RCDS Science News

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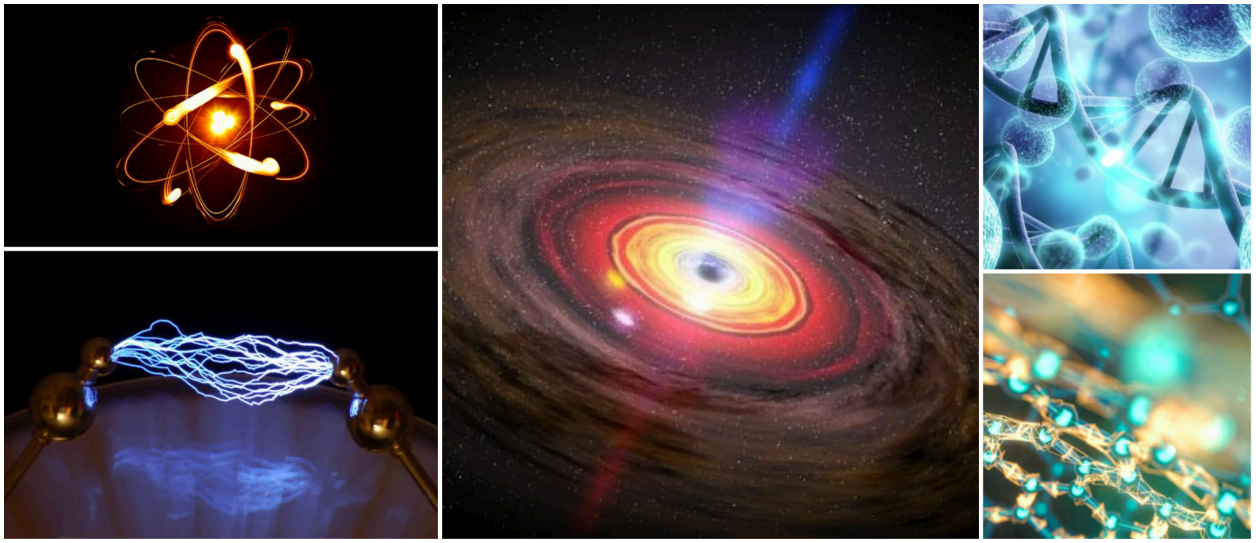

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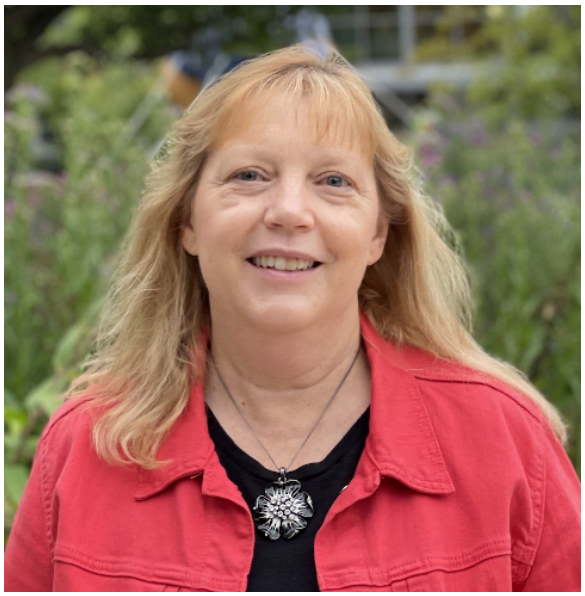
Interview with Ms. Bischoff

Colette Sawyer '25 - 1/17/24



Did you always know that you wanted to study biology and environmental studies?

Yeah, in fact yes. I was always interested in biology. In undergrad I majored in biology and my minor was in environmental science. In graduate school for my masters degree, I have a bio-ecology major and that is where I did the fish study, where I was looking for genetically pure populations for the state of Utah to reintroduce the native Colorado River Cutthroat trout. (We talked about that in AP Bio when we talked about hybrid zones, remember.) I also worked for the US Fish and Wildlife Service as part of their breeding bird survey and I had a whole section of folks that worked with me in these mountains between Utah and Wyoming.

So when you chose to study fish in graduate school was that influenced by your mentor?

