SEEKING SCIENCE

Science of Sleep

Learn about the science behind sleep and how chemicals in our body cause this psychological state! 6

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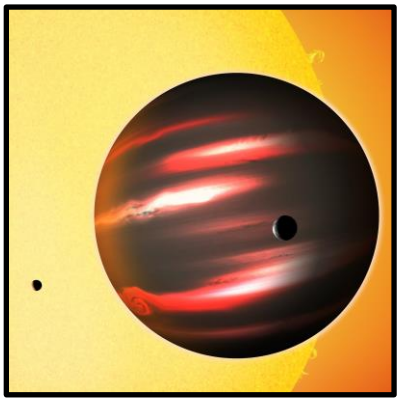
Extreme Exoplanets

Edward Huang

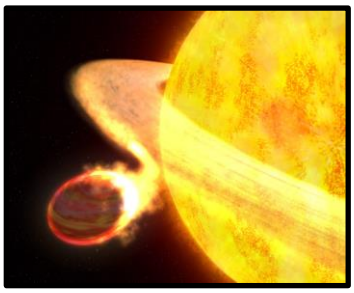
Exoplanets, planets outside of our solar system, are of immense importance to astronomists. Scientists have discovered more than 5000 exoplanets, with some being stranger than others. Here are some of the most unusual ones that astronomers have observed.

TrES-2b is a planet that is orbiting the star, GSC 03549-02811, 750 lightyears away from our solar system. Discovered in 2006, it is well known as being the darkest planet ever found. The planet's gases absorb more than 99% of all light it receives from its star. Combined with the fact that it orbits its star at only 3 million miles, it is extremely hot, over 1800 degrees Fahrenheit. To put this into perspective, the Earth orbits 93 million miles away from the sun. Like Jupiter, TrES-2b is a gas giant, and its gases are believed to be composed of sodium, potassium, and titanium oxide, resulting in its unusually high heat absorption.



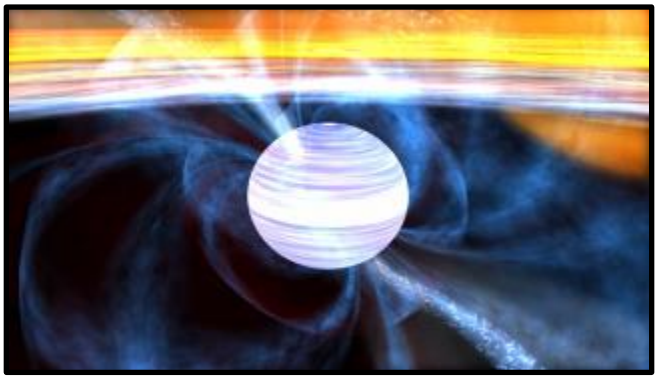
Another unusual exoplanet is WASP-12b, which is remarkably like TrES-2b. Although not as dark as TrES-2b, this planet orbits its star at only 2 million miles (about 3218688 km). Planets like WASP-12b and TrES-2b are classified as "hot Jupiters", in that they are gas giants that orbit absurdly close to their host star. Hot Jupiters like these are phase-locked, meaning that the same side of the planet always faces the star. In the case of WASP-12b, the tidal forces from the star's gravity are so strong that the planet is even

pulled into an egg shape. Additionally, the planet has one of the lowest recorded densities since the energy flux from the star causes the gases on the planet to inflate dramatically.

