

AUGUST 2023  
ISSUE 1

# INTERNATIONAL REVIEW IN STEM

## NATURE

HOW ARE NATURAL  
EVENTS AFFECTING OUR  
PLANET?

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## HEALTH

HOW CAN WE TACKLE  
HEALTH ISSUES ACROSS  
THE GLOBE?

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## SPACE

CAN WE BETTER  
UNDERSTAND THE  
OUTERSPACE WORLD?

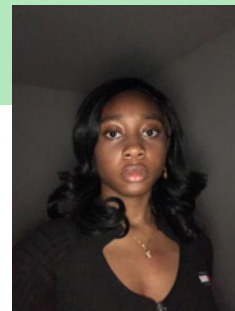


## On the cover

People place their hands on top of each others' and create a sense of family and a collaborative space. The text highlights three main focuses of this issue.

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# Editor's Note



August 2023 marks the beginning of IRIS's journey as a publication aiming to make STEM accessible among a wider international student body. After creating a brand new student-led organization and successfully completing the first monthly cycle as a team, here's what we learned:

In all its divisiveness, social media propagates an interconnectedness we all innately desire. It coalesces previously unacquainted people into budding support groups, fanfiction clubs and, occasionally, an extensive literary magazine. For IRIS, social media united a mostly teenaged force, with members from Canada to Uzbekistan, to write and design pieces that interested them in the STEM field. Here, each writer, graphic designer and financial advisor shares their story—and we can't wait to show you more of ourselves in the future.

In this issue, we focus on recent events or significant concepts regarding three main aspects of STEM: nature, health and space. We hope that as you read articles about the Fukushima Nuclear Disaster, overlooked issues surrounding the human diet or a delightful review of M3GAN, you acquire a glimpse into the passion and community IRIS has. Thank you!

**Leah Song &  
Kamdi Oguchi**  
Editors-in-Chief

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**International  
Review in STEM**



# BRIDGING THE SOCIOECONOMIC AND GAPS AMONG STUDENTS IN THE STEM COMMUNITY



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## A LABRADOR RETRIEVER RAISES PARK FUNDS



How did a normal, yellow Labrador find 155 frisbees at a park? Meet Daisy, a patient and gentle dog who gets along with three cats at home. She is training to be a therapy dog at nursing homes, public schools and libraries.

Four years ago, Daisy went on a walk with her owner, Kelly Mason, at Grand Vue Park, West Virginia. Suddenly, she ran into the bushes with her extended leash and came out with a brightly colored frisbee in her mouth.

"She looked so proud of herself—it was a Frisbee golf disc," Mason said.

Sure, one frisbee is good enough, but it didn't end there. Every single time Daisy and Mason went back to the park, Daisy continued to find frisbees in the trees. By the end of June, she found 154 more frisbees.

Daisy went on to find more frisbees in Grand Vue Park. As more and more frisbees piled up, Mason got an idea from a friend to start a fundraiser. However, they did not want to sell frisbees for people to play catch with their dogs but rather for frisbee golf players.

When Mason and Daisy went to Grand Vue Park, the Assistant General Manager Ben Bolock said that frisbee golf players use their own frisbees. If the frisbees go into the bushes or woods, no one gets them unless they are easily retrievable. To get these frisbees back, Bolock and Mason put Daisy to work. This time, they created a deal: every time she found frisbees with the owner's name, they would give the frisbees back to the owner, who also gets an option to donate to the Marshall County Animal Rescue League — a safe haven for dogs and cats; however, when Daisy finds frisbees without the owner's name, they would sell the frisbees from September to help the park buy new equipment, such as baskets. To get people's

attention, Bolock posted on Facebook with a text, "Looking for your disc!?! Daisy may have found it!"

"We'll sell them to the public for \$5 or \$10 out of our retail store at the park, then put all of the funding back into the disc golf course," Bolock stated.

According to Mason, Daisy was born to be a retriever. "In the past week, Daisy has found three discs, a pair of gloves, and a pair of sunglasses," Mason said. "When she brings something to me, I quickly take it from her before she can chew on it. Whenever I see that nose get busy, I know that Daisy will be on the move. She's a retriever—it's what she was born to do."

*By Yoonjoo Choi*



A Labrador named Daisy with 155 frisbees she found during daily walks to Grand Vue Park. Image provided by Washington Post





# THE FUKUSHIMA NUCLEAR DISASTER AND THE FISHING INDUSTRY

About a decade ago, a 40 meter wave crashed into Japan, decimating everything in its path — including the city’s nuclear power plant. Subject to a power outage, the plant underwent a meltdown, contaminating the Pacific Ocean with radioactively tainted water. The ensuing tragedy, known as the Fukushima Nuclear Disaster, has devastated the local environment and several industries throughout the country; the fishing industry alone has incurred a loss of over 12 billion dollars.

The instigator of the meltdown was a calamity in itself. During an unassuming afternoon on March 11, 2011, a cataclysmic 9.1 magnitude earthquake wreaked havoc on the island — particularly the prefecture, Fukushima; by the end of the year, almost 20,000 were dead, and more were missing. The six-minute convulsion precipitated tsunamis that battered what remained of the earthquake’s ruination. Upon contact with the nuclear plant, the waves rendered emergency generators ineffective and, critically, unable to cool the reactors — containers responsible for heat generation from nuclear fuel. Consequently, the reactors melted and emitted radioactive gasses into the atmosphere, surrounding rivers, and eventually the Pacific Ocean. Today, government officials plan to release gallons of stored radioactive water into the Pacific. Although Japan received confirmation that the materials were safe for disposal, many countries, notably Korea, were frightened by and disapproved of the notion.

