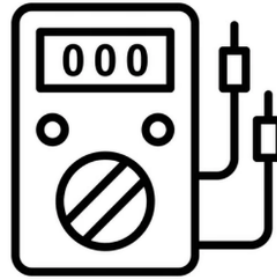
While not often talked about, lead poisoning can be a real problem. Lead can come from a large number of sources, including but not limited to; toys, paint, pipes, storage batteries, weights, cable covers and sheets used to shield us from radiation, etc. Lead exposure can have long-lasting effects on the body, even causing death. It is extremely important to prevent this from happening. Fortunately, lead in objects can be detected through the chemical process known as leaching.

In this experiment, different solutions (and time periods) were tested to leach lead out of objects. Then, the most efficient solution was used to try to detect lead in objects that were found around the house. It was found that having the objects in the most acidic solution, vinegar, for four hours was the most effective for detecting lead. Happily, no lead was detected in the objects found around the house.

Junior Interdisciplinary

Second Place

Natalie Cruz



REPORT

Hot or Cold? Using Thermocouples to Find Out!

Have you ever wondered how a thermometer knows you have a fever? If your curious, I answered the question: do the metals used to build a thermocouple affect the reliability of a thermocouple thermometer? To determine reliability, I tested three different thermocouple thermometers (Type K, J and T) under known temperatures and compared them to an expected temperature. The most reliable thermocouple was Type T with its average accuracy being ± 1.5 degrees Celsius of the expected temperature. The voltage that Type T produces is always expected and consistent causing it to be accurate.

Thermocouples are one of the most common methods to measure temperature and are used worldwide in various applications, including industries, because of their advantages. Knowing which thermocouple is most reliable is one of the key factors companies keep in mind while deciding which thermocouples to use for their products.

Joshua Auer



REPORT

Clean Energy from Dirty Bananas

Microbial Fuel Cells (MFCs) capture the electricity produced by anaerobic bacteria that digest organic matter and release electrons. In this experiment different percentages of compost (0%, 15%, and 40% blended bananas) were added to the dirt containing anaerobic bacteria to determine which amount yielded the highest maximum power output (uW). The hypothesis was that the MFC containing 15% compost would have the highest power and best ratio of nutrients to bacteria. Three MFCs were constructed per experimental condition and the voltage across different resistors was measured over time. The results confirm that the 40% MFC produced the highest power.

Anerie Patel



REPORT

How the Greenhouse Effect Affects Plant Growth

Have you ever thought about how climate change will affect plants? I experimented with the greenhouse effect by growing plant with different types of scenarios. I learned that when plants have some amount of heat trapped inside they grow best. The plant has more moisture, is warmer than room temperature and has some air circulation.

SEE LESS ^

TEAM



Jogging Your Memory

This STEM project will explore if social orientation (extroversion or introversion) is correlated with short term memory. This experiment includes 12 participants partaking in three online tests; one will determine their personality, and from there their social orientation, and the other two will determine the accuracy of their short term memory (the first including shapes and patterns to memorize and the other, letters). From the results of these three tests it is determined that there was no direct answer; the first test, taken the first time, presented a fairly equal result, the first test, taken the second time, presented the introverted volunteers with a fairly higher score than the extroverted volunteers, and the second test presented the extroverted volunteers with a fairly higher score than the introverted volunteers. Therefore, it could be concluded that there was no correlation between memory and social orientation.

Clara Tokarski



REPORT

Automatic Dog Feeder

My automatic dog feeder can be set on a timer so that you can leave your dog alone and rest assured that he will be fed. The machine can hold 3 days worth of food for a small dog, and the timer can be set to your dog's exact needs.

TEAM



CURIOSITY & INGENUITY

#innovation

#region_grade_junior7/8

LeeMing King



REPORT

Maglev Cable car

SUMMARY - My maglev will go to low earth orbit carrying passengers and cargo. It will use a pulley system which will pull one maglev up and bring the other down. It can also be used to bring back and launch satellites at a much lower cost. My design will only be able carry cargo and passengers but will not be able to launch rockets into space. It will be useful to take tourists and astronauts to space stations now and in the future.

SEE LESS ^

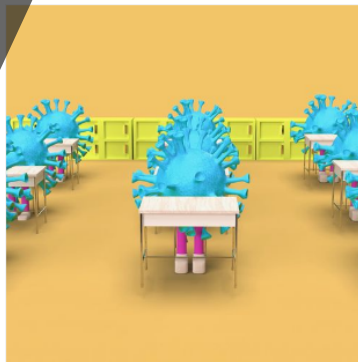
TEAM



Junior Interdisciplinary

First Place

Rowan Parkinson



REPORT

Can You Hear Me? An Evaluation of the Effects of Face Masks on Sound Attenuation

On July 7, 2020, the wearing of face masks in shared spaces in Ottawa was made mandatory under the Health Protection and Promotion Act. Considering that it is also now mandatory for students and teachers to wear masks in classrooms, it is important to make sure that information and instructions are not only being communicated clearly but loudly enough to be heard.

To quantitatively examine the effects of face masks on sound, I measured the decibel levels of 5 phonetically neutral sentences spoken at 4 different distances (following a typical classroom seating plan) using 9 different masks and then calculated and analyzed the respective sound attenuations.

The results of this study imply that all face masks, even those considered "thin," play an important role in attenuating sound. Based on the results of this study, modifications to classroom seating, based on the type of mask worn by a student, could be made to ensure optimal in-class audition.

Hayden Vermeij



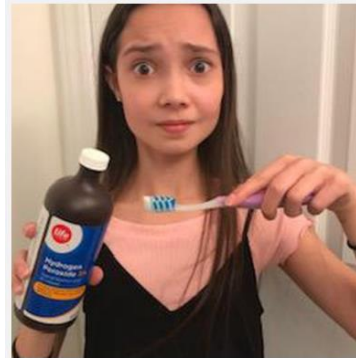
REPORT

Celiac Disease can be Crumby!

Celiac Disease is an autoimmune disease that can cause severe digestion problems even when a tiny amount of gluten is ingested. As I have Celiac Disease, I investigated whether a condiment can be cross-contaminated from gluten crumbs on a knife at the lowest level (5ppm) to cause a reaction for a Celiac? Would the more times a knife is exposed to gluten then returned to a condiment cause the ppm of gluten to rise? Would the condiments' qualities, density and stickiness, affect the ppm of gluten transferred by the knife into the condiments?

My results showed that cross-contamination happens at the lowest level to cause a reaction when you have spread a condiment on 5 slices of toast. The results also showed that the denser the condiment is, the fewer parts per million it will have. People with Celiac Disease should be aware of cross-contamination when using condiments.

Reese Machacek



REPORT

Which whitening toothpaste is best for sensitive teeth?

I am trying to discover which toothpaste is the best for whitening teeth without the use of hydrogen peroxide. Hydrogen peroxide is generally known to be effective for whitening teeth. However, it can aggravate tooth sensitivity or increase gum irritation for people with these pre-existing conditions.

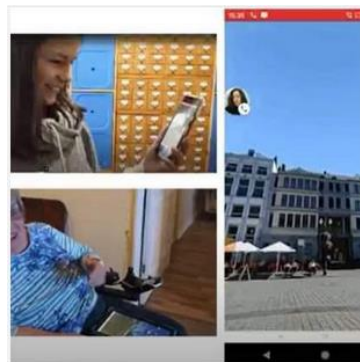
This experiment tests 5 kinds of toothpaste and reveals a clear-cut winner.

SEE LESS ^

TEAM



Madeleine Galuga



REPORT

Découvertes dynamiques

En début de pandémie, j'avais remarqué que mes échanges virtuels avec mes grand-parents étaient répétitifs et limités aux défis de la situation dans laquelle nous nous trouvions. Ceci avait un effet négatif sur le moral et la santé mentale des aînés dans ma vie. J'ai donc entrepris le projet des Découvertes dynamiques avec ma grand-mère. De chez moi, je fais dérouler des images immersives en 360 degrés sur la tablette de ma grand-mère en utilisant une application de réalité virtuelle. En même temps, nous discutons de souvenirs et de faits intéressants en lien avec ces lieux via téléphone. Je mesure les changements de son humeur, son adaptabilité aux problèmes technologiques, ainsi que son intérêt pour le projet par l'entremise d'un formulaire rempli après chaque rencontre. Les données démontrent que ce projet améliore aussi son sentiment de bien-être et sa santé mentale. Ces visites virtuelles sont une activité positive qui permettent un moment de répit du stress causé par la pandémie. Son vocabulaire quotidien devient de plus en plus varié et elle admet passer un temps de conversation de qualité pendant les visites. Mon intention est de partager ces réussites avec le plus grand nombre de jeunes possible afin d'aider notre population aînée. J'ai passé en entrevue sur les ondes de Radio-Canada et d'Unique FM et une synthèse de mon projet a été publiée dans le blogue de la revue Curium ainsi que dans le journal local. Un groupe d'élèves de mon école participeront au projet sous peu.