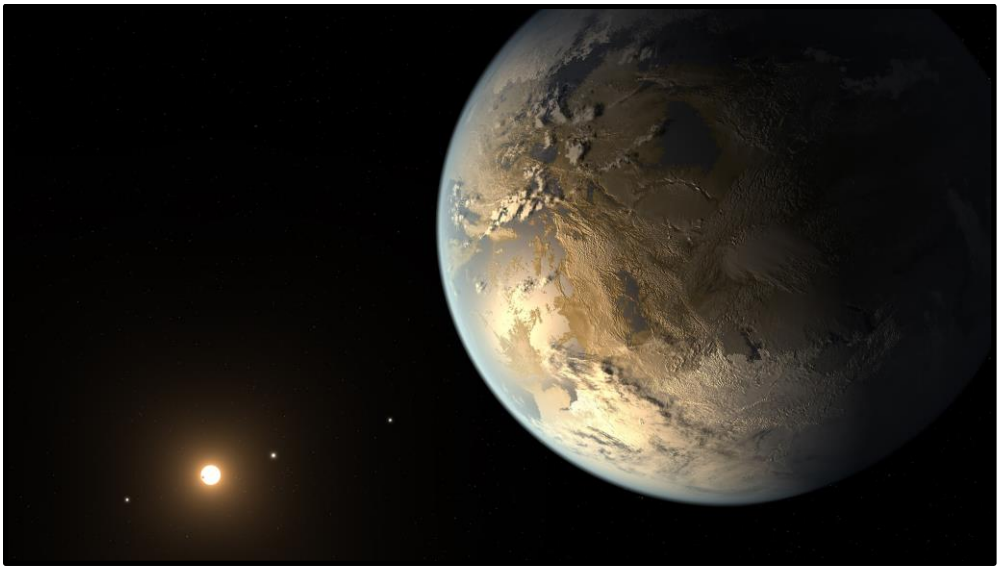


Moving on from hot Jupiters, scientists have found a planet that orbits two stars at once. Kepler-16b is known to have a circumbinary orbit, meaning that it is in a double-star system. Theoretically, one can see a double sunset if standing on its surface. This makes it like the famous fictional planet, Tatooine, from Star Wars. Unfortunately, though, scientists have deemed this planet too cold to be inhabitable, due to its cold temperatures.

CoRoT-7b is a planet believed to have a molten lava surface. It is one of the first terrestrial planets to be found, as well as one of the smallest. Despite being like Earth in its mass and rocky surface, it suffers from immense heat. Its close orbit to its star heats the planet about as hot as the filament of a light bulb. The discovery of CoRoT-7b has allowed scientists to create a new classification of planets: "lava-ocean" planets.



The strangest planet is PSR J1719−1438 b, which orbits a pulsar, a magnetized neutron star that shoots beams of electromagnetic radiation. This planet is constantly suffering from its host star's intense radiation, causing its atmosphere to deplete slowly. Scientists believe that this planet is the remnant of an old star. Additionally, this planet is carbon-based and has an extreme density. Astronomists have called it the "Diamond Planet" due to its carbon composition and density like diamond.



Lastly, astronomers have found a planet that has the possibility of sustaining life: Kepler-186f. This planet is in the "goldilocks zone", which means it is not too far nor too close from its star. Additionally, the planet has a remarkably comparable size to Earth. Its temperature is also perfect for liquid water, making it a candidate for extraterrestrial life. Although scientists do not know for sure yet if the planet's atmosphere is capable of sustaining life, they are hopeful that technology will advance enough for them to study further.

The discovery of exoplanets has allowed researchers to have a better understanding of Earth and life. Planets like Kepler-186f give scientists hope of finding life in space. In the search for extraterrestrial life, they have found thousands of wonderfully strange and diverse exoplanets. The planets previously listed cover only the beginning, and there are many more exoplanets, some even more extreme.