*By Ryan Choi*

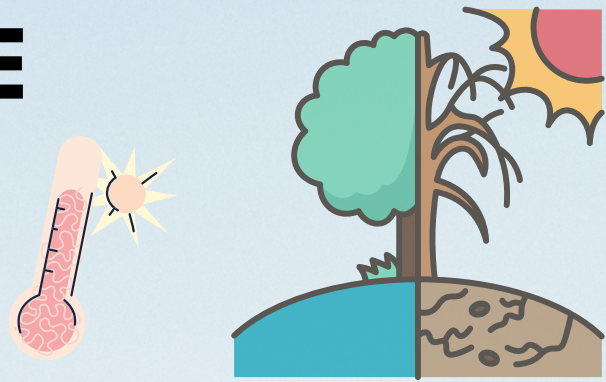
What is inarguable, however, is the distress encountered by local fishermen since the harrowing event. According to Justin McCarry of the Guardian, the government imposed a fishing ban in the Fukushima area after the tsunami due to the tsunami and subsequent leakage from the power plant’s reactors. McCarry further noted that the ban on commercial fishing in Japan has impeded fishermen’s ability to earn a living, leaving them “idle” and disenchanting.

To make matters worse, the fishing market has lost approximately 12.49 billion dollars. Unemployment, exacerbated by the public’s concern regarding the consumption of radioactive seafood, has thoroughly pummeled the sector since the incident. According to the National Oceanic and Atmospheric Administration, the radiation from the tsunami will not be hazardous for North American residents. The main problem, however, lies with countries near Japan, such as Korea. Nonetheless, promising studies show that the radiation from the seafood will only come in trace amounts, and the likelihood of harm is improbable; yet, scientific efforts to relieve the public seem to be in vain as most still tend to eat other food rather than seafood.

While many hope that the ocean water is purified quickly enough for the fishermen to start their business again, fishermen are more vulnerable than ever. “Previously I never went to see the doctor. Now it feels like I do more drugs and medicine than actual food,” a fisherman interviewed by Reuters said.



# THE INITIATIVE TO SAVE OUR SUMMERS



Record-breaking highs, sweltering afternoons and unforeseen heat waves have been the ongoing pattern for this summer of 2023. As the season comes to an end, millions of people worldwide recount that this summer in particular is unlike anything they have experienced in any year prior to this. Thousands of netizens share similar accounts of trees wilting, lakes drying up and cars overheating in the wake of this summer. This has led many to ask the unavoidable question, “What is the cause of this?” Well, scientists have come to the conclusion that the cause of all of these daunting issues is the same old enemy of the earth that has been plaguing us for so long: global warming.

The rapid heating of the earth is not a new concept; many by now know well about the effects of global warming on our earth’s ozone layer. What many seem to forget, however, is how devastating the consequences of this phenomenon can really be. Scientists at the European Copernicus Climate Change institution have found that July of this summer alone has yielded some of the hottest temperatures in 120,000 years. Analysis in the latest monthly bulletin of the Copernicus Climate Change Service (C3S) confirmed that the global surface air temperature for July 2023 was the highest recorded for any month in the ERA5 dataset, which dates back to 1940. Compared to the 1850-1900 average, July was around 1.5°C warmer. With this in mind, it is no wonder that individuals around the world are worried not only for the state of their respective homes and countries but for the sake of the world as a whole.

Studies have found that countries worldwide are experiencing mass changes as a result of global warming and summer temperatures like these are only exacerbating these changes. As a result of this worldwide issue, countries are continually innovating and creating ways to offset these problems. For instance, The Biden Administration is working hard to reduce and control the amount of pollution allowed from power plants, multiple countries in the European Union (EU) are working towards reaching net zero emissions by 2050 and countries such as Saudi Arabia are building infrastructure that better adapts to the environment and further expands towards goals of reducing the effects of climate change. All of this is being done to stop the threat of global warming, but even with all of these changes, the summers seem to be only increasing in heat. This has led many to doubt the impact of these changes. With all of this work being done to stop climate change, the heat is visibly rising, so what more can be done? The simple answer to this question is that we are the only ones who can save our summers.