Well, my study was more influenced by the type of question that I wanted to ask at the time. Because the DNA technology was not as good when I was in grad school, I had wanted to work on birds but I studied fish because, fish in a stream are genetically very different from one stream to another whereas birds are very homogenous over a large area. So fish were a better population to study.

So did you have a mentor in or throughout college and in what ways did they guide you?

Yeah I did have a mentor and, as an undergrad at the school I went to, we had to do a research project. So I studied animal behavior and mating behaviors in this type of bird in western NY. And my mentor for that project was also, I would say, he was also my mentor for, kind of like my advisor in college. My mentor, yeah he helped me, he was actually friends with my advisor I had in graduate school so he connected me with my grad school advisor. We met at a bird meeting where I was presenting the undergraduate research we did.

And so what would you recommend, what would be some advice you would give to

young scientists interested in your field specifically?

Well in my field, just look out there for the different opportunities. There are so many different opportunities and be open minded about what types of schools and programs you would choose for both undergrad and grad school. I was able to, for grad school I did work on fish as my research project, but the work I did with birds on the breeding bird survey paid for my grad school. So you could do what is called a graduate-assistantship. I did both- I did graduate assistantship which paid for my summer, and then during the year I was a teaching assistant for the biology department. As a teaching assistant was where I learned I really like to teach in addition to research, by exploring different options it helps you find your niche better.

So when did you go into academia? Was it right after grad school or later on?

Right after grad school I actually taught in Weber State University in Ogden, Utah for a year and then I taught at Corning community college and then I ended up teaching at Pre K -12 schools so that was kind of my order. And actually right now I am working on my doctorate on representation in stem but focusing on representation in computer science.

And so did you have someone who influenced you overall from your high school career until now that has guided you through this?

I grew up in upstate NY where we lived on a dirt road so I was very exposed to nature and things like that, so I think my parents started me on the biology path. My dad is also an engineer, and that also influenced my interests and even career path. One of my favorite teachers in high school was my biology teacher and my homeroom teacher was another biology teacher, but he was, I would say , influential too.. At each school I went to, I made sure to make connections with a like minded mentor type of person, or at least one, but a lot of times more than one. And in grad school I had I would say a geneticist mentor, fisheries mentor and a bird mentor. In undergrad I had an animal behavior and a developmental biology professor who I would also consider a mentor. But again, I really have always loved biology.

Do you prefer academia over research?

Yeah I prefer teaching over research. Research is fun and doing a little bit of research is great but I like the interaction of the students versus the interactions in the lab. I worked in labs and it can get narrow minded and laser focused. I tend to be interested in a range of topics and not just specialize.

And what is one thing that you really liked about what you did or what is one fun fact you like to tell people about what you studied?

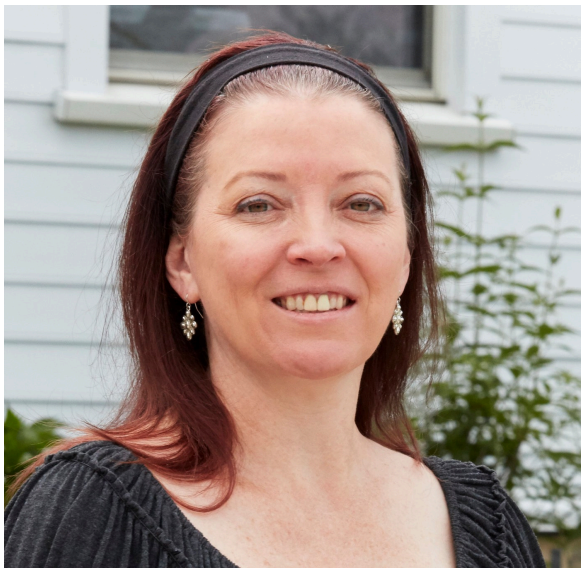
One fun fact, I always thought it was so cool I got paid to walk in the woods with binoculars and look for birds in graduate school and a couple environmental

consulting jobs. Like it was one of those things that now I do that for fun, but when I was in grad school that was how I made money. So, um, it is great when you can have a job that is something you would probably just do for nothing.

Editor's Note:
On behalf of myself, the other writers and editors, we thank Ms. Bischoff for this amazing interview and volunteering as advisor for the Science News!!