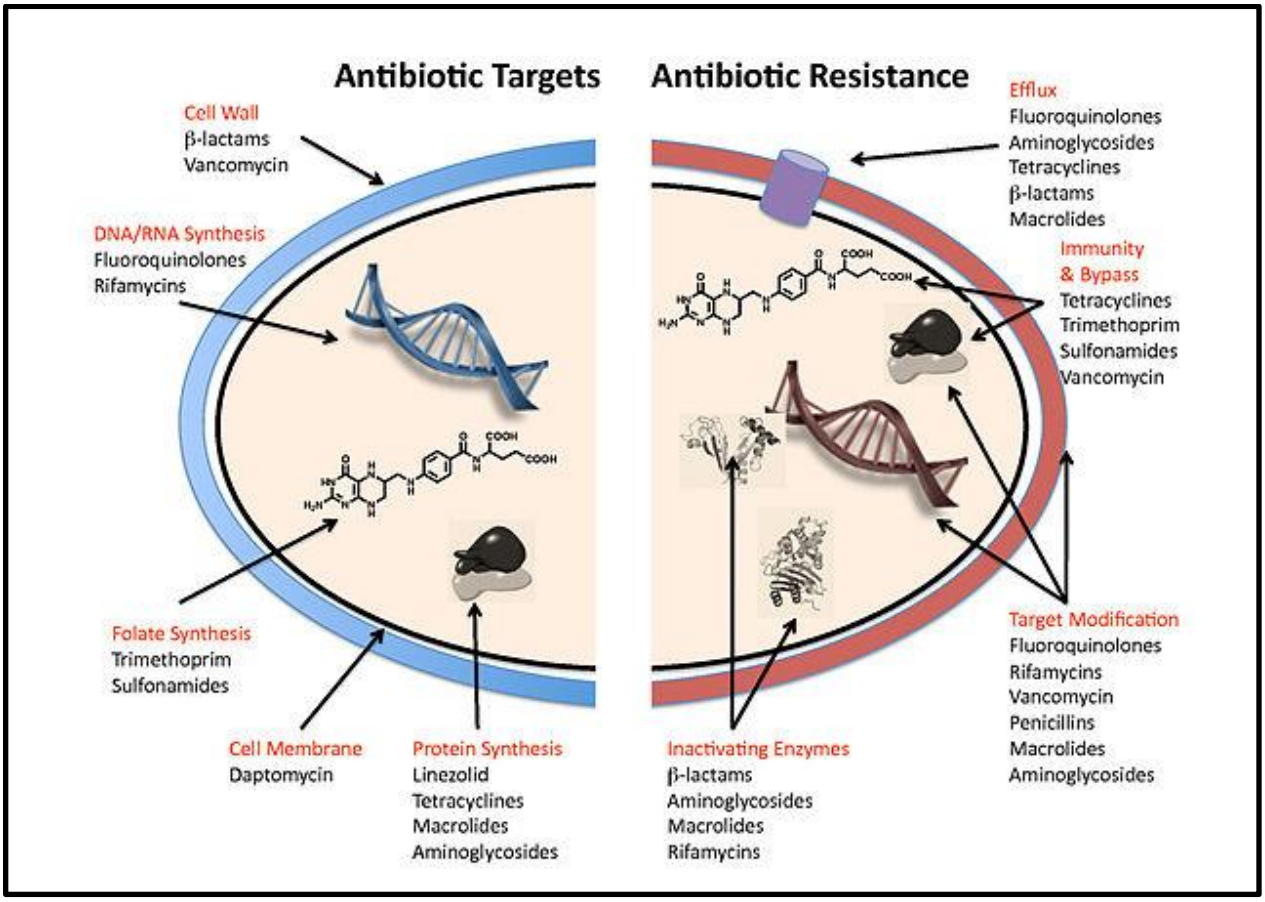
War on Bacteria

Eddie Zhang

Antibiotics: the greatest invention in human history. Before the 1930s and before antibiotics, a simple cut wound could result in an incurable infection, usually leading to death. Now, hundreds of lethal bacteria are treatable and survivable. The first antibiotic developed and used was Penicillin. From then on, antibiotic production skyrocketed and is now widely accessible by the public. However, the modern usage of antibiotics may result in its own downfall.

Antibiotic resistance is becoming a major concern to scientists worldwide. As of now, there are approximately 18 antibiotic resistant strains of bacteria and fungi. This raises alarms as these bacteria, as the name suggests, can survive antibiotics used to neutralize them.

These new strains can arise due to our modern use of antibiotics. Bacterial cells, like any other cells, have the chance to mutate, which changes their DNA and their phenotypic properties. By chance, a bacteria may pick up a gene that allows it to neutralize antibiotics. When we introduce antibiotics to the bacteria, the ones without the mutation will be killed off, leaving the resistant ones behind. The remaining bacteria then can multiply. Soon enough, most of the new population will acquire this trait and the bacteria become antibiotic resistant.



Bacteria are rapidly evolving against our antibiotics, which presents a dangerous problem that can affect many aspects of society. Our modern use of antibiotics goes beyond treating diseases in humans. Antibiotics are used in agriculture, aquaculture, oil production, food, and more. This makes matters worse, as more use means more evolution and natural selection, leading to even more antibiotic resistant strains.