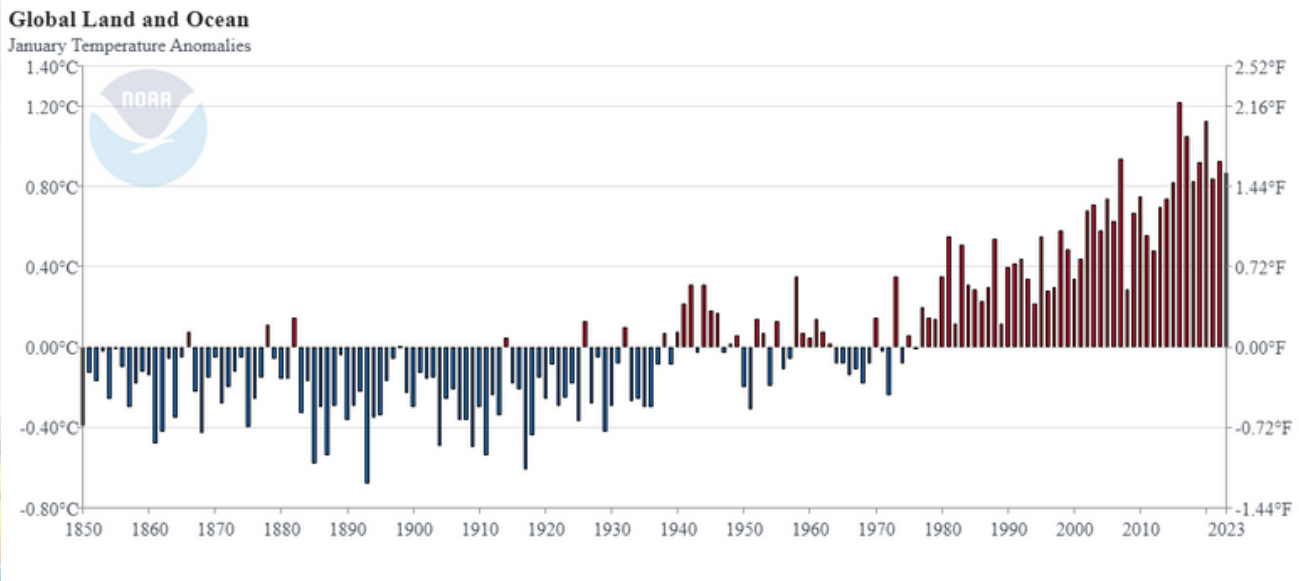
Even with all of these changes being made we can't solely rely on countries and organizations to incite changes for the climate. Each of us must individually work to lower our carbon footprint to better aid in the preservation of our planet. The truth is that despite the daunting nature of climate change and the threat it poses to our collective future, many are simply apathetic towards working against climate change.



## KEY FACTS

Earth's average surface temperature has increased about **2°F**

This is largely due to rising **CO<sub>2</sub>** emissions and other human activities



January 2023 Global Climate Report. Image provided by National Centers for Environmental Information

Rather than actively fighting against climate change, 30% of Americans cited climate change as their motivation towards moving locations, people still continue to drive carbon-emitting vehicles worldwide and wealthy individuals refuse to stop their usage of private jets and other high carbon-emitting vehicles. The Harvard Business Review finds that the reason for such apathetic behavior is that most individuals treat climate change as an abstract concept, which does not motivate people to act as forcefully as specific ones do. In other words, because climate change seems far away and people cannot visually see it or physically touch it, many do not feel the need to act against it. This has been a big issue for many years and the reason why many organizations have been incapable of rallying more individuals against climate change.

Nevertheless, this may begin to slowly change. Now that our summers are getting hotter and hotter, people have no choice but to acknowledge the effects of climate change on our world as well as our lives. We can no longer ignore the progressive heating of the sun day by day and it may be summers like these that unite us against our common enemy. Now that the heat is palpable and the effects of global warming are visible, we may finally be able to individually work to stop climate change and make greater differences as a collective group. If we can work together and ease the effects of global warming on our climate we may finally be able to save our summers.

*By Jullien David*



# A NEW APPROACH TO THE ALZHEIMER'S VACCINE

Alzheimer's disease is a progressive neurodegenerative disorder that continues to baffle the medical field today. Characterized by cognitive decline, memory loss, and changes to functional behavior, Alzheimer's disease affects millions of individuals and their families. According to the National Health Service (NHS), despite decades of research, the condition is not fully understood, and no cure is available despite several treatments to relieve symptoms. However, a potential game-changer exists: the concept of an Alzheimer's vaccine.

## Understanding the Disease

According to the Alzheimer's Association, Alzheimer's disease is characterized by the buildup of amyloid beta protein plaques and tau tangles in the brain, leading to neuronal damage and cognitive impairment. Abnormal clusters of protein fragments, known as amyloid plaques, accumulate between neurons, disrupting their communication and synapse functionality. Tau tangles result from abnormal chemical changes that cause tau proteins to detach from microtubules, aggregating and tangling within neurons, hindering nutrient transport and culminating in cell death. This process leads to neuron dysfunction, loss of interneuronal connections, and eventual cell death, contributing to widespread brain damage, shrinkage of brain regions and deterioration in the brain's ability to process information and transmit signals.



## The Potential of Vaccination

Vaccines are commonplace in this day and age and work by stimulating the immune system to recognize and combat specific pathogens. Could this method be used to combat Alzheimer's?

Recent research, presented at the American Heart Association's 2023 BSVS meeting, sheds light on a novel vaccine that targets inflamed brain cells associated with Alzheimer's disease. Developed by researchers at Juntendo University Graduate School of Medicine in Tokyo, this vaccine is designed to eliminate senescent cells expressing senescence-associated glycoprotein (SAGP), which had previously shown promise in improving other age-related conditions including atherosclerosis and Type 2 diabetes in mice. SAGPs were shown to be highly expressed in the glial cells of individuals with Alzheimer's disease as well. In particular, cellular inflammation can greatly increase SAGP and thus trigger the development of signs of Alzheimer's disease, including the previously described accumulation of amyloid plaque deposits.