Interview with Dr. Krasovec

Jaymin Ding '25 - 2/20/24



I recently had the chance to interview Dr. Krasovec and learn more about her background and physics journey. I hope that others reading this will be inspired by her story.

What made you interested in physics?

I had the most amazing high school physics teacher. His name was Mr. Brown. He was a big guy who always wore rock and roll t-shirts and had a big red beard. And he spent every summer riding his Harley up and down the California coast. And he was just very entertaining and very cool.

So he made you interested in physics?

Yeah. I didn't know what I wanted to major in, so I went to the orientation at college and thought, you know what? Until I figure out what I want to do, I'm just going to go with the arts and sciences and take physics classes. And I never changed. And from there, it's been a love of physics ever since.

Are there any specific interests in physics that you have?

Well, I started in astrophysics because space is just super cool. Right? And I did an internship in California, which was super cool. And I did astrophysics things and wrote code. Then, I changed to geophysics because I wanted to do something more practical and applicable to the real world, which, as it turns out, all fields of science are not applicable but also applicable depending on how you approach them. So, I don't know; I was a little naive about that. But studying the Earth is also very cool.

Did you do any specific projects in geophysics?

Yes, I did a project that used seismic waves to map the Earth. So, a lot of computer programming and the head of my committee would use seismic waves to map subduction. So you'd see the shape of the plates being subducted under Japan and

things like that. But a lot of it was imaging oil reservoirs. So, I was largely funded by and offered jobs with oil companies.

What has your path been like since high school in the physics field?

Well, I guess getting an undergraduate physics degree isn't generally going to get you a job in physics. So clearly the thing to do for me was get a PhD. And so I did. But then I didn't really want to live in Texas or do oil. So I worked at a small geophysical company for a few years, and actually, that was some really interesting stuff, too. But then I had a friend who taught at Andover. As it turns out, my friend was a chemistry Ph.D. and loved to play soccer and loved to do pottery. I have a lot of hobbies, and I thought, boy, teaching would be cool because then I could do physics, but I could also exercise my hobbies and get involved in many aspects of student life.

How would you describe the process of getting an undergraduate degree in physics or getting a Ph.D. in physics?

That's not a small question. I mean, you have to love doing it, right? I just enjoyed the material, and I enjoy solving problems. And the thesis certainly was hard because at least where I went, there was no one saying, here's the problem you should solve, and here's how you should do it. This is why I think YPT is so valuable. It was like you're just given a few years of classes, and then you're thrown to the wolves, and they're like, here's a project you could get involved in. And for me, getting the Ph.D. thesis wasn't solving a problem. It was figuring out what the problem was. And I can remember distinctly that I had been working on this data set for two years, and I had no idea what to do with it. And it was a very flawed data set. But one night in the depths of February, I figured out, oh, here's a thing that's wrong with it and here's why, and here's an algorithm I can do to correct the problem. And I didn't know the algorithm yet, but I understood, oh, here's a problem. And there's a path to finding a solution. And three months later, it was done.

What specifically was your PhD thesis about?

So there's a way of imaging the underground where you put sources down in a borehole. The sound waves have less distance to travel, and you can get a higher-frequency image of the reservoir. And the problem is, you're only looking at the reservoir from one angle because your source is in a limited space, as opposed to these big surveys where they put sources and receivers over tens of miles on the surface, and you get lots of angles. And there were some particular failures in the data set that I had. So, it was geometrically very limited. And I worked out some geometrical relationships that allowed me to remove artifacts. I looked at my thesis at some point recently, and I don't remember half of the theory and my theory chapter, but you know, I remember what it means, but I don't remember how I derived it. It was really complicated.

It's really satisfying to know you've figured out something no one else has.

So, would you say this method was completely innovative?

I mean, it was based on other things, but no one had done specifically what I did. Really, we're always standing on the shoulders of someone else, right? Very few people come up with something that's completely novel and completely unique. And even Newton, right, built his laws based on other people's observations.

What would you say to students who might be having a difficult time in physics? What would you do, or what would you say to encourage them or help them out?