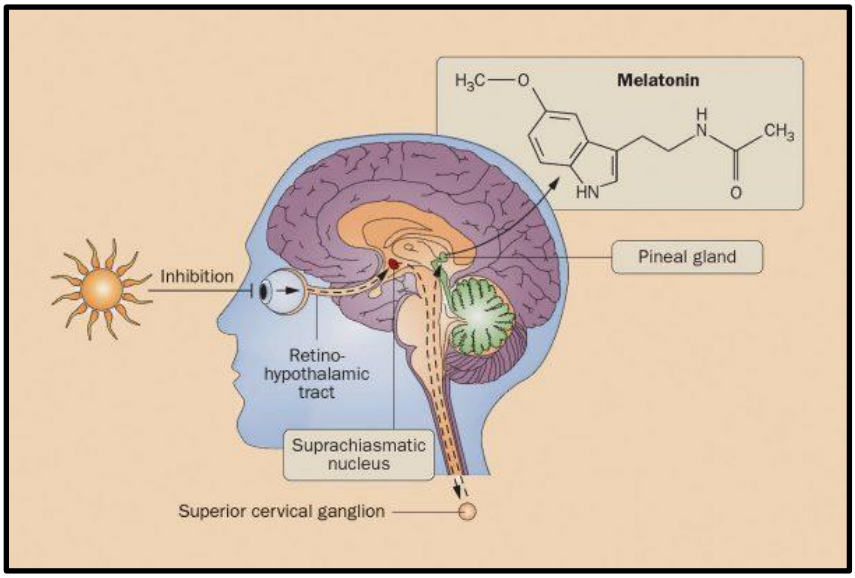
This is not only limited to antibiotics, however. Pesticide resistance follows a similar pattern of emergence. This further deepens the crisis of modern-day healthcare, and if a solution is not found soon, we might lose the war on bacteria.

The Science of Sleep

Cathie Zhu

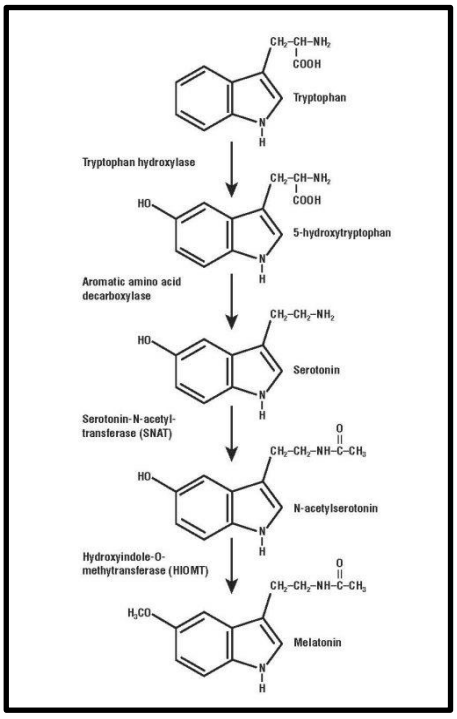
Why do teenagers find it difficult to wake up early? Why are more schools opting for later starting times? The science of sleep may provide the answers to these questions.

Our bodies have internal clocks, called circadian rhythms, which are responsible for releasing certain chemicals throughout the day and encouraging us to do certain activities at certain times. A crucial chemical involved in this routine is melatonin, a hormone that plays a role in sleep. Melatonin levels increase and peak in bodies throughout the night, signifying a body's need for sleep. By morning, the amount of the chemical decreases, allowing for a refreshed body when awoken. A person's 24-hour sleep schedule is maintained by their body's translation of the time of day into melatonin production. When the eye's retina is exposed to light, a signal is sent from the retina to the suprachiasmatic nucleus in the brain, which causes us to feel awake. The suprachiasmatic nucleus sends signals to other parts of the brain that control hormones and body temperatures. The signals then travel down the spinal cord and back to the pineal gland, where melatonin production takes place. This process prevents melatonin production during the day. However, when it is dark outside, the retina is unable to send the signals, and the pineal gland continues to produce melatonin.