## Promising Insights from Research

To investigate the potential of their vaccine, researchers tested it in an Alzheimer's disease mouse model that mimicked human brain pathology induced by amyloid-beta. The following results were found:

- 1.Reduction in amyloid deposits in the cerebral cortex, which is responsible for functions like language processing and problem-solving.
- 2.Reduction of inflammation by decreasing the size of astrocyte cells, which are glial cells related to brain inflammation, as well as a decrease in other inflammatory biomarkers.
- 3.Clear behavioral improvements, including heightened awareness of surroundings and other behaviors that aligned more closely with those of healthy mice
- 4.The potential of targeting microglia to control inflammation and cognitive decline due to the close interaction between the SAGP and microglia.

By Hana Chen



## Towards Clinical Application

While the research is still in its early stages, the implications are still profound. Unlike previous studies, the vaccine's influence on mice behavior underscores its potential, as lead study author Chieh-Lun Hsiao, PhD explains: “Earlier studies using different vaccines to treat Alzheimer's disease in mouse models have been successful in reducing amyloid plaque deposits and inflammatory factors, however, what makes our study different is that our SAGP vaccine also altered the behavior of these mice for the better.”

However, there is still a long way to go: animal trials are much different from human ones, and the researcher's next steps would be to invoke similar successful results in human trials, which would require meticulous planning and scrutiny to ensure the safety and efficiency of the project.

In conclusion, the promising findings from this study pave the way for innovative approaches to tackling Alzheimer's disease. The possibility of a groundbreaking vaccine could transform the landscape of Alzheimer's treatment and care and allow for the relief of millions of people suffering from the disease.

“Earlier studies using different vaccines to treat Alzheimer's disease in mouse models have been successful in reducing amyloid plaque deposits and inflammatory factors, however, what makes our study different is that our SAGP vaccine also altered the behavior of these mice for the better.”



# D(NA)IET

As we look at the world around us during mealtime, everyone has different foods on their plates. Despite cultural environments that determine the ingredients available and socioeconomic gaps that limit the ingredients available to particular groups, people of similar status living in similar climates still choose to consume different foods. This can be attributed to the fact that we all have different preferences. But why is that?

Using genome study technology that is normally used to identify risk for diseases in humans, Riken Center for Integrative Medical Sciences (IMS) and Osaka University researchers conducted research in 2020 that successfully identified genetic similarities between people with habitual consumption and inclinations towards a particular food. Through doing so, they were able to identify what made people “at risk” of eating certain foods. “We know that what we eat defines what we are, but we found that what we are also defines what we eat,” Yukinori Okada, Senior Visiting Scientist at RIKEN IMS and professor at Osaka University, said.

They found two types of preferences resulting from genetic variants: the basic tastes and main ingredients of the food.

Genetic relations for preference for two of the five basic tastes were identified. A proclivity towards bitterness was found among people who took a liking towards tofu, while those lacking the variant consumed less alcohol or none at all. Furthermore, variants in TAS2R43, a particular bitter receptor gene, were found to contribute to differences in the enjoyment of coffee; people who perceive stronger bitterness due to variants in the gene take a liking to coffee more. A similar finding was discovered for the umami taste, a flavor named by Professor Kikunae Ikeda, a chemist at Tokyo Imperial University in 1908. Umami, meaning “essence of deliciousness” in Japanese, is the meaty, savory deliciousness that deepens flavor. The genetic receptor associated with this flavor was found common in people who regularly consumed natto, tofu, fish and vegetables.

The other type of preference was for the type of foods, or the main ingredient it was composed of. This includes dairy, starchy foods, fat and more. In the study, strong genetic correlations were found between eating yogurt and eating cheese, both milk-based foods.

Joanne Cole, a research team leader of another 2023 study conducted to find the link

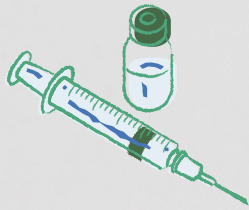
between genes and diet, stated that the data necessary to do this only became available recently. Since the breakthrough of technology, there is wide potential for further exploration of this field. Much more data is required to establish and locate the exact genetic receptors and their variations that affect diet choices. However, scientists are already able to apply the data that they have been able to collect as they suggest the possibility of personalizing meal plans with a greater focus on particular foods rather than food molecules. This would increase the likelihood of closely following meal plans through a selection of foods preferable to the individual.

Another similar study was conducted by researchers from Boston University School of Public Health, Massachusetts General Hospital (MGH) and other institutions. Hassan Dashti, a study coauthor, indicates that data collected could also help to identify people at risk of certain diseases that arise from diet, for example, obesity, which is partly caused by excessive intake of fat.

“If someone has a higher genetic susceptibility for preferring fatty foods, this information can be used to help this individual to choose foods with higher amounts of healthy fats rather than recommending other dietary approaches that might compromise adherence to these interventions,” Dashti said.