Rund Hajjaji

The antibacterial property of spices
using different solvents for
extraction

Intermediate Interdisciplinary

Honourable Mentions

Adrian Nitu



REPORT

Outsmarting Traffic - An innovative two-pronged approach to traffic management in cities

Traffic is an extremely pressing issue in modern life, but traffic innovations don't get much news coverage. I wanted to address the traffic management problem, so I developed a pair of systems which together increase traffic flow by a good amount. I started by creating a prototype of a device which can be applied to roads to sense passing vehicles and tell drivers how fast to go. Then, I created the second half of my project: a traffic simulator, and a neural network which trains on the simulator. Using both of these, I achieved major improvements over current methods.

Intermediate Interdisciplinary

Third Place

Kayl Absi



REPORT

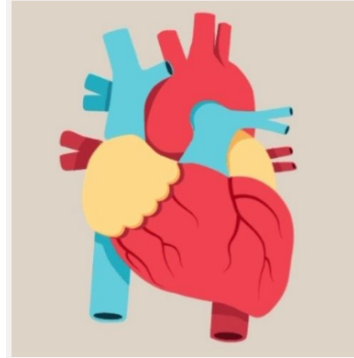
La réparation des plaies cutanées

Le but de mon projet était de trouver la méthode la plus efficace pour la réparation de différents types de plaies cutanées. J'ai pris quatre blocs de peau de cochon et j'ai créé quatre plaies que j'avais sélectionnées sur chaque bloc. Ensuite, j'ai mis en place des différentes méthodes de réparation de plaies cutanées telles que les agrafes, les points de sutures, les adhésifs et les pansements pour les fermer le mieux possible. Par la suite, j'ai observé la peau en la tournant pour regarder le côté postérieur afin de mesurer leur taille sous un microscope à dissection. L'importance de ce projet est à un calibre assez haut puisque les résultats pourront d'aider les chirurgiens et les médecins à sélectionner les méthodes de réparations de plaies qui permettent un réhabilitation plus rapide au niveau de la peau du patient.

Intermediate Interdisciplinary

Second Place

Abel Diress & Adam Mulugeta



REPORT

Developing a Non-Invasive Inexpensive Biosensor to Predict Heart Disease

Killing over 17.9 million people worldwide each year, heart disease has torn the lives of almost everyone on the planet in one way or another. Despite its unquestionable impacts, it is still ignored by the public at large as the main cause of death. However, as we grow more accustomed to this health crisis, advances in medical technology have opened doors to tools of prevention previously thought to be impossible.

In this project, we try to garner such advances in the form of a biosensor that can predict heart disease in a patient well before it's too late. In short, by measuring several statistics such as cholesterol level and maximum resting heart rate, we can understand the patient's cardiovascular condition and draw conclusions. Through rigorous research, development, and testing, our solution could have the potential to radically change the way we diagnose and prevent heart disease.

Intermediate Interdisciplinary

First Place

Ria Patel



REPORT

The Final Countdown: how much longer until quantum computers become the next cybersecurity threat

Stronger, faster, more secure. That's the goal of modern technology. Currently, quantum computers are the fastest and blockchain technology the most secure. At the crossroads of these fields lies a unique problem: quantum hacking. When will quantum computers be able to hack current encryptions? How much time do we have left? Using computer programming, I created a simulation to compare the time taken for a traditional and quantum computer to find 128, 256, 512 and 1024 bit encryption keys and blockchain approval keys. This will predict how much longer we have before quantum hacking becomes a global cybersecurity threat.

SEE LESS ^

Senior Interdisciplinary

Honourable Mentions

Derek Huynh & Matthew Biniam

Fundus Image-Based Detection of
Ocular Diseases Using Deep
Convolutional Neural Networks

Senior Interdisciplinary

Third Place

Anish Goel



REPORT

Proteomic Analysis Reveals the Dysregulation of Foundational Pathways in Alzheimer's Disease

Despite recent advances and conventional characterizations, the origins of Alzheimer's Disease (AD) remain largely unknown. Furthermore, the failure of emerging therapies to alleviate hallmark pathologies expresses the significance of analyzing the underlying mechanisms of AD. Therefore, proteomics serves as an invaluable tool for identifying altered proteins and foundational pathways specific to AD. In this study, a large-scale, unbiased proteomic analysis was performed via an LC-MS/MS-based, label-free quantitative proteomic approach in 3x-Tg-AD and NTg mouse models to understand the multifactorial etiology of AD. Such an integrated approach combined the use of bioinformatics, differential expression analysis, disease-protein relationships, pathway and protein enrichment analyses. The mass spectrometric characterization of the hippocampal proteome revealed the identification of 921 proteins, 70 of which were considered statistically significant, and 25 of which were considered novel differentially expressed proteins. Statistically significant proteins were enriched in metabolic pathways, carbon metabolism, oxidative phosphorylation, the extracellular exosome, acetylation, phosphoproteins and in the mitochondrion. 3x-Tg-AD mice displayed the dysregulation of critical pathways similar to those found in other diseases. Overall, this study investigates alterations in protein abundance and pathways specific to AD pathogenesis. Additionally, this study grants novel insight into the negative contribution of various pathways and proteins in accelerating the neuropathological features of AD.

Note: please look at the replies of each section for an in-depth analysis

Senior Interdisciplinary

Second Place

Avery Parkinson



REPORT

Lab to Table: A differential gene expression analysis of RNA-sequenced bovine stem cells & myocytes

What distinguishes a muscle cell from a fat cell or a skin cell? The answer is "gene expression". More precisely, the particular combination of genes that are turned on or off dictates cellular morphology and function.

Although gene-sequencing has been employed vastly in the study of disease and pharmaceuticals, there has been little application in the emerging field of cellular agriculture. In particular, there have been no studies identifying the genetic regulations required to develop "meat cells" from stem cells. This is of relevance, considering that the foremost challenge with culturing meat is ensuring that the embryonic stem cells reliably differentiate into the muscle tissue characteristic of meat.

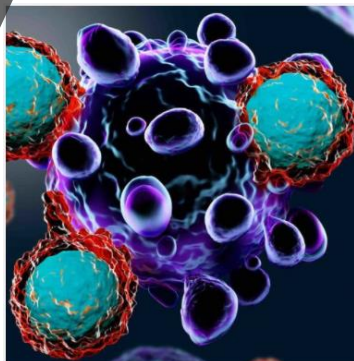
The purpose of this study was to design a bioinformatics pipeline to conduct a differential gene expression analysis on the transcriptomes of a bovine embryonic cell and a mature bovine myocyte in order to identify the genes responsible for myocyte differentiation.

I successfully identified 23 genes, providing both a basis for the genes responsible for determining myocyte differentiation and a novel point of intervention in the meat culturing bioprocess.

Senior Interdisciplinary

First Place

Vansh Sethi



REPORT

A Novel Method to Predict T-Cell Receptor Specificity using Deep Learning

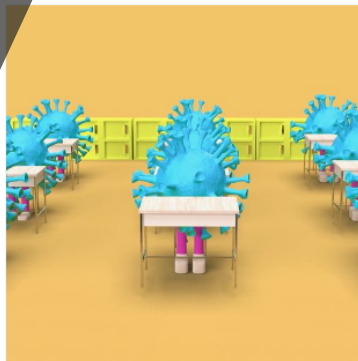
Chimeric antigen receptor (CAR) T-cell therapy is an immunotherapy that involves engineering a patient's T-cell receptors, a type of white blood cell, to allow for the T-cells to bind with pathogenic and diseased cells and trigger programmed cell death. The major difficulty in implementing CAR T-cell therapy in practice is determining the specificity of what the T-cell's receptors should look like. This project provides a novel method to accurately predict parts of a T-cell receptor given an diseased cells' receptor. This is done by using deep learning, a subset of artificial intelligence, to predict the CDR3 protein sequence, variable segment and joining segment of the T-cell. The deep learning models were able to reach an accuracy of 90%, and can effectively determine candidate T-cells for CAR T-cell therapy. By doing so, this project can be leveraged to increase the response time and effectiveness of CAR T-cell therapy in practice.

Junior Divisional Awards

An astronaut in a white spacesuit stands on a dark, rocky surface, looking out over a vast, hazy landscape under a dramatic, orange-hued sky with large, billowing clouds. The scene is backlit by a low sun, creating a silhouette effect on the astronaut and the ground.

Discovery

Rowan Parkinson



REPORT

Can You Hear Me? An Evaluation of the Effects of Face Masks on Sound Attenuation

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The image features three wind turbines in silhouette against a vibrant sunset sky. The sky transitions from deep purple at the top to bright orange and yellow near the horizon, with scattered clouds catching the low light. The turbines are positioned at different heights and angles, creating a sense of depth. The word "Energy" is centered in a clean, white, sans-serif font, overlapping the middle turbine.