Melatonin itself is derived from an amino acid called tryptophan, which is absorbed from the bloodstream to the pineal gland. Amino acids are organic acids that are the building blocks of proteins. The synthesis of melatonin from tryptophan occurs through a multistep process. Tryptophan is first converted to 5-hydroxytryptophan, another amino acid, by the enzyme tryptophan hydroxylase. It is then converted again to a brain chemical called serotonin by an enzyme named aromatic amino acid decarboxylase. Enzymes are biological catalysts that speed up the rate of chemical reactions. Serotonin's conversion to melatonin includes two enzymes: serotonin-N-acetyltransferase (SNAT) and hydroxyindole-O-methyltransferase (HIOMT). Both enzymes begin their activities soon after the start of darkness. The amount of melatonin produced is reliant on SNAT, which peaks when it is dark outside. However, SNAT is phosphorylated at night. Phosphorylation, the addition of a phosphate group to a protein or other organic molecule, prevents SNAT from being degraded and therefore increases melatonin production. The opposite of this process occurs in the morning, allowing a person to feel ready to begin their day.

The discovery of the chemistry of sleep aided scientists' realization that it truly is harder for teens to wake up early than adults. In teens, melatonin is produced about three hours later in the 24-hour sleep cycle than in children or adults. Teenagers are kept up later due to this, and when awoken early, SNAT is still active and producing melatonin, leaving them feeling sleepy during the mornings. They typically require nine hours of sleep nightly, but due to their late bedtimes and early school start times, they average around seven hours of sleep per night. Their lack of sleep causes them to feel drowsy, affecting their attention span in class. The Minneapolis Public School District changed its start time from 7:15 a.m. to 8:40 a.m. and discovered students averaged more than five extra hours of sleep each week, with increased rates of attendance as well. Furthermore, the number of car crashes involving teenagers in Fayette County, Kentucky, decreased by almost 17% two years following later school start times, proving the benefits of shifting school start times to later in the morning.

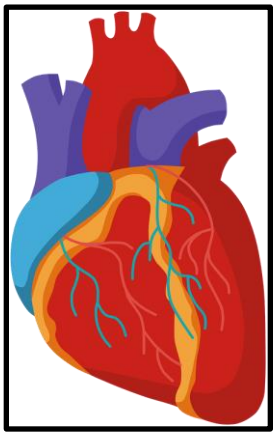


Balancing the biological sleep schedule of teenagers with the demands of society may be difficult. However, increased districts are considering changing the starting times of schools to later. This understanding of chemistry allows society to realize what needs to be done to improve teens' lives.

How Organ Donations Work

Cody Duan

In 2021, more than 40,000 organ transplants were performed. Anyone can be an organ donor of the heart, lung, liver, kidney, and much more. An organ transplant is when a healthy organ of a person is removed, to replace a failing organ of another person. Organ donors can be deceased, alive, old, or young.



Organ transplants are extremely complicated. First, the organ must be transported from the donor within a certain time limit. The heart, lungs, and kidneys all have their own time limits that must be taken into consideration. Sometimes, the body will reject the new organ, so much research must be done to find the right organ. Such research would include finding people with the same blood type, tissue type, organ size, and distance from the donor.

There are two ways of getting an organ donor. Those in need of an organ transplant are put on a waiting list. Once there is an organ donor, the person at the top of the list will receive the organ. The other way is to find a friend or family member to donate an organ. Sometimes, people are willing to donate organs to those they do not know, so some will advertise on social media, looking for a donor.

An organ rejection only occurs 10-15 percent of the time. Although it is uncommon, it is still a frequent problem. These people will be put on medicine for the rest of their life, which will suppress the immune system, thus stopping the rejection.

Those who successfully receive organ transplants will have their lives extended by about 10 years. The donor does not benefit from donating an organ, but they will know that they have saved a life due to their sacrifice.

Recollection and Recognition: Memory

Arthur Liang

Ever wonder how the brain can store your experiences, knowledge, and skills, and allow you to retrieve these thoughts in the blink of an eye? Your brain does this through memory. Psychologists have produced a modal model to describe memory, which divides memory into 3 separate areas: sensory, short term, and long-term memory.