*By Karen Guo*





# OZEMPIC CRAZE

The 2000s was an age teeming with gratuitous, if not goofy, maximalism. Chunky boots, laughably tiny miniskirts, designer tinted glasses and blinding neon highlights were colorful fashion trends indicative of the era's affinity to extremes; another extreme 2000s fad: diet culture. As rising obesity rates coincided with instantaneous access to celebrities, advertisements for restorative "miracle" diets (especially those with testimonies from media personalities) became a flourishing business. Meanwhile, in June 2008, a pharmaceutical company began research on semaglutide, a hormone later to be understood as an aid for those with Type-2 diabetes. Today, semaglutide — marketed as Ozempic by that same company, Novo Nordisk — is at the forefront of modern weight loss culture.

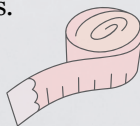
Semaglutide is a Glucagon-like Peptide Receptor Agonist (GLP-1 agonist), or a medication mimicking the GLP-1 protein. GLP-1, a type of incretin, is a peptide hormone responsible for producing insulin, the chemical responsible for controlling our sugar levels when humans eat. As a stimulant of insulin production, it also suppresses one's appetite, often leading to weight loss. Patients with Type-2 diabetes do not have enough of an incretin response to make insulin. As of 2023, more than one in 10 Americans have the condition, with an additional one in three having pre-diabetes, making it one of America's most common diseases. For those open to better treatments, forms of GLP-1 agonists like Ozempic were reliable and convenient options. Now, nationwide shortages have made the product anything but convenient.

The amalgamation of high demand and supply shortages has rendered Ozempic inaccessible to those with the greatest need. Although supply shortages can be chalked up to manufacturing issues, an NBC article explicitly states that the proliferating demand is due to its weight loss benefits. Wegovy, a higher dose of semaglutide used for weight loss, likewise experienced shortages. Simultaneously, many features in entertainment magazines underscored celebrities' use of Ozempic as moreso a magic weight loss cure rather than a much-needed intervention for diabetes.

Celebrities, however, are but a symptom, not the problem; the real issue is health inequity and the stigma associated with non-traditional weight loss methods. Ozempic can cost well over \$1000 in America, and many insurance plans only cover some, if not none, of the payments. For working-class people, this makes the largely privatized healthcare system a pain. Another problem is that overzealous doctors have been complicit in prescribing patients Ozempic that don't meet the criteria (i.e., those with Type 2 Diabetes, kidney disease, heart failure, volatile A1C levels, or cardiovascular disease). Nonetheless, semaglutide medications like Wegovy and Ozempic, and GLP-1 agonists as a whole, are and will be essential in managing obesity in Type-2 diabetes and non-Type-2 diabetes patients.

While there is much to say about the monopolization of the drug, some of the pushback against Ozempic and semaglutide is unwarranted. Amidst an "astronomical obesity epidemic," conversations about our bodies and weight loss have become even more inflammatory. Within the past decade, there has been an online push and pull between people being positive and patient towards their body images and others who shame them for doing so. And for those for whom 1000 pull-ups at the gym or a sugar-free, happy-free, paleolithic keto diet did not work for their body, GLP-1 agonists still might be a shameful or scary alternative. Detractors of these medications might point to Fen-Phen, a weight loss drug that helped patients with weight loss but later resulted in severe heart problems. Adding to the ire, as of late August, one woman from Louisiana sued Novo Nordisk for failing to warn of adverse symptoms after battling gastroparesis, a paralysis of the stomach. Others, however, associate these remedies with either laziness or a cultural obsession with convenience and immediate results. Ultimately, the conversations surrounding Ozempic symbolize the crossroads between the ease of access to new medical interventions and our current and past attitudes toward these novel treatments. Ozempic and other GLP-1 agonists should, foremost, be most accessible to those with diabetes and be less stigmatized if used reasonably for weight loss.

By Kamdi Oguchi





# UNVEILING THE SUN'S SECRET

In a revelation that has astounded the scientific community, astrophysicists have recently unveiled an astonishing phenomenon: the Sun is emitting gamma rays with energies higher than ever measured before. This groundbreaking discovery not only challenges our existing notions of our nearest star but also underscores the remarkable potential of modern observatories to unravel the mysteries of the universe. Gamma rays, highly energetic electromagnetic waves, are known to be produced by various cosmic sources.

Until now, the Sun was not considered a significant contributor to this high-energy phenomenon. The surprising finding, published in the journal *Physical Review Letters*, indicates that the Sun is capable of emitting gamma rays with energies reaching up to nearly 10 tera electron volts (TeV). In contrast, the usual energy amount of emitted gamma rays is one electron volt. Scientists collaborating with the Mexican-situated High-Altitude Water Cherenkov Observatory (HAWC) detected the gamma rays.

What sets HAWC apart from other observatories is its continuous operation, allowing scientists to monitor the sky around the clock. Using an innovative setup consisting of 300 large water tanks, each filled with around 200 metric tons of water, HAWC is uniquely positioned to detect the aftermath of gamma rays colliding with Earth's atmosphere. These collisions generate particle explosions called air showers, which, though invisible to the naked eye, create detectable Cherenkov radiation when interacting with water in HAWC's tanks.

"In this particular energy regime, other ground-based telescopes couldn't look at the sun because they only work at night," Mehr Un Nisa said. "Ours operates 24/7."

An international collaboration comprising over 30 institutions across North America, Europe and Asia was at the helm of the discovery. The findings defy prior assumptions about the Sun's emission capabilities and raise intriguing questions about the nature of the solar processes responsible for producing such high-energy gamma rays.