Energy

Joshua Auer



REPORT

Clean Energy from Dirty Bananas

Microbial Fuel Cells (MFCs) capture the electricity produced by anaerobic bacteria that digest organic matter and release electrons. In this experiment different percentages of compost (0%, 15%, and 40% blended bananas) were added to the dirt containing anaerobic bacteria to determine which amount yielded the highest maximum power output (uW). The hypothesis was that the MFC containing 15% compost would have the highest power and best ratio of nutrients to bacteria. Three MFCs were constructed per experimental condition and the voltage across different resistors was measured over time. The results confirm that the 40% MFC produced the highest power.

An aerial photograph of a city intersection. The image shows a multi-lane road with white lane markings and arrows. A green median runs down the center of the road. On the right side, there is a crosswalk with white stripes and a small green island. A black car is visible on the right side of the road. In the bottom left corner, there is a curved road with a guardrail and some trees. The word "Environment" is written in white, sans-serif font across the center of the image, overlapping the road and the median.

Environment

Anerie Patel



REPORT

How the Greenhouse Effect Affects Plant Growth

Have you ever thought about how climate change will affect plants? I experimented with the greenhouse effect by growing plant with different types of scenarios. I learned that when plants have some amount of heat trapped inside they grow best. The plant has more moisture, is warmer than room temperature and has some air circulation.

SEE LESS ^

TEAM



A close-up, shallow depth-of-field photograph of a blue stethoscope. The stethoscope is coiled on a light blue, reflective surface. The chest piece, which has two white, rounded binaural components, is in sharp focus in the lower-left foreground. The tubing of the stethoscope extends towards the upper-left background, where it becomes increasingly out of focus. The background is a soft, light blue gradient. In the center of the image, the word "Health" is written in a clean, white, sans-serif font.

Health

Hayden Vermeij



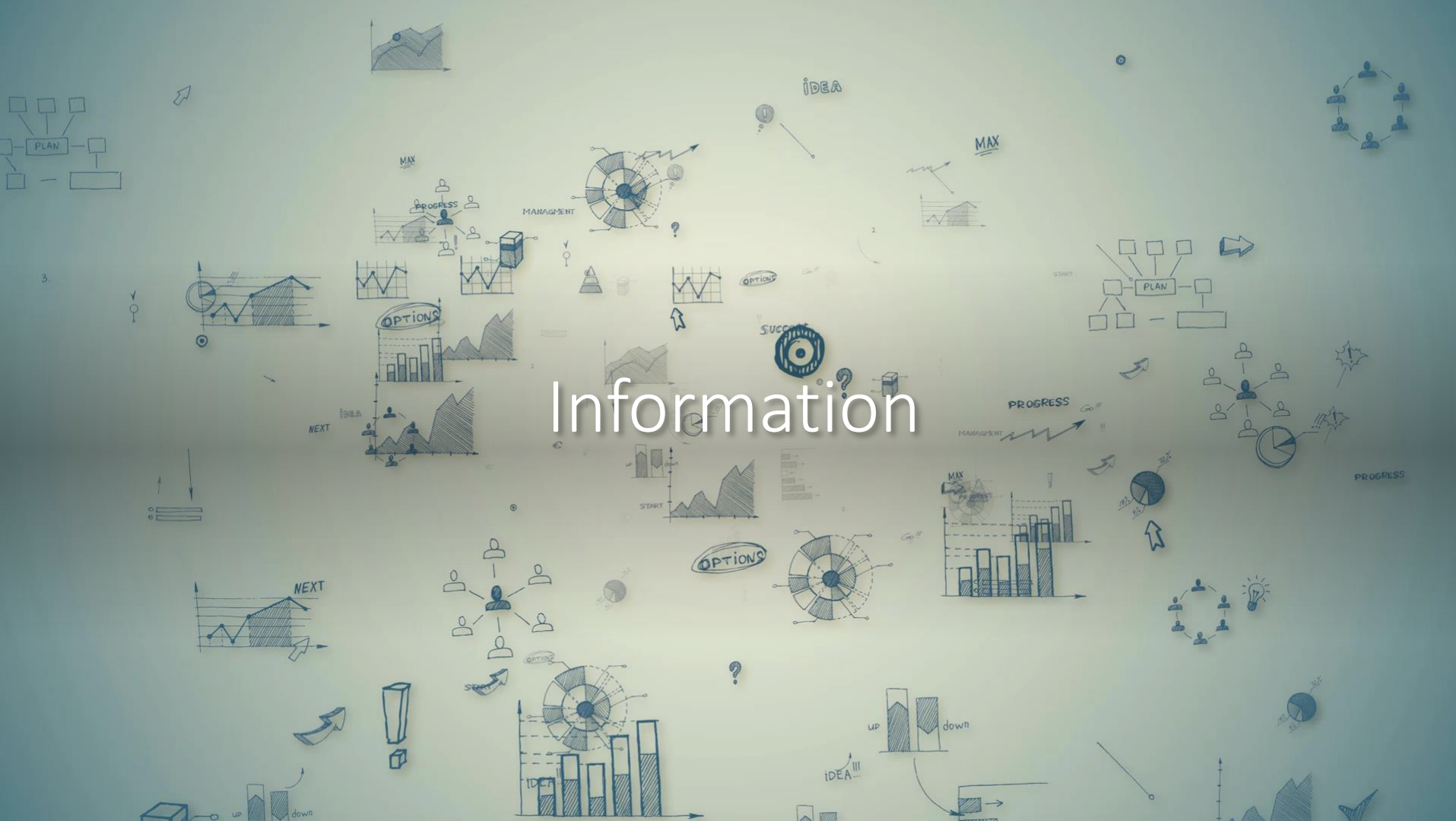
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Information



Sarah Di Silvestro



REPORT

Sugar High!

4 Different sweeteners (honey, maple syrup, molasses, and sugar) were combined with yeast and warm water in a plastic 500ml bottle with a balloon attached to the neck of the bottle. Every 10 minutes for up to an hour the balloon's circumference was measured in order to see which sweetener created the most gas. This experiment was conducted for a purpose of finding the best sweetener to use when making bread. Furthermore, with this knowledge, it may improve future bread recipes for bakers.

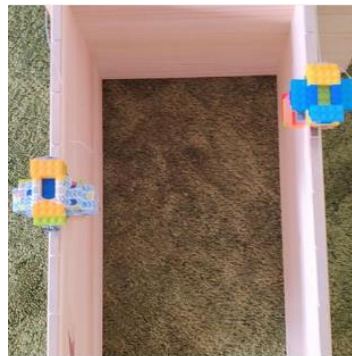
SEE LESS ^

TEAM



Innovation

LeeMing King



REPORT

Maglev Cable car

SUMMARY - My maglev will go to low earth orbit carrying passengers and cargo. It will use a pulley system which will pull one maglev up and bring the other down. It can also be used to bring back and launch satellites at a much lower cost. My design will only be able carry cargo and passengers but will not be able to launch rockets into space. It will be useful to take tourists and astronauts to space stations now and in the future.

SEE LESS ^

TEAM



Resources



Christine Swann



REPORT

Looking for Lead

While not often talked about, lead poisoning can be a real problem. Lead can come from a large number of sources, including but not limited to: toys, paint, pipes, storage batteries, weights, cable covers and sheets used to shield us from radiation, etc. Lead exposure can have long-lasting effects on the body, even causing death. It is extremely important to prevent this from happening. Fortunately, lead in objects can be detected through the chemical process known as leaching.

In this experiment, different solutions (and time periods) were tested to leach lead out of objects. Then, the most efficient solution was used to try to detect lead in objects that were found around the house. It was found that having the objects in the most acidic solution, vinegar, for four hours was the most effective for detecting lead. Happily, no lead was detected in the objects found around the house.

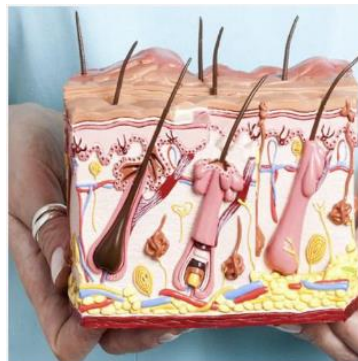
Intermediate Divisional Awards



An astronaut in a white spacesuit stands on a dark, rocky surface, looking out over a vast, hazy landscape under a dramatic, orange-hued sky with large, billowing clouds. The scene is backlit by a low sun, creating a silhouette effect on the astronaut and the ground.