Mostly, if I see students struggling in physics, there's one of two causes. One, maybe they're not interested in it, which is valid; if you don't like a subject, it's hard to learn it. Right? There are subjects I haven't liked, and I was terrible at learning. So, if you can find some way to think of it as a puzzle that's enjoyable, that helps. The other reason students struggle is that they don't trust themselves enough; they think it's all about doing what someone else has told them is the right thing to do instead of finding their own way to do it. Which is a natural part of education, right? When you're in elementary school, of course, you're doing what other people tell you because you don't know anything. You need to get this information. And at some point, you have to just trust yourself to run on your own. And that can be terrifying for a student who's never done it.

Is there anything unique about the problem-solving process in physics specifically, or just the problem-solving process in general?

It's just very logical. If you know the patterns to look for, it can be very efficient.

And what about students who are interested in pursuing physics in the future? Do you have any inspirational advice for them?

Pay attention to what's going on out there in the world! There are so many applications that are unique. And it's not all the physics that you learn in high school, right? There's physics-based stuff in computing, biology, chemistry, and data. Just data and computing can do so much, like physics-based animations. There are just so many really cool things you can do out there that you don't want to stay in your tower; you want to read about what other people are doing. Right? Because they're doing some really cool stuff. You want to branch out.

Computer science has become, at least recently, a much more common thing in science fields. In the past, was that always the case? And how would you say physics has adapted to integrate computer coding and science?

I think it's just become more common. And computers are just so powerful now. When I was in school, we had these massive multi-parallel computer systems that took up a whole room, were so cutting edge, and cost zillions of dollars. And now a basic PC

can do that. What's funnier is that the people 20 to 30 years before me didn't have computers. So, to do the data processing for these kinds of things, they had all these amazing slide rules. What people did without computers was quite ingenious.

The slide rule was a hand-operated mechanical calculator.

They're kind of brilliant. You can do anything with them. You can get long division, exponentials, and logs.

That actually looks really complicated.

Yeah, computers are just so powerful now. They can do crazy things very easily and quickly.

Before you were interested in physics, or even after you became interested in physics, are there any other things that you find really interesting?

Yeah, I mean, I've had many hobbies. So, in undergrad, I majored in physics and math, and I minored in dance, which I guess other advice I would give people is don't put any rules on it. I don't know if you're supposed to run back and forth between ballet class, math class, modern class, and physics, but do that if you want. Who cares? In grad school, I was really into making pottery, and I remember I gave an interview to someone in grad school, and they were like, tell me about how geophysics relates to pottery. I'm like, no, it doesn't. I mean, I do pottery, and it's fun. And then I go write code, and it's fun, and it doesn't have to be some universal truth or anything. You do things that make you happy.

But there are professors out there who will say, how dare you join that theater production when you should be working on your thesis? And yeah, you want to get your thesis done, but you have to have other things that are fun and that you enjoy. And if there's anyone telling you you can't do the things you really love, they're wrong.

Just out of curiosity, how long have you been doing YPT for?

I started here in 2008, and I attended the 2009 tournament just to see it. And then the other physics teacher that was here left in 2012. And after that, I took over the team. So I kind of just watched and helped a little bit. But the 2013 tournament was, I think, the first one. Is that right? No, I took over before he left, so maybe he did 2009, and then 2010 was canceled because of snow. So maybe, yeah, I think I was involved in 2011 and 2012. Then he left after that, and I took over. And I've had various teachers help with it since then.

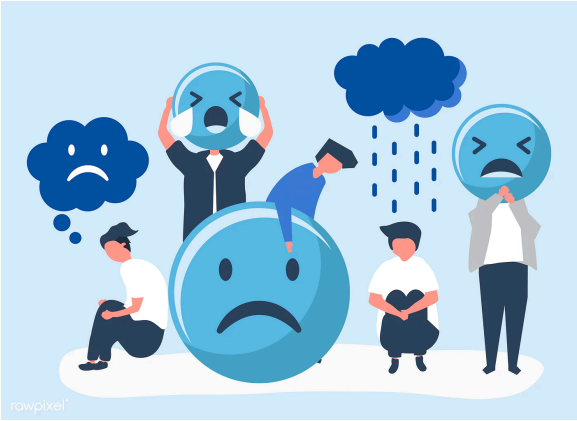
Editor's Notes:
(1) On behalf of myself and the other writers and editors, we thank Dr. Krasovec for this amazing interview!!
(2) Dr. Krasovec currently teaches AP Physics 1 and AP Physics C – MEM and is a coach for the Rye Country Day School Young Physicists Tournament team.
(3) YPT refers to the US Invitational Young Physicists Tournament (USIYPT), hosted by the US Association for Young Physicists Tournaments (USAYPT). Rye Country Day

School is a proud three-time champion of USIYPT, with victories in 2012, 2017, and 2024.