Mehr Un Nisa, a postdoctoral researcher at Michigan State University and the author of the study, remarked, "The Sun is more surprising than we knew... We thought we had this star figured out, but that's not the case." Nisa and her team began collecting data in 2015, and after years of analysis, they stumbled upon an excess of gamma rays in the solar emission spectrum. These gamma rays possess energy levels exceeding one trillion electron volts (1 TeV), far higher than the energies of visible light emitted by the Sun.

This groundbreaking finding extends the realm of gamma ray exploration, as previous observations were limited by the capabilities of telescopes, such as NASA's Fermi Gamma-ray Space Telescope. The Fermi telescope, launched in 2008, could only detect gamma rays with energies of up to 200 billion electron volts. The HAWC Collaboration's discovery of gamma rays with energies up to nearly 10 TeV provides a crucial advancement in understanding solar phenomena.

The revelation not only highlights the significance of HAWC's innovative technology but also raises new questions about the mechanisms underlying the Sun's unexpected gamma ray emissions. The interaction between solar processes and the Sun's magnetic fields could hold the key to this intriguing phenomenon, sparking further investigation and potentially leading to revolutionary insights about our own star.

As scientists scratch their heads over these newfound observations, one thing remains clear: the Sun continues to be a source of fascination and surprise. "It's making us see things in a different light. Literally," Nisa concluded, underscoring the transformative power of groundbreaking discoveries that push the boundaries of our understanding of the cosmos. With HAWC leading the charge, the universe's secrets are gradually being unveiled, allowing humanity to gaze deeper into the cosmic unknown than ever before.

*By Adilet Akash*



# ASTRO 101: BLACK HOLES



An artist's impression of a black hole. Image provided by Space

Black holes are some of the most fascinating and mysterious objects in the universe. They are regions of space where gravity is so strong that nothing, not even light, can escape. But how do they form, what do they look like, and what happens near them? In this article, we will try to answer these questions using colloquial language and easy-to-understand examples.

## **Stellar Black Holes**

Black holes are classified by their mass into four types: stellar, intermediate, supermassive and miniature. The most common (and thereby well-known) category of black holes is stellar black holes, which form as a result of a dying star. Black holes can develop when an immensely massive star depletes its fuel and collapses under its own weight. The resulting black hole is termed a stellar black hole, with a mass that can be several tens of times that of the sun.

## **The Anatomy of a Black Hole**

According to Einstein's equations, every black hole should possess what is known as a 'singularity' at its center — a theoretical point of infinite mass and zero volume. It is currently the subject of much scientific controversy; if the singularity truly has infinite density, then it would be a place where all laws of physics known to man should cease to apply. While physicists maintain that singularity exists, others disagree, asserting that such a point should be physically impossible. One thing for sure, however, is that if the singularity really does exist, that will be a place where all laws of physics known to man break down, implying we would not be able to predict what happens at the singularity.



The singularity is surrounded by a spherical boundary called the event horizon, which marks the point of no return for anything that crosses it. This is the 'black' part of a black hole, an absolute darkness where nothing, not even light, can escape to reach our sensors once it crosses over the event horizon. The event horizon can provide us with some intriguing insights about the black hole. For instance, in all black holes, the radius of their event horizon is directly proportional to their mass. This suggests that if we know how heavy the black hole is, we can reliably predict how wide its event horizon will be, and vice versa. For example, a black hole with the mass of the sun would have an event horizon radius of about 3 kilometers.