Discovery

Kayl Absi



REPORT

La réparation des plaies cutanées

Le but de mon projet était de trouver la méthode la plus efficace pour la réparation de différents types de plaies cutanées. J'ai pris quatre blocs de peau de cochon et j'ai créé quatre plaies que j'avais sélectionnées sur chaque bloc. Ensuite, j'ai mis en place des différentes méthodes de réparation de plaies cutanées telles que les agrafes, les points de sutures, les adhésifs et les pansements pour les fermer le mieux possible. Par la suite, j'ai observé la peau en la tournant pour regarder le côté postérieur afin de mesurer leur taille sous un microscope à dissection. L'importance de ce projet est à un calibre assez haut puisque les résultats pourront d'aider les chirurgiens et les médecins à sélectionner les méthodes de réparations de plaies qui permettent un réhabilitation plus rapide au niveau de la peau du patient.

An aerial photograph of a city intersection. The image shows a multi-lane road with white lane markings and arrows. A green median runs down the center of the road. On the right side, there is a crosswalk with white stripes and a small green island. A black car is visible on the right side of the road. On the left side, there is a blue truck. The word "Environment" is overlaid in white text in the center of the image. The background includes trees, a sidewalk, and some buildings in the distance.

Environment

Valérie Théberge



REPORT

MAM - Sensibilisation à la réduction de la consommation de viande

(FR) «Manger Avec Modération» est un projet et une sensibilisation par rapport à la surconsommation de viande dans notre société actuelle. J'évoque les effets nocifs sur l'environnement ainsi que sur la santé.

(EN) "Eat With Moderation" is a project who's goal is to raise awareness about the overconsumption of meat in our current society. I explain the harmful effects of meat on the environment as well as on our health.

SEE LESS ^

TEAM



AGRICULTURE, FISHERIES & FOOD

Discovery

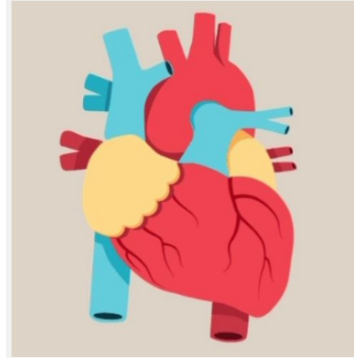
environment

region_grade_intermediate9/10

A blue stethoscope is shown on a light blue background. The stethoscope is coiled, with its chest piece and tubing visible. The word "Health" is written in white, sans-serif font in the center of the image.

Health

Abel Diress & Adam Mulugeta



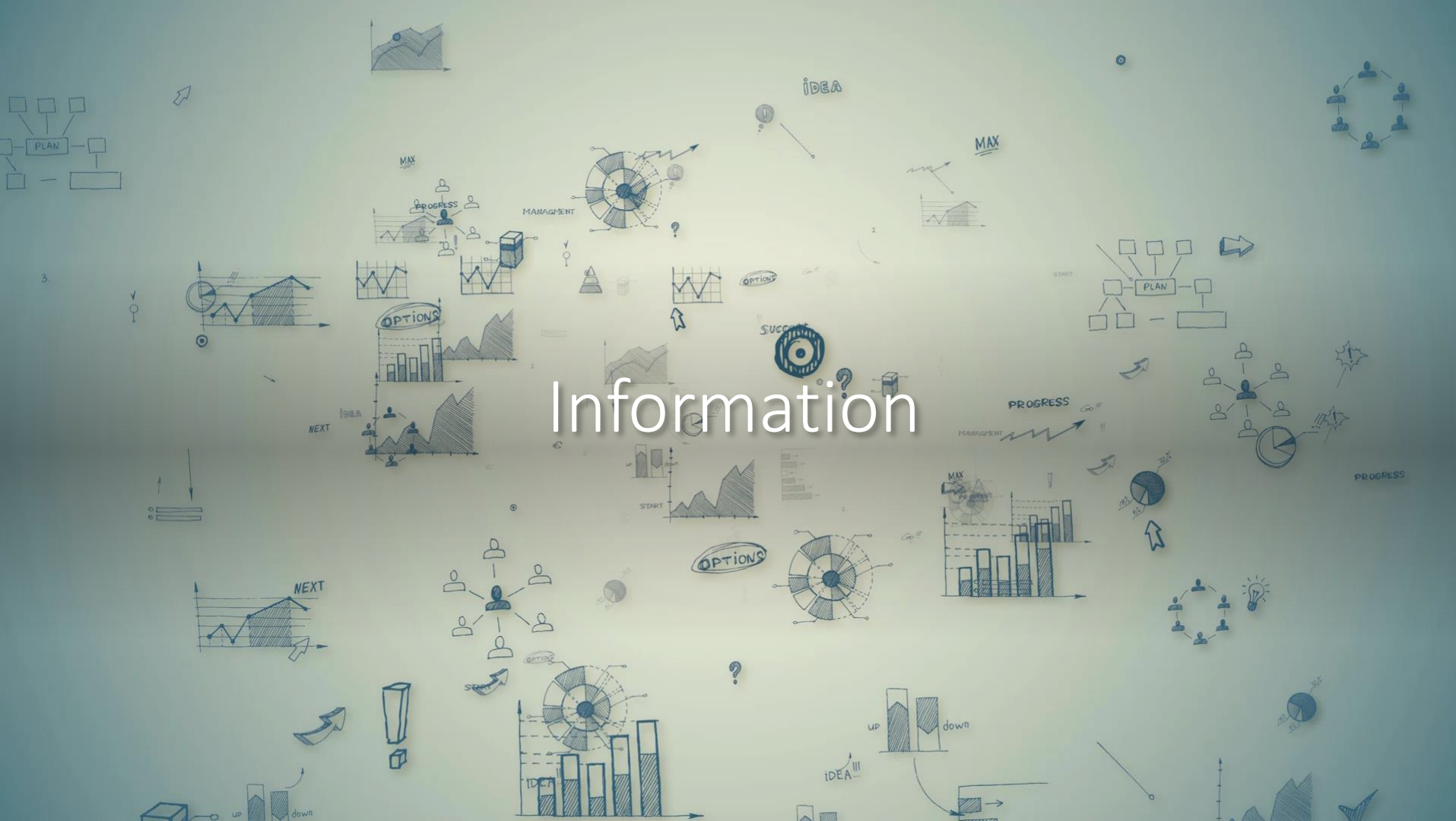
REPORT

Developing a Non-Invasive Inexpensive Biosensor to Predict Heart Disease

Killing over 17.9 million people worldwide each year, heart disease has torn the lives of almost everyone on the planet in one way or another. Despite its unquestionable impacts, it is still ignored by the public at large as the main cause of death. However, as we grow more accustomed to this health crisis, advances in medical technology have opened doors to tools of prevention previously thought to be impossible.

In this project, we try to garner such advances in the form of a biosensor that can predict heart disease in a patient well before it's too late. In short, by measuring several statistics such as cholesterol level and maximum resting heart rate, we can understand the patient's cardiovascular condition and draw conclusions. Through rigorous research, development, and testing, our solution could have the potential to radically change the way we diagnose and prevent heart disease.

Information



Ria Patel



REPORT

The Final Countdown: how much longer until quantum computers become the next cybersecurity threat

Stronger, faster, more secure. That's the goal of modern technology. Currently, quantum computers are the fastest and blockchain technology the most secure. At the crossroads of these fields lies a unique problem: quantum hacking. When will quantum computers be able to hack current encryptions? How much time do we have left? Using computer programming, I created a simulation to compare the time taken for a traditional and quantum computer to find 128, 256, 512 and 1024 bit encryption keys and blockchain approval keys. This will predict how much longer we have before quantum hacking becomes a global cybersecurity threat.

SEE LESS ^



Innovation

Adrian Nitu



REPORT

Outsmarting Traffic - An innovative two-pronged approach to traffic management in cities

Traffic is an extremely pressing issue in modern life, but traffic innovations don't get much news coverage. I wanted to address the traffic management problem, so I developed a pair of systems which together increase traffic flow by a good amount. I started by creating a prototype of a device which can be applied to roads to sense passing vehicles and tell drivers how fast to go. Then, I created the second half of my project: a traffic simulator, and a neural network which trains on the simulator. Using both of these, I achieved major improvements over current methods.

Senior Divisional Awards



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Discovery

Avery Parkinson



REPORT

Lab to Table: A differential gene expression analysis of RNA-sequenced bovine stem cells & myocytes

What distinguishes a muscle cell from a fat cell or a skin cell? The answer is "gene expression". More precisely, the particular combination of genes that are turned on or off dictates cellular morphology and function.

Although gene-sequencing has been employed vastly in the study of disease and pharmaceuticals, there has been little application in the emerging field of cellular agriculture. In particular, there have been no studies identifying the genetic regulations required to develop "meat cells" from stem cells. This is of relevance, considering that the foremost challenge with culturing meat is ensuring that the embryonic stem cells reliably differentiate into the muscle tissue characteristic of meat.