(4) The text in bold was said by the interviewer (Jaymin Ding), and regular text was said by the interviewee (Dr. Krasovec).

Seasonal Affective Disorder

Annabella Yu '26 - 12/7/23



Holidays are coming up: Diwali, Thanksgiving, Christmas, and Kwanza. But why does it feel like we can't enjoy these days to the fullest? Every day leading up to these celebrations are spent trying to catch up with the mountains of work and commitments, doing the best we can to sluggishly make our way to the end of the day, then endlessly scrolling through social media until our eyes become tired and our head spins. Finally, we end the day with no assignments finished, an exponentially growing to-do list, and waking in the morning to worry–unable to face our problems.

Could this be the effect that school has on kids today? Possibly. However, science and medicine suggest another reason for the tired episodes that happen mostly during the fall and winter seasons.

Seasonal affective disorder, or SAD (a very fitting acronym), describes the condition of a type of depression triggered by the change in seasons. (Some people are also affected by a rare branch of SAD: "summer depression" starting in late spring and early summer; ending in the fall.) Common symptoms of SAD are feelings of sadness or hopelessness, lack of energy, loss of interest in usual enjoyable activities, oversleeping, and weight gain.

To put it simply, because of the shorter, colder days with less visible sunlight, the circadian rhythm (body's internal clock) is disrupted. The circadian rhythm influences sleep cycles and hormone release, both of which are closely related to mental health.

When exposed to less sunlight, the signal for certain neurotransmitters, such as serotonin and melatonin (both playing a role in mood regulation/sleep-wake cycles respectively), will drop or rise significantly. For instance, a drop in serotonin can lead to difficulties in emotional processing, pain processing, and other important neuroprocesses. In contrast, lack of sunlight increases the production of melatonin, a hormone that causes drowsiness. Because melatonin responds to darkness, too much melatonin can lead to one feeling tired and irritable.

Other effects of chemical changes caused by changes in seasons include: purposeless physical activity (inability to sit still, pacing, etc.), feeling worthless or guilty for no apparent reason, difficulty concentrating/feeling motivated, reduced social contact, and thoughts of death or suicide. Depending on the type of SAD, there can be differences in how a person is affected. One with summer depression may have trouble falling asleep (insomnia), feeling agitated and anxious, while people with winter depression may oversleep and constantly feel tired.

Anyone can have SAD, but certain factors that may contribute to the development of SAD include a person's gender, genetic predisposition, geographic location, and age. Approximately 5 percent of adults in the U.S. experience SAD, and it lasts about 40 percent of the year. It is more common among women than men (likely due to hormonal fluctuations). A history of depression can also put one at higher risk of developing SAD. How close one is to the equator also seems to be a factor, as that determines how much sunlight a person receives. Stress is also a big contributing factor, as pre-existing stress can add onto the developing symptoms that affect sleep and mood by themselves already.

There are treatments for SAD, such as light therapy or cognitive behavior therapy (talk therapy). It is important to talk with a professional if you think you may be affected (or have friends/family) who may have symptoms of seasonal depression.

Happy holidays!

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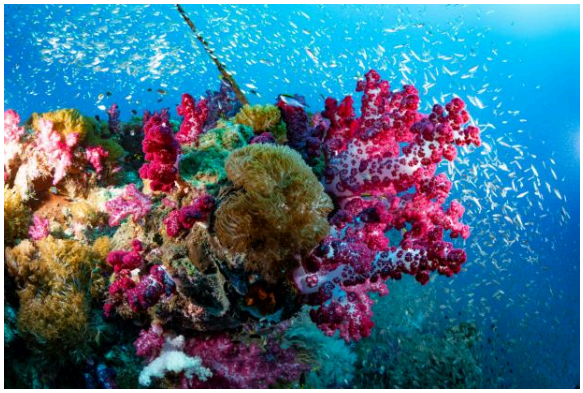
Coral Reef Crisis Summer of 2023