Sensory memory is the immediate memory of information coming in from your senses. If the information coming in is visual, it is iconic, and if it is auditory, it is echoic. Sensory memory only lasts for a few seconds, constantly being replaced with new input. Information from sensory memory can then be transferred to short-term memory through attention.

Short-term memory can hold information for up to a minute. Items in the short-term memory can be maintained by rehearsal. There are 2 types of rehearsal, maintenance and elaborative. Maintenance rehearsal is a simple repetition to keep something in short-term memory. For example, you can repeat a phone number over and over to remember it. Elaborative rehearsal involves understanding and organizing information to keep in short-term memory. Both types of rehearsal are effortful processing, where we make a conscious effort to remember something. Automatic processing is unconscious remembering when we are engaged in well-practiced skills, like how to ride a bike. Items in short-term memory may be forgotten or encoded into long-term memory. Items are forgotten through decay or are replaced by added information.

When items are encoded into long-term memory, it becomes a lasting memory, capable of being remembered for your whole life. Information in this store is primarily semantically encoded (encoded in the form of word meanings), others can be visually or acoustically (sound) encoded. Information in long-term memory is either episodic memory (memory of experiences), semantic (knowledge), or procedural (skills and habits).

Recalling memories in long-term memory can be context-dependent (recalling info in a similar environment to where you learned it) or state-dependent (info learned while drunk is more likely to be remembered while drunk). In your brain, long-term memory is stored in a network of neuron nodes, and while looking for a memory, nodes that activate will trigger nearby nodes, which then trigger more nodes, causing a spreading effect. The stronger a connection to a memory, the stronger that node's connection to other nodes is, the easier the activation can travel, and the easier you can access that memory.

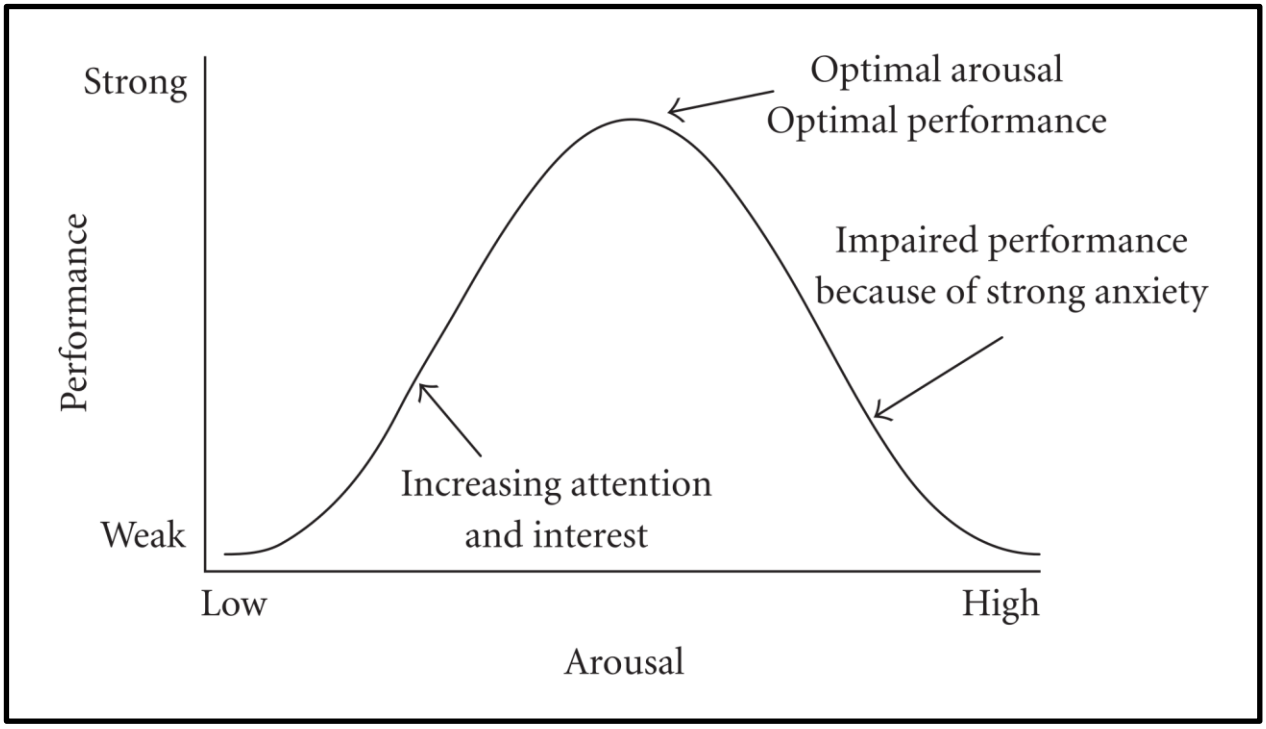
In conclusion, memory can be divided into sensory, short-term, and long-term. Sensory is short-lived memories of sensory info. Short-term info lasts a bit longer, which can then be encoded into long-term memory. Long-term memory is near-permanent and can be accessed by thinking about the context or state you learned the information from. Nodes in your brain fire in a spreading pattern that can easily access memories with stronger connections. Memory is an important part of human intelligence, so hopefully, the information you learned here will get encoded into your long-term memory.