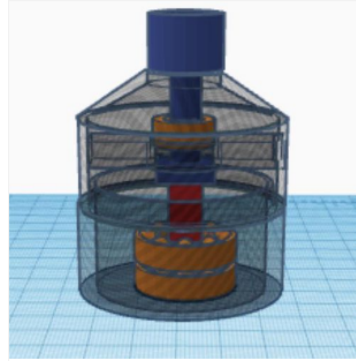
The purpose of this study was to design a bioinformatics pipeline to conduct a differential gene expression analysis on the transcriptomes of a bovine embryonic cell and a mature bovine myocyte in order to identify the genes responsible for myocyte differentiation.

I successfully identified 23 genes, providing both a basis for the genes responsible for determining myocyte differentiation and a novel point of intervention in the meat culturing bioprocess.

The image features three wind turbines in silhouette against a vibrant sunset sky. The sky transitions from deep purple at the top to bright orange and yellow near the horizon, with scattered clouds catching the low light. The turbines are positioned at different heights and angles, creating a sense of depth. The text "Energy & Resources" is centered in a clean, white, sans-serif font, overlaid on the middle turbine.

Energy & Resources

Ariana Ahmadi & Ramtin Raouf



REPORT

S.S.E.G

Coming from a background of ancestors who lived in 3 world countries, it inspired us to give back at those who survived to have us. 3 world countries, who are in need of electricity inspired us to create an affordable method to generate it, without a high cost. Hi, my name is Ariana, and my name is Ramtin, and we hope to inspire others to create efficient and affordable electricity for everyone.

In this sense, my partner and I thought, why not create electricity using a water source. We were always inspired by the essence of hydroelectricity, physics, and giving back to others.

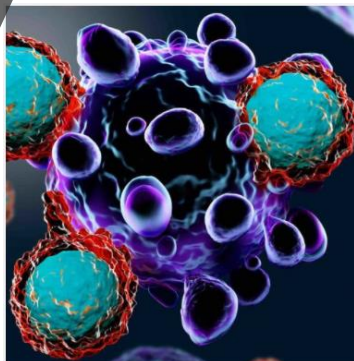
We created a hydro-power turbine that conducts electricity in still water, in order to insure countries that only has small bodies of water such as lakes, and still rivers can produce electricity.

In this case, we also added a net to the hydroelectric system to ensure the water that passes through our system will be cleansed from large debris in order to ensure trash is removed from the water itself.

A close-up, shallow depth-of-field photograph of a blue stethoscope. The stethoscope is coiled on a light blue, reflective surface. The chest piece, which has two white, rounded binaural components, is in sharp focus in the lower foreground. The tubing of the stethoscope extends into the background, where it becomes increasingly out of focus. The background is a soft, light blue gradient. In the center of the image, the word "Health" is written in a clean, white, sans-serif font.

Health

Vansh Sethi



REPORT

A Novel Method to Predict T-Cell Receptor Specificity using Deep Learning

Chimeric antigen receptor (CAR) T-cell therapy is an immunotherapy that involves engineering a patient's T-cell receptors, a type of white blood cell, to allow for the T-cells to bind with pathogenic and diseased cells and trigger programmed cell death. The major difficulty in implementing CAR T-cell therapy in practice is determining the specificity of what the T-cell's receptors should look like. This project provides a novel method to accurately predict parts of a T-cell receptor given an diseased cells' receptor. This is done by using deep learning, a subset of artificial intelligence, to predict the CDR3 protein sequence, variable segment and joining segment of the T-cell. The deep learning models were able to reach an accuracy of 90%, and can effectively determine candidate T-cells for CAR T-cell therapy. By doing so, this project can be leveraged to increase the response time and effectiveness of CAR T-cell therapy in practice.



Innovation

Derek Huynh & Matthew Biniam

Fundus Image-Based Detection of Ocular
Diseases Using Deep Convolutional Neural
Networks



Special Awards



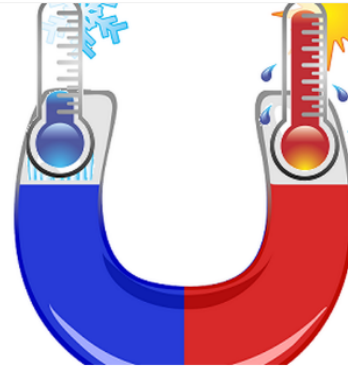
The background of the slide features a series of concentric circles in a light gray color, centered on the left side. The circles vary in radius and are both solid and dashed lines, creating a subtle, modern design.

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)



Best projects related to the HVAC industry

Emma Kao



REPORT

What is the effect of temperature on magnetic strength?

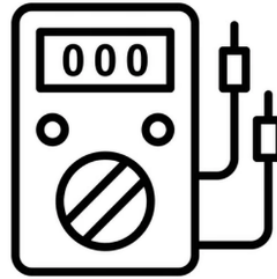
Did you know magnetism is widely used in our daily lives from MRI machines, electric cars and even refrigerator doors? Since these products are used all over the world, how can engineers make sure the magnetism will still function under different ranges of temperature?

Well, by the time you are finished reading my project, you will know the answer!

I did this experiment because it is important to understand the effects of temperatures on magnetic strength so we can design and manage better applications of magnets.

05/15/2020

Natalie Cruz



REPORT

Hot or Cold? Using Thermocouples to Find Out!

Have you ever wondered how a thermometer knows you have a fever? If your curious, I answered the question: do the metals used to build a thermocouple affect the reliability of a thermocouple thermometer? To determine reliability, I tested three different thermocouple thermometers (Type K, J and T) under known temperatures and compared them to an expected temperature. The most reliable thermocouple was Type T with its average accuracy being ± 1.5 degrees Celsius of the expected temperature. The voltage that Type T produces is always expected and consistent causing it to be accurate.

Thermocouples are one of the most common methods to measure temperature and are used worldwide in various applications, including industries, because of their advantages. Knowing which thermocouple is most reliable is one of the key factors companies keep in mind while deciding which thermocouples to use for their products.

Antoine Gobeil & Dean Parsons



REPORT

Système de pompage solaire a budget minimum

Est-ce que tu as jamais imaginé comment chanceux tu es quand tu bois un verre d'eau? 11% de la population mondiale n'ont pas accès à l'eau potable. Cette machine pompe de l'eau souterraine, la filtre, et l'apporter à une ville, et tout ceci faite possible avec de l'énergie solaire. On a aussi vu que nous parents étaient très intéressés, et ils ont bien compris ce que notre but était. Les juges de la foire a aussi aimé, et ont bien compris le concept. Pour les pays sous-développé, ce projet va être un miracle.

SEE LESS ^



Honeywell Aerospace

Aleksander Smith



REPORT

Collision Egg-cellence: A Crash Test Experiment

Will the shape of the front of a car affect the severity of the damage the car absorbs in a head-on collision? This experiment will reveal what hood shape can keep passengers the safest and what hood shape crumples the least. This experiment will be tested by running aluminum foil cars carrying egg passengers into a wall in order to test safety and durability. Will a box shaped front, a rounded front, or a triangle shaped front succeed? Hours of work yielded conclusive results. The car with a rounded front keeps the passenger the safest and a car with a boxed front will obtain the least damage to the hood. My results are important to the future safety of cars, knowing that according to the WHO 1.35 million people die a year from car accidents.

SEE LESS

Ria Patel



REPORT

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Stronger, faster, more secure. That's the goal of modern technology. Currently, quantum computers are the fastest and blockchain technology the most secure. At the crossroads of these fields lies a unique problem: quantum hacking. When will quantum computers be able to hack current encryptions? How much time do we have left? Using computer programming, I created a simulation to compare the time taken for a traditional and quantum computer to find 128, 256, 512 and 1024 bit encryption keys and blockchain approval keys. This will predict how much longer we have before quantum hacking becomes a global cybersecurity threat.

SEE LESS ^

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▼ Laurentian Chapter of SETAC Award (L-SETAC)

Best projects on a topic related to environmental toxicology, chemistry, pollution, contamination, remediation or environmental protection

Jasper Warren

A Sea Of Plastic: Reducing
Microplastics in our Oceans

Aliyan Boodhwani



REPORT

Uncovering the Dirt on Masks

The goal of this experiment was to find the answer to the question: Which mask, cloth-based, disposable or N-95, is the most biodegradable? This experiment used strength tests to figure out which of the masks biodegraded the most in soil over a period of two and a half weeks.

SEE LESS ^

TEAM

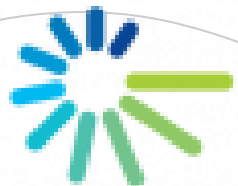


CURIOSITY & INGENUITY

#Discovery

#environment

#region_grade_junior7/8



**Canadian Nuclear
Laboratories**

**Laboratoires Nucléaires
Canadiens**

Best project in any category showing the beneficial uses of nuclear science and technology in electricity production, medicine, industry, transportation, environmental protection or other application

Joshua Auer



REPORT

Clean Energy from Dirty Bananas

Microbial Fuel Cells (MFCs) capture the electricity produced by anaerobic bacteria that digest organic matter and release electrons. In this experiment different percentages of compost (0%, 15%, and 40% blended bananas) were added to the dirt containing anaerobic bacteria to determine which amount yielded the highest maximum power output (μW). The hypothesis was that the MFC containing 15% compost would have the highest power and best ratio of nutrients to bacteria. Three MFCs were constructed per experimental condition and the voltage across different resistors was measured over time. The results confirm that the 40% MFC produced the highest power.