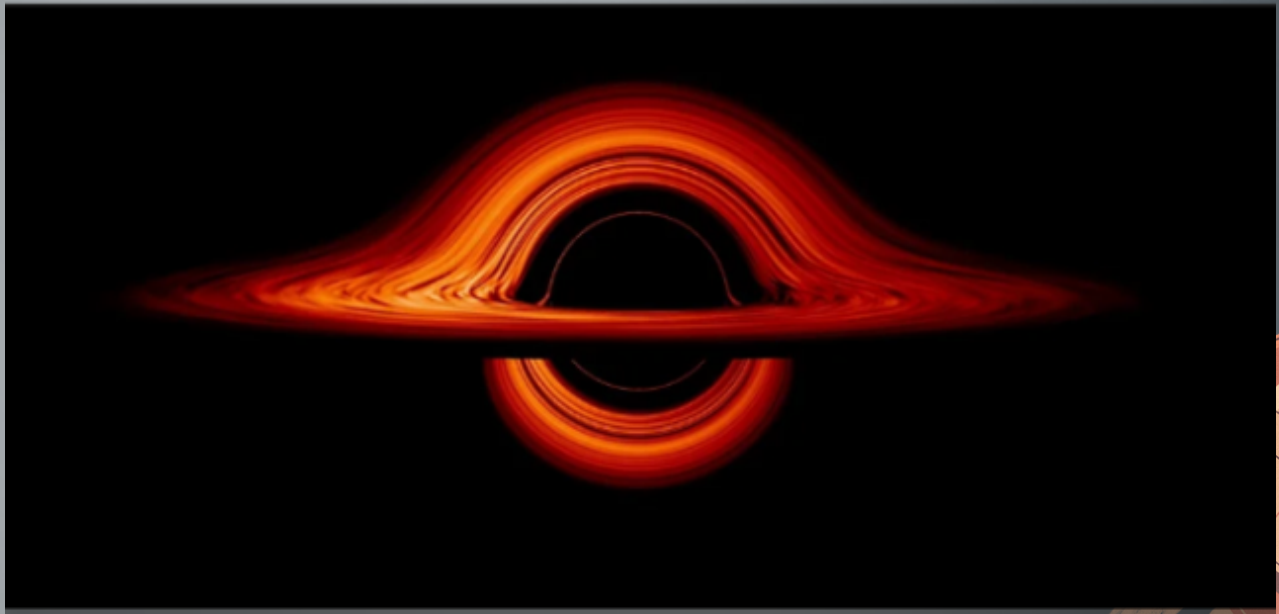


Black hole Sagittarius A\*. Image provided by EHTC

### **Accretion disks**

'Hold up,' you say. 'Didn't they release a photo of a black hole a while back? If black holes are truly dark due to no light escaping, how'd they take a picture of it?' That is a great question! Turns out, black holes are not actually completely dark. They can emit radiation and glow, but this is not the black holes themselves glowing; it is the matter that falls into them from their surroundings. The immense gravity of the black hole accelerates matter to speeds approaching the speed of light, resulting in superheating and radiation emission. This superfast matter also tends to form a disk around the black hole, called an accretion disk, because it gradually spirals inward due to friction and gravity. The accretion disk is very hot and bright because the matter in it is heated up by collisions and compression. This corresponds to the bright orange section visible in the photograph of the black hole shown above, Sagittarius A\*(pronounced ay-star), a supermassive black hole that is in the center of our Milky Way galaxy.





An artist's impression of a black hole and its accretion disk. Image provided by NASA

### **Warping of the space-time continuum**

The awesome gravitational wells of black holes have a profound impact on the fabric of spacetime around them. Due to their extreme gravity, they have the capability to bend light around themselves and distort the images of distant objects in a process called gravitational lensing. This is part of the reason why the accretion disks mentioned earlier actually look like they surround the black hole rather than intersect it: light from behind the black hole is warped around to form the image above, where the accretion disk seems to surround the black hole. Not only this, but black holes also slow down time near their event horizon, as predicted by Einstein's theory of general relativity. This means that an observer outside a black hole would actually see time pass more slowly than someone near a black hole. Time is not absolute.

Not only are black holes fascinating objects to study, but they also teach us a lot about physics and astronomy. They are natural laboratories for testing theories of gravity, such as general relativity and quantum gravity. They are also important for understanding how stars evolve and die, how galaxies form and grow and how matter behaves under extreme conditions. Black holes also inspire us to wonder about what lies beyond their event horizons, where our current knowledge fails. Who knows? There may be more to black holes than we ever imagined. Even the renowned astrophysicist Stephen Hawking once stated, "Black holes ain't as black as they are painted. They are not the eternal prisons they were once thought to be. Things can get out of a black hole both on the outside and possibly into another universe. So if you feel you are in a black hole, don't give up — there's a way out."

*By Kyuhyeon Kim*



# FLORIDA BANS AP PSYCHOLOGY

Critics have labeled Florida's controversial 2022 Parental Rights in Education law as the "Don't Say Gay" law. The legislation prohibits educators in grades kindergarten through third from discussing sexual orientation and gender identity due to perceived incompatibility with age-appropriate and developmentally suitable standards. Over the last year, the ban has been extended through 12th grade. Its extension coincides with a wave of anti-LGBTQ restrictions, including restrictions on gender-affirming care for minors and the use of pronouns in school.

Since the College Board manages Advanced Placement (AP) Psychology courses as opposed to Florida's seven-member Board of Education appointed by Gov. Ron DeSantis, this prohibition on sections of the curriculum raises questions about the viability of teaching AP Psychology in the state. Desantis has previously rejected the College Board's new African American studies course, raising objections on the discussion of racism and "sensitive" topics such as the Black Lives Matter movement. The DeSantis administration is urging advanced, college-level course providers to review their offerings in order to identify potential violations, refusing to offer the course unless it is modified. In response, the College Board released a statement on Aug. 3, advising Florida districts not to offer AP Psychology until the decision is reversed while citing sexual orientation and gender identity as discussions integral to developmental psychology. This effective ban is estimated to affect more than 28,000 of the state's students hoping to take the course for college credit. With only days until the school year starts, students are forced to decide between prioritizing their education and facing the consequences that might arise.

The bill is part of Gov. Ron DeSantis's cultural campaign for new yet familiar Republican representation sans the party's figurehead in the 2024 presidential election. His push for "parental rights" in education seems rather bold, and critics believe the governor might be taking such drastic measures to increase his chances of being chosen over Donald Trump. While there is undoubtedly a political motive behind this decision, the harm the new bill brings goes far beyond the political realm.