Josie Choi ‘26 - 12/7/23



This summer, our planet’s oceans faced an unprecedented crisis as coral reefs, the dazzling underwater ecosystems that are home to a myriad of marine life, fell victim to a devastating wave of destruction. Referred to as the “rainforests of the sea,” coral reefs play a vital role in maintaining marine biodiversity and supporting countless species. Coral reefs also protect our shorelines from hurricanes and other natural disasters. The alarming increase in coral reef killings, attributed to climate change, pollution, and harmful human activities, has ignited an immediate response from scientists worldwide.

Rising sea temperatures due to climate change have caused a phenomenon called coral bleaching, a stress response where corals lose an algae found in their tissue called zooxanthellae and turn white. This algae is crucial for their immune system so without its presence, their structure and immunity is weakened, making them susceptible to diseases. On top of climate change, pollution from plastics and chemicals, destructive fishing practices has driven these delicate ecosystems to the brink of collapse. Scientists warn that if we don’t take immediate action, we could witness the silent extinction of these keystone marine species.

Amidst the dire news, a beacon of hope shines brightly: youth have stepped up as passionate advocates for our oceans. Across the globe, young activists are promoting their opinions, organizing rallies, and leveraging social media platforms to spread awareness about the coral reef crisis. Through beach clean-ups, online campaigns, and educational initiatives, they are driving change within their communities.

How You Can Help:

1. Reduce Plastic Usage: Use reusable items and say no to single-use plastics to prevent them from ending up in the oceans.
2. Conserve Water: Use water wisely to reduce runoff and pollution in oceans and seas.
3. Support Reef-Friendly Organizations: Contribute to organizations working to protect and restore coral reefs.
4. Spread Awareness: Educate your peers about the importance of coral reefs and the actions we can take to save them.

ON MY MIND - The Acoustic Landscapes about our Ocean

Colette Sawyer '25 - 1/17/24

All cetaceans in the world rely on sound for communication and survival in the ocean. As little light penetrates the profound depths of our oceans, reliance on sight has been replaced by sophisticated adaptations to utilize sound by ocean mammals. Sound waves which can travel long distances in the ocean can help marine creatures navigate the waters, communicate with each other, detect predators, forage and reproduce. This soundscape, however, is changing. A surge in anthropogenic noise, emanating from human activities such as oil rigs and offshore wind farms, altered geophysical sources such as melting icebergs, and decreases in sound generating animals change the ocean's natural acoustic environment threatening the survival of many marine mammals. (1)

Anthropogenic noise can have a significant impact on marine mammals even in our backyard. New York State has promised to achieve a goal of full reliance on green energy by 2040. In order to do so, it has begun to build offshore wind farms. (2) The management of a successful offshore energy plant involves three main phases: construction, post-construction, and decommissioning. Construction activities require extensive boat traffic and pile driving to secure the wind turbines, substantially elevating anthropogenic noise levels in the environment. Operational wind turbines generate constant noise while their cables emit electromagnetic sound waves. Any maintenance activities introduces additional boat traffic. Decommissioning, the process of removing turbines, likewise generates abrupt and constant noise that disrupts the soundscape. In addition to increases in anthropogenic noise from construction, maintenance and decommissioning of wind farms, many of these wind farms are located in the middle of endangered species habitats such as that of the Right Whale (ref).

Indeed, this summer many whales were found beached on our shores. Conservationists wondered whether the

construction of these wind farms not only altered the soundscape of the oceans but may have had detrimental consequences on the ability of these whales to navigate the waters. (3) Although research on the exact cause of death of beached whales is difficult to do and is currently ongoing these concerns need to be evaluated. It is known that right whales communicate daily using calls at a specific frequency and many studies have shown that the noise generated by boat traffic and wind turbines are at the same frequency as these whale's calls, masking calls made by the whales themselves. (4) Other scientists have shown that constant background noise can impact migration routes, lead hearing damage and alter stress behaviors in mammals. (4)

According to the Marine Mammal Protection Act of 1972 governments must try "to prevent marine mammal species and population stocks from declining beyond the point where they cease to be significant functioning elements of the ecosystems of which they are a part." (5). Given the importance of sound for the survival of marine mammals, any changes to the 'soundscape' of our oceans should be researched and prioritized in protecting endangered species. Despite evidence that anthropogenic noise interferes with whale communication, there is a scarcity of studies defining the specific behavioral changes resulting from these disruptions. Wind energy companies contend that skepticism about the benefits of wind farms comes from politicians rather than scientists. It is therefore important that scientists have their voices heard as we try to combat the effects of climate change by showing that we are committed to research examining how these interventions will impact the natural habitat of marine mammals, especially those already endangered, before imposing interventions that can cause irrevocable damage.