Ottawa Horticultural Society

To a student who has demonstrated a keen interest, knowledge and creativity in the area of horticulture and/or plant science through an outstanding project.

Isabella Furu



REPORT

Water Pollution and Rate of Photosynthesis in Aquatic Plants

Hi, and welcome to my science fair project! My science fair question is, "If an aquatic plant is placed in water contaminated by plastic, bleach, or motor oil, will the rate of photosynthesis decrease, and if so, which pollutant will most affect the rate of photosynthesis?".

The project is meant to give people a better understanding of freshwater pollution and how it affects plant photosynthesis, which has a major impact on the health of the environment and life around it.

I chose three common household types of pollution: plastic, oil, and bleach. Then, I took an aquatic plant called a hornwort, and placed it upside down in a beaker full of water, and shone a light on it. Bubbles started popping out of the stem, which are bubbles of oxygen that indicate that the plant is photosynthesizing. I compared the number of bubbles released by the plant across the different conditions (clean water vs each of the 3 types of polluted water).

My results showed that adding the pollutants had a negative effect on the rate of photosynthesis, and that bleach nearly stopped photosynthesis with a 91% decrease. These results are important because they give us an insight into exactly how much pollution is affecting plant life in the water, and if there is anything we can do about it. Results suggest it is especially important to keep bleach out of our freshwater environments. On a positive note, findings also suggest that a quick clean-up of plastic and oil can be beneficial in reducing harm and protecting aquatic plants. Please take a look at my slides for more information!

Téo Webb



REPORT

La façon la plus efficace de pousser des plantes

J'adore faire pousser des plantes, surtout lorsque je peux les utiliser pour cuisiner. Par contre, ce qui me dérange le plus c'est d'attendre plusieurs semaines pour qu'ils poussent, puis ensuite recevoir des résultats faibles. Alors pendant ce projet, j'ai trouvé la façon la plus efficace de pousser des plantes dans des minis serres, dans des endroits non traditionnels. J'ai utilisé différentes lumières et différentes quantités d'eau. Puis, les résultats étaient surprenants!

SEE LESS ^



Ted Rogers Innovation

An outstanding exhibitor or exhibitors with entrepreneurial spirit and a project that demonstrates commercial potential

Avery Parkinson



REPORT

Lab to Table: A differential gene expression analysis of RNA-sequenced bovine stem cells & myocytes

What distinguishes a muscle cell from a fat cell or a skin cell? The answer is “gene expression”. More precisely, the particular combination of genes that are turned on or off dictates cellular morphology and function.

Although gene-sequencing has been employed vastly in the study of disease and pharmaceuticals, there has been little application in the emerging field of cellular agriculture. In particular, there have been no studies identifying the genetic regulations required to develop “meat cells” from stem cells. This is of relevance, considering that the foremost challenge with culturing meat is ensuring that the embryonic stem cells reliably differentiate into the muscle tissue characteristic of meat.

The purpose of this study was to design a bioinformatics pipeline to conduct a differential gene expression analysis on the transcriptomes of a bovine embryonic cell and a mature bovine myocyte in order to identify the genes responsible for myocyte differentiation.

I successfully identified 23 genes, providing both a basis for the genes responsible for determining myocyte differentiation and a novel point of intervention in the meat culturing bioprocess.



J.R. Hall Award

Elizabeth
Zhang & Emma
Bao



REPORT

Does Slime Really Relieve Stress?

We've all heard at some point that slime relieves stress, but does it really? We ran a few experiments to test just that, keep on reading to find out our results!

TEAM



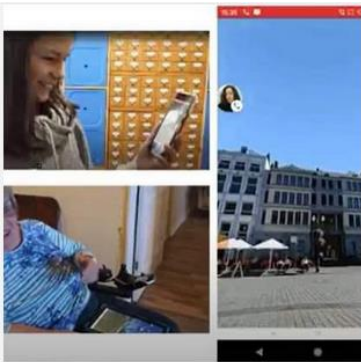
CURIOSITY & INGENUITY

Discovery

health

region_grade_junior7/8

Madeleine Galuga



REPORT

Découvertes dynamiques

En début de pandémie, j'avais remarqué que mes échanges virtuels avec mes grand-parents étaient répétitifs et limités aux défis de la situation dans laquelle nous nous trouvions. Ceci avait un effet négatif sur le moral et la santé mentale des aînés dans ma vie. J'ai donc entrepris le projet des Découvertes dynamiques avec ma grand-mère. De chez moi, je fais dérouler des images immersives en 360 degrés sur la tablette de ma grand-mère en utilisant une application de réalité virtuelle. En même temps, nous discutons de souvenirs et de faits intéressants en lien avec ces lieux via téléphone. Je mesure les changements de son humeur, son adaptabilité aux problèmes technologiques, ainsi que son intérêt pour le projet par l'entremise d'un formulaire rempli après chaque rencontre. Les données démontrent que ce projet améliore aussi son sentiment de bien-être et sa santé mentale. Ces visites virtuelles sont une activité positive qui permettent un moment de répit du stress causé par la pandémie. Son vocabulaire quotidien devient de plus en plus varié et elle admet passer un temps de conversation de qualité pendant les visites. Mon intention est de partager ces réussites avec le plus grand nombre de jeunes possible afin d'aider notre population aînée. J'ai passé en entrevue sur les ondes de Radio-Canada et d'Unique FM et une synthèse de mon projet a été publiée dans le blogue de la revue Curium ainsi que dans le journal local. Un groupe d'élèves de mon école participeront au projet sous peu.



OTTAWA REGIONAL SCIENCE FAIR

ORSF Award for
Health Research

Lauren Rasalingam



REPORT

Are Your Hands Really Clean

One year into the coronavirus pandemic hand sanitizers can be found in most households, but just how effective are they in this setting?

According to the WHO, hand sanitizers can be used in households the same way as healthcare settings - however, there is minimal evidence to support this.

This study sought to answer the novel question: are hand sanitizers effective in household settings, and if so, which is the most effective? The study also looked at how hand sanitizers are used and whether it can be used on soiled hands.

This was done by swabbing hands pre and post sanitization, growing and counting microorganisms and then calculating percent reduction of colony forming units. Statistical significance was calculated using the student t-test.

The results are clear: hand sanitizers can be used effectively in household settings with the gel hand sanitizer having the highest percentage alcohol proving to be the best.

Hayden Vermeij



REPORT

Celiac Disease can be Crumby!

Celiac Disease is an autoimmune disease that can cause severe digestion problems even when a tiny amount of gluten is ingested. As I have Celiac Disease, I investigated whether a condiment can be cross-contaminated from gluten crumbs on a knife at the lowest level (5ppm) to cause a reaction for a Celiac? Would the more times a knife is exposed to gluten then returned to a condiment cause the ppm of gluten to rise? Would the condiments' qualities, density and stickiness, affect the ppm of gluten transferred by the knife into the condiments?

My results showed that cross-contamination happens at the lowest level to cause a reaction when you have spread a condiment on 5 slices of toast. The results also showed that the denser the condiment is, the fewer parts per million it will have. People with Celiac Disease should be aware of cross-contamination when using condiments.