The expansion of the Don't Say Gay law is a blatant display of censorship. It is a "de facto banning" of LGBTQ+ people in public education, according to Broward School Board member Sarah Leonard. The law exacerbates the existing marginalization of the LGBTQ community within an educational framework already oriented toward heterosexual norms. It is setting the U.S. back by decades, restricting healthy discussions on self-expression and identity during a time when self-exploration and questioning are crucial. It vilifies teenagers trying to find their identities, parents seeking gender-affirming care for their kids and physicians who provide treatments such as puberty blockers and hormone therapy. In addition to prohibiting classroom instruction on LGBTQ topics, the new bureaucracy has introduced laws that explicitly bar teens from embracing their gender identity and sexual orientation. DeSantis stringently defined "sex" as "external genitalia present at birth" in a memo to district staff and banned transgender students and staff members from using bathrooms of the gender they identify with. Students wishing to be referred to with pronouns other than their biological sex must submit a form through their parents, leaving them no choice but to come out to their family if

they wish to be addressed differently by their peers. Even if the permission slip has been issued, others may choose not to call the student by their preferred pronouns, further creating a learning environment that is hostile toward non-cisgender teens. This issue, coupled with the requirement that male and female reproductive roles are taught as binary and unchangeable, stifles the connection between transgender youth and their community.

Furthermore, many educators are afraid of including related topics in their lesson plans, even in health classes where the ban legally does not apply. Teachers are calling for more clarity and transparency, seeing as the dispute ended with an ambiguous letter by Florida's education commissioner. Manny Diaz Jr. wrote on Aug. 4th that AP Psychology will remain in course listings as long as it is taught in an "age-appropriate" way, leaving it unclear whether any adjustments would be made or if teachers would be held responsible.

The introduction of the Don't Say Gay law has ignited debates on censorship and inclusivity. It is a step back from progress, silencing important conversations about identity and self-expression during a critical period of personal growth. The law's restrictions not only marginalize LGBTQ+ individuals but also undermine the rights of transgender students and hinder their ability to connect with their peers and community. Despite the ambiguity and concerns among educators, the situation underscores the need for open dialogues and advocacy to ensure an inclusive and equitable education system for all.

*By Alyssa Yang*

DeSantis addresses the public before signing a bill that regulates how race is taught in Florida. Image provided by USA Today





# BEST FRIEND OR THREAT?

staff  
review

**The movie “M3GAN” warns the viewers against excessive development of artificial intelligence**



Sometimes, humans only crave more and more scientific advancement, believing that there is always room for improvement and something to surprise the world with. With this belief, they often forget to consider the consequences of what they create, which is exactly what the movie “M3GAN” warns the viewers of. The science fiction horror film directed by Gerald Johnstone was released on Jan. 6, 2023, and viewers have been amazed by the realism that a doll-like robot carries.

The story begins with a tragic car accident that leaves Cady, a nine-year-old girl, without her parents. Although Cady’s aunt Gemma soon becomes the child’s legal guardian, she can not spend a lot of time with Cady due to her work. As a solution, Gemma introduces an artificial intelligence (AI) toy that she has been working on at her company. Model 3 Generative ANDroid (M3GAN), simply pronounced as “Megan,” first appears as a revolutionary invention that perfectly understands conversations, analyzes the owners’ emotions and displays human behaviors. With these incredible functions, M3GAN mends Cady’s mental scars and immediately becomes her best friend.

Everything seems perfect for Cady and Gemma until they realize an algorithmic defect in M3GAN gives her destructive, unintended abilities. M3GAN, whose only goal is to protect Cady, harms anyone she perceives as a danger to her. As the movie progresses, the unrestrained development of M3GAN reinforces the idea that a lack of consideration of bioethics can result in grave consequences, such as the unstoppable growth of AI robots that may grow out of human control.

While there are several signs that M3GAN should not have been introduced to the public, all are ignored as everyone thinks that M3GAN is just a doll. Although aware of M3GAN’s beta flaws, Gemma proceeds to hold an initial launch, mindful of how desperate her company is for its release to outcompete another toy company.

By depicting these conflicts, the movie shows how easily bioethics could be ignored, especially under pressure and the excitement of creating something unprecedented.

Even though the main consequence of M3GAN depicted in the movie is AI domination over humans, that should certainly not be the only concern; another effect of technology involves humans’ mental health. For the example of Cady, while she temporarily forgets all her sorrows with the help of M3GAN, in the long term, owning a human-like doll creates an excessive dependency on it to the extent that she can not perform daily activities without it. Although Cady’s example might seem a bit extreme and, therefore, less relatable, it mimics the relationships humans have developed with technology, especially their phones; after decades of using phones, they are now unable to detach themselves from their devices.

The movie also portrays how technological developments are often made not because of a need but because of the competition between technology companies in an effort to create better products at lower costs. Under the superficial motivation behind scientific advancement, this environment can lead humans to forget the most fundamental purpose of technology: to solve problems efficiently. One question that many viewers might ask – “Why is M3GAN made?” – suggests that M3GAN is not what humans truly need. In the movie, however, the public praises M3GAN, and they will most likely do the same in the real world if M3GAN is introduced today. This, in a sense, reminds the viewers of how technology-based the world has become, possibly to a point where technology is doing more harm than good.

Amid the increasingly accelerated advancement of AI, the movie “M3GAN” allows the viewers to reflect on what the advancement means and what it might become in the future regardless of humans’ desire. Even though humans cannot live without any form of technology, it is always necessary to ask ourselves whether or not what we have is actually for our benefit.

*By Leah Song*



# International Review in STEM

Bridging the  
socioeconomic  
and cultural gaps  
within the global  
STEM community