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NASA experiment explores how lunar dust interacts with astronauts and equipment

Jaymin Ding ‘25 - 2/20/24

Researchers recently conducted a suborbital flight test aimed at understanding the behavior of lunar regolith, commonly known as moon dust, and its potential detrimental effects on astronauts and equipment as NASA prepares for lunar missions under the Artemis program. This experiment, called the Electrostatic Regolith Interaction Experiment (ERIE), was developed in collaboration with the University of Central Florida and focused on investigating how abrasive dust grains interact with various surfaces on the moon, including astronauts’ spacesuits and critical equipment.

ERIE was among 14 NASA-supported payloads launched aboard Blue Origin’s New Shepard rocket on December 19 from Launch Site One in West Texas. During the flight test, ERIE collected data on tribocharging, which refers to the generation of electric charges through friction, in the microgravity environment. This aspect is particularly important because the moon’s surface is highly charged due to phenomena such as solar wind and ultraviolet light from the sun. This charging phenomenon causes regolith grains to be attracted to astronauts and their equipment, creating potential hazards similar to static electricity.

The experiment involved the use of a triboelectric sensor board developed by a team at NASA’s Kennedy Space Center in Florida. This sensor board was designed to measure the positive and negative charges generated when simulated regolith particles interacted with insulators within the ERIE payload during the microgravity phase of the flight. By studying the behavior of these charges, researchers hope to gain insights into how lunar dust moves around and ultimately settles on surfaces, which can have abrasive effects and potentially block thermal radiators.

One of the major challenges highlighted by the researchers is the lack of effective solutions for mitigating the dust charging problem on the moon. Unlike on Earth, where objects can be electrically grounded

to dissipate static charges, there is no similar mechanism on the lunar surface. This presents significant challenges for maintaining the functionality of equipment and ensuring the safety of astronauts during lunar missions.

The data collected from the ERIE experiment will be crucial for informing the development of technologies aimed at addressing these challenges. For example, the findings could lead to the implementation of triboelectric sensors on rovers' wheels, allowing astronauts to measure the charges between the vehicle and the lunar surface. Ultimately, the goal is to develop innovative solutions that will help prevent lunar dust from adhering to and damaging astronaut suits, equipment, and electronics during future missions.

The successful completion of this flight test, supported by NASA's Flight Opportunities program, marks an important milestone in advancing our understanding of lunar regolith and addressing the challenges associated with lunar exploration. By rapidly demonstrating space technologies with industry flight providers like Blue Origin, NASA is paving the way for safer and more effective lunar missions under the Artemis program.

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GDF15: Every Woman's Worst Enemy

Jenny Xu '27 - 2/22/24

Morning sickness is something women of all generations have most likely experienced during pregnancy. Only now have we found an answer to this phenomenon.

Pregnancy is a miraculous journey that brings joy and excitement, but it also comes with its fair share of challenges, with morning sickness being a common and often unpleasant experience for many expectant mothers. Recent research has shed light on a potential link between a protein called GDF15 and the occurrence of morning sickness, opening up new avenues for understanding and managing common pregnancy symptoms.

Morning sickness, characterized by nausea and vomiting, is a prevalent condition that is caused during the early stages of pregnancy. While the exact causes remain unknown, hormonal changes, particularly the rise in human chorionic gonadotropin (hCG), have been traditionally linked to morning sickness. However, new studies have suggested that GDF15 might play a significant role in modulating the severity of this symptom. GDF15, or Growth Differentiation Factor 15, is a protein that plays a crucial role in regulating appetite, energy balance, and body weight. A surge of a hormone made by fetuses triggers nausea and vomiting coming from morning sickness. Subsequently, women who have naturally low levels of protein in their blood before pregnancy are more likely to suffer from a more severe form of morning sickness called hyperemesis gravidarum, a type of vomiting so severe and frequent it can lead to weight loss, dehydration, and even hospitalization and death of the fetus or mother, when hit with the rush of protein, researchers reported on December 13 in Nature.