Kayl Absi



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Canadian Meteorological and Oceanographic Society Winner

Excellence in meteorological and/or oceanographic theme

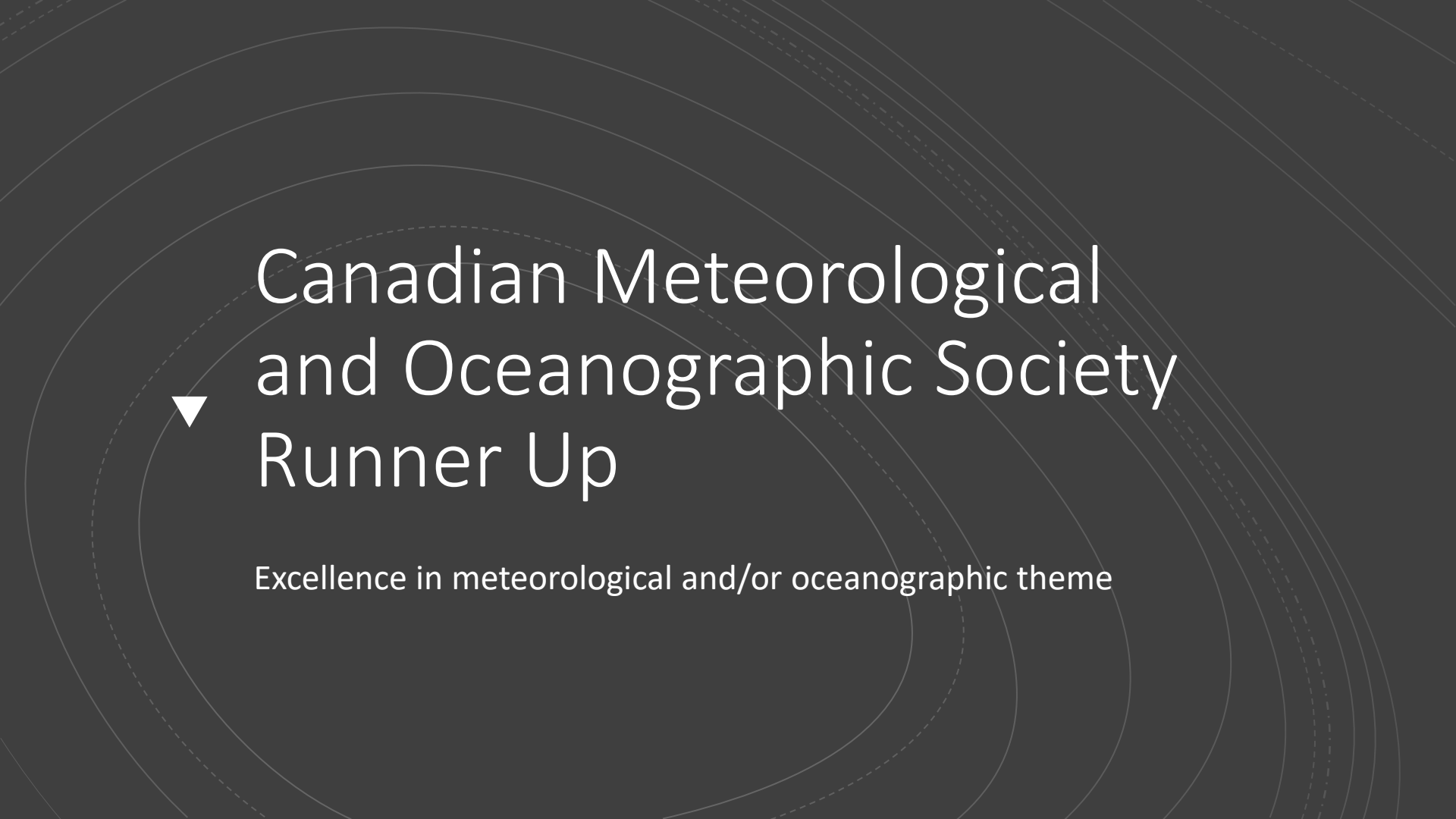
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Canadian Meteorological and Oceanographic Society ▼ Runner Up

Excellence in meteorological and/or oceanographic theme

Anerie Patel



REPORT

How the Greenhouse Effect Affects Plant Growth

Have you ever thought about how climate change will affect plants? I experimented with the greenhouse effect by growing plant with different types of scenarios. I learned that when plants have some amount of heat trapped inside they grow best. The plant has more moisture, is warmer than room temperature and has some air circulation.

SEE LESS ^

TEAM



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▼ Ottawa Field Naturalists' Club

For outstanding projects that demonstrate a knowledge of some aspect of natural history, field ecology, or wildlife conservation

Anerie Patel



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SEE LESS ^

TEAM



Isabella Furu



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REPORT

La façon la plus efficace de pousser des plantes

J'adore faire pousser des plantes, surtout lorsque je peux les utiliser pour cuisiner. Par contre, ce qui me dérange le plus c'est d'attendre plusieurs semaines pour qu'ils poussent, puis ensuite recevoir des résultats faibles. Alors pendant ce projet, j'ai trouvé la façon la plus efficace de pousser des plantes dans des minis serres, dans des endroits non traditionnels. J'ai utilisé différentes lumières et différentes quantités d'eau. Puis, les résultats étaient surprenants!

SEE LESS ^

Juliette Tovell Baudier



REPORT

Companion Farming, A New Alternative?

11% of the earth's surface is used for crop production, and the global population is rising. Food production must rise by 50% in the next thirty years in order to sustain the population. Therefore, we must find new ways to farm to feed future generations. The problem is, we're currently using many farming methods that are harmful to us, and to our planet. I decided to find a way to sustainably farm, and increase yields. My project is on companion farming. Companion farming is when you put two symbiotic plants together to improve their growth.

SEE LESS



Grand Prizes

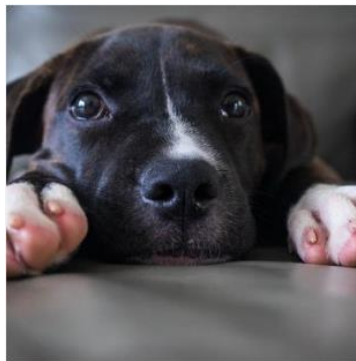




Popular Vote

Project to receive the most votes by their peers

Emma Beaudoin



REPORT

Left Paw, Right Paw

Dogs are often called humans' best friends. But how similar or different are we really?

We know humans have a strong preference for one hand, resulting from a dominant side of the brain. Dogs use their noses and mouths for most tasks. Do they also have a dominant side of the brain?

To investigate, I asked 61 dogs to reach for a treat. And discovered that, just like humans, the majority of dogs are right pawed!

SEE LESS ^

TEASE

Carleton University Science and Engineering Entrance Award



Carleton
UNIVERSITY

Avery Parkinson



REPORT

Lab to Table: A differential gene expression analysis of RNA-sequenced bovine stem cells & myocytes

What distinguishes a muscle cell from a fat cell or a skin cell? The answer is "gene expression". More precisely, the particular combination of genes that are turned on or off dictates cellular morphology and function.

Although gene-sequencing has been employed vastly in the study of disease and pharmaceuticals, there has been little application in the emerging field of cellular agriculture. In particular, there have been no studies identifying the genetic regulations required to develop "meat cells" from stem cells. This is of relevance, considering that the foremost challenge with culturing meat is ensuring that the embryonic stem cells reliably differentiate into the muscle tissue characteristic of meat.

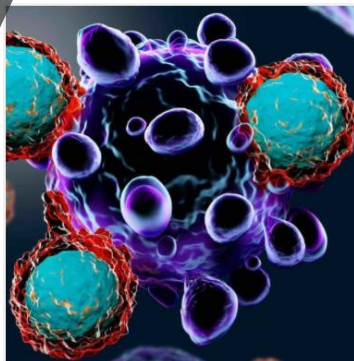
The purpose of this study was to design a bioinformatics pipeline to conduct a differential gene expression analysis on the transcriptomes of a bovine embryonic cell and a mature bovine myocyte in order to identify the genes responsible for myocyte differentiation.

I successfully identified 23 genes, providing both a basis for the genes responsible for determining myocyte differentiation and a novel point of intervention in the meat culturing bioprocess.

University of Ottawa Scholarship for Science and Engineering



Vansh Sethi



REPORT

A Novel Method to Predict T-Cell Receptor Specificity using Deep Learning

Chimeric antigen receptor (CAR) T-cell therapy is an immunotherapy that involves engineering a patient's T-cell receptors, a type of white blood cell, to allow for the T-cells to bind with pathogenic and diseased cells and trigger programmed cell death. The major difficulty in implementing CAR T-cell therapy in practice is determining the specificity of what the T-cell's receptors should look like. This project provides a novel method to accurately predict parts of a T-cell receptor given an diseased cells' receptor. This is done by using deep learning, a subset of artificial intelligence, to predict the CDR3 protein sequence, variable segment and joining segment of the T-cell. The deep learning models were able to reach an accuracy of 90%, and can effectively determine candidate T-cells for CAR T-cell therapy. By doing so, this project can be leveraged to increase the response time and effectiveness of CAR T-cell therapy in practice.



Best in Age
Category:
Junior



Hayden Vermeij



REPORT

Celiac Disease can be Crumby!

Celiac Disease is an autoimmune disease that can cause severe digestion problems even when a tiny amount of gluten is ingested. As I have Celiac Disease, I investigated whether a condiment can be cross-contaminated from gluten crumbs on a knife at the lowest level (5ppm) to cause a reaction for a Celiac? Would the more times a knife is exposed to gluten then returned to a condiment cause the ppm of gluten to rise? Would the condiments' qualities, density and stickiness, affect the ppm of gluten transferred by the knife into the condiments?

My results showed that cross-contamination happens at the lowest level to cause a reaction when you have spread a condiment on 5 slices of toast. The results also showed that the denser the condiment is, the fewer parts per million it will have. People with Celiac Disease should be aware of cross-contamination when using condiments.



Best in Age
Category:
Intermediate



Ria Patel




REPORT

The Final Countdown: how much longer until quantum computers become the next cybersecurity threat

Stronger, faster, more secure. That's the goal of modern technology. Currently, quantum computers are the fastest and blockchain technology the most secure. At the crossroads of these fields lies a unique problem: quantum hacking. When will quantum computers be able to hack current encryptions? How much time do we have left? Using computer programming, I created a simulation to compare the time taken for a traditional and quantum computer to find 128, 256, 512 and 1024 bit encryption keys and blockchain approval keys. This will predict how much longer we have before quantum hacking becomes a global cybersecurity threat.

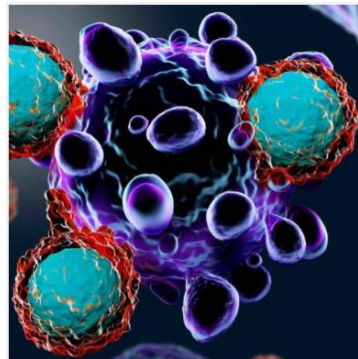
SEE LESS ^



Best in Age
Category:
Senior



Vansh Sethi



REPORT

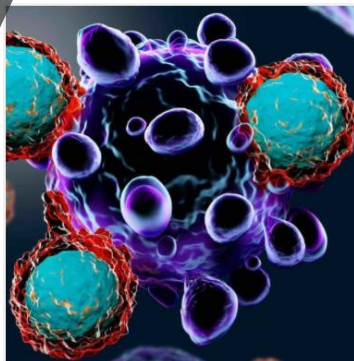
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NSERC Young Innovator: Best in Fair

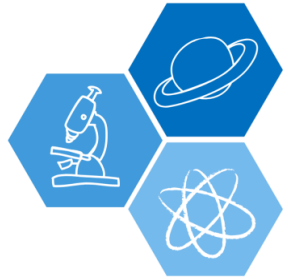
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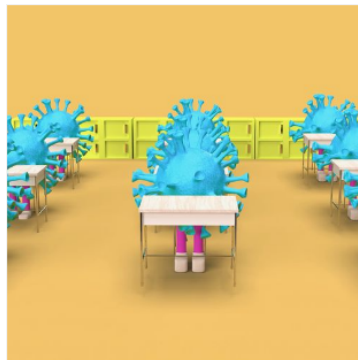
**OTTAWA
REGIONAL
SCIENCE
FAIR**



Youth Science Canada
Sciences jeunesse Canada

11 Canada Wide
Science Fair Finalists

Rowan Parkinson



REPORT

Can You Hear Me? An Evaluation of the Effects of Face Masks on Sound Attenuation

On July 7, 2020, the wearing of face masks in shared spaces in Ottawa was made mandatory under the Health Protection and Promotion Act. Considering that it is also now mandatory for students and teachers to wear masks in classrooms, it is important to make sure that information and instructions are not only being communicated clearly but loudly enough to be heard.

To quantitatively examine the effects of face masks on sound, I measured the decibel levels of 5 phonetically neutral sentences spoken at 4 different distances (following a typical classroom seating plan) using 9 different masks and then calculated and analyzed the respective sound attenuations.

The results of this study imply that all face masks, even those considered "thin," play an important role in attenuating sound. Based on the results of this study, modifications to classroom seating, based on the type of mask worn by a student, could be made to ensure optimal in-class audition.

Joshua Auer



REPORT

Clean Energy from Dirty Bananas

Microbial Fuel Cells (MFCs) capture the electricity produced by anaerobic bacteria that digest organic matter and release electrons. In this experiment different percentages of compost (0%, 15%, and 40% blended bananas) were added to the dirt containing anaerobic bacteria to determine which amount yielded the highest maximum power output (μW). The hypothesis was that the MFC containing 15% compost would have the highest power and best ratio of nutrients to bacteria. Three MFCs were constructed per experimental condition and the voltage across different resistors was measured over time. The results confirm that the 40% MFC produced the highest power.

Hayden Vermeij



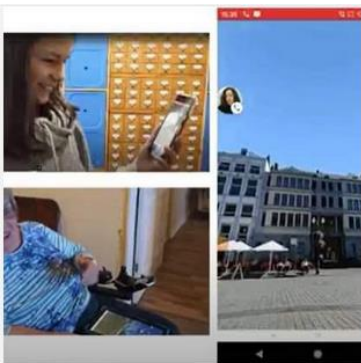
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Madeleine Galuga



REPORT

Découvertes dynamiques

En début de pandémie, j'avais remarqué que mes échanges virtuels avec mes grand-parents étaient répétitifs et limités aux défis de la situation dans laquelle nous nous trouvions. Ceci avait un effet négatif sur le moral et la santé mentale des aînés dans ma vie. J'ai donc entrepris le projet des Découvertes dynamiques avec ma grand-mère. De chez moi, je fais dérouler des images immersives en 360 degrés sur la tablette de ma grand-mère en utilisant une application de réalité virtuelle. En même temps, nous discutons de souvenirs et de faits intéressants en lien avec ces lieux via téléphone. Je mesure les changements de son humeur, son adaptabilité aux problèmes technologiques, ainsi que son intérêt pour le projet par l'entremise d'un formulaire rempli après chaque rencontre. Les données démontrent que ce projet améliore aussi son sentiment de bien-être et sa santé mentale. Ces visites virtuelles sont une activité positive qui permettent un moment de répit du stress causé par la pandémie. Son vocabulaire quotidien devient de plus en plus varié et elle admet passer un temps de conversation de qualité pendant les visites. Mon intention est de partager ces réussites avec le plus grand nombre de jeunes possible afin d'aider notre population aînée. J'ai passé en entrevue sur les ondes de Radio-Canada et d'Unique FM et une synthèse de mon projet a été publiée dans le blogue de la revue Curium ainsi que dans le journal local. Un groupe d'élèves de mon école participeront au projet sous peu.

Clara Tokarski



REPORT

Automatic Dog Feeder

My automatic dog feeder can be set on a timer so that you can leave your dog alone and rest assured that he will be fed. The machine can hold 3 days worth of food for a small dog, and the timer can be set to your dog's exact needs.

TEAM



CURIOSITY & INGENUITY

#innovation

#region_grade_junior7/8

Kayl Absi

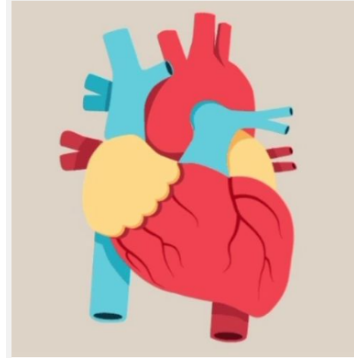


REPORT

La réparation des plaies cutanées

Le but de mon projet était de trouver la méthode la plus efficace pour la réparation de différents types de plaies cutanées. J'ai pris quatre blocs de peau de cochon et j'ai créé quatre plaies que j'avais sélectionnées sur chaque bloc. Ensuite, j'ai mis en place des différentes méthodes de réparation de plaies cutanées telles que les agrafes, les points de sutures, les adhésifs et les pansements pour les fermer le mieux possible. Par la suite, j'ai observé la peau en la tournant pour regarder le côté postérieur afin de mesurer leur taille sous un microscope à dissection. L'importance de ce projet est à un calibre assez haut puisque les résultats pourront d'aider les chirurgiens et les médecins à sélectionner les méthodes de réparations de plaies qui permettent un réhabilitation plus rapide au niveau de la peau du patient.

Abel Diress &
Adam
Mulugeta



REPORT

Developing a Non-Invasive Inexpensive Biosensor to Predict Heart Disease

Killing over 17.9 million people worldwide each year, heart disease has torn the lives of almost everyone on the planet in one way or another. Despite its unquestionable impacts, it is still ignored by the public at large as the main cause of death. However, as we grow more accustomed to this health crisis, advances in medical technology have opened doors to tools of prevention previously thought to be impossible.

In this project, we try to garner such advances in the form of a biosensor that can predict heart disease in a patient well before it's too late. In short, by measuring several statistics such as cholesterol level and maximum resting heart rate, we can understand the patient's cardiovascular condition and draw conclusions. Through rigorous research, development, and testing, our solution could have the potential to radically change the way we diagnose and prevent heart disease.

Ria Patel



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SEE LESS ^

Avery Parkinson



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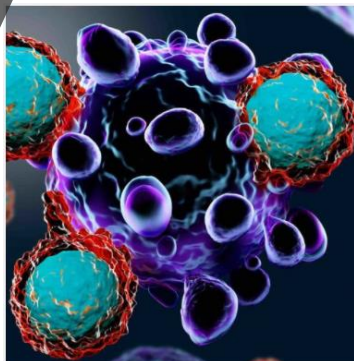
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Congratulations to Everyone!



We hope to see you again next year!