The findings could help identify people at risk of severe illness and lead to treatments. Initially identified for its association with cancer and metabolic disorders, GDF15 has become a focal point of interest in pregnancy-related research. Up to 80 percent of pregnant people get nauseous in the early stages of pregnancy, and about half vomit- a combo of symptoms often called morning sickness. Three percent of

pregnant people will develop hyperemesis gravidarum.

Knowing GDF15's role in morning sickness can help the development of targeted therapies that will ease the symptoms and improve the quality of life of women in the process of pregnancy. Scientists are considering the possibility of fine-tuning the GDF15 levels, resulting in an improved pregnancy experience for women who are sensitive to an excessive amount of hormones. While GDF15 is potentially the main cause of morning sickness, it should be known that pregnancy-related symptoms are multifactorial and involve a complex number of hormones. It is likely that GDF15 is a protein that sends a message to other hormones like estrogen and progesterone in order to regulate the process of morning sickness. However, more research is needed to understand the intricate links between these factors.

Discovering that GDF15 is the cause of morning sickness adds a new dimension to our understanding of pregnancy-related symptoms, and along with the ongoing research and discovering the successive factors, information gathered can be used to design new programs fighting morning sickness and make pregnancy more tolerable and pleasant. The recognition of GDF15 enables us to walk closer to the goal of complete maternal care. So next time you come in contact with a pregnant woman, assure them that their morning sickness is not completely their fault, but in fact mostly their fetuses'!

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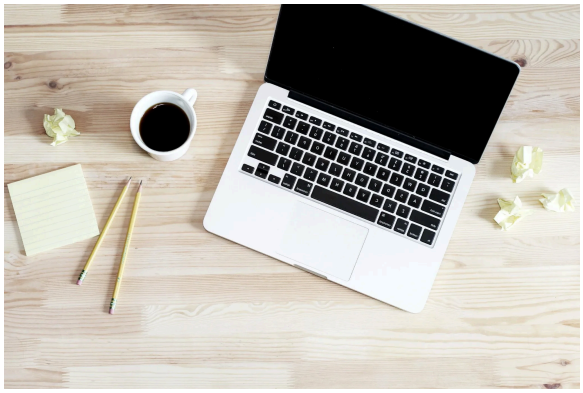
The Benefits of Note-Taking with a Pencil vs. Typing on a Computer

Aarush Dey '27 - 2/22/24



Today's world is dominated by technology, and education is no exception. Throughout history, however, learning through paper and pencil has been a standard and easy way to process information. In contrast, in the new age, note-taking by typing on computers has become the norm because of their efficiency and convenience. While typing is far easier and less time-consuming than handwriting, multiple studies have shown that taking notes by hand can help us understand and retain information much better.

Many studies have indicated that writing with a pencil involves multiple senses like sight, touch, and fine motor skills, sedating information deep within our minds and memory. This allows us to better retain information and recall information on things we have taken notes on.

Furthermore, hand-writing encourages summarization or content, to shorten the amount of physical writing required. Moreover, while taking written notes, many people take notes in the form of diagrams and drawings which often help more than bullet points.

In addition, the rhythm developed while writing activates regions of the brain associated with problem-solving and creative cognition, and the tangible nature of paper notes encourages a personal connection and ownership regarding the information being learned. On the other hand, typing is fast-paced and held within an environment with lots and lots of distractions. With links to entertainment being only a click away, maintaining constant focus is almost impossible, especially for school-age kids. Note-taking on paper makes it far more difficult to lose focus and therefore, strengthens one's attention span.

Overall, typing on a computer grants efficiency, while taking notes on paper doesn't, but instead offers multiple cognitive benefits. From understanding information on a deeper level to retaining information for a longer period of time, taking notes by hand is far superior to

typing on a keyboard. So next time you are given the choice between traditional handwritten notes and typing on a laptop, correctly weigh your options and choose wisely, taking more into consideration than just efficiency!

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