Scored by Mentality

Brian Wang

Why do we do better on tests when there are little to no nerves about them? Should we even study at all? Well, it is in part due to the Yerkes- Dodson law. According to this theory, different situations occur depending on the amount of pressure a person experiences. There is an optimal level of attention for varying difficulties of tasks.

Due to the nature of our minds, we tend to work better under higher levels of arousal when the given task is undemanding. When we work with a small amount of arousal, our preference is that the duty at hand is tough. By plotting these properties, a graph of a curve is produced, and according to this curve, the performance lowers when the arousal is too low because the person is only interested in the topic.



On the higher end of the spectrum, performance decreases due to anxiety, which makes the most optimal level of presentation and arousal is directly in the middle, which explains why we tend to do better on tasks when we are not nervous about them.

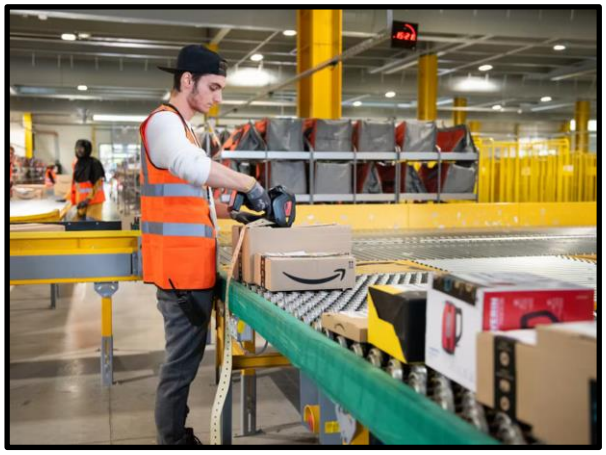
If, for instance, someone was to participate in an athletic competition, their best performance is displayed when they are intrigued about the subject. The more prepared a student is for the race, the more attention they gain. During an entrance exam for a super prestigious school someone wants to go to, they must learn to prepare for the test and lower their anxiety to a medium level for their best attempt. Any exhilaration too elevated or too shallow can worsen the presentation.

What does this all mean? Well, this law posits valuable information for students. We must learn to control our tension during an extremely important or nerve-wracking assignment. Not only should we prepare our crystallized knowledge, but we should also account for our mental levels. Therefore, yes, we should study, but only to an extent.

The Hawthorne Effect

Ethan Chen

In psychology, the Hawthorne Effect is the name given to a phenomenon where people or animals act differently when they are aware of being observed. For instance, a worker in a factory may put more effort in if they know a supervisor is watching their performance. This effect, however, is usually temporary. In the famous experiment conducted at Western Electric's Hawthorne Works, employees' productivity increased any time researchers were present. After the researchers completed their experiment and stopped observing, productivity immediately went back down.



In research, the Hawthorne Effect has the strongest impact on the results of experiments. The main psychological effect at work here is demand characteristics. This is when subjects of an experiment believe that researchers are looking for a certain result. Their behavior can change silently and subtly during an experiment to help the researcher achieve their results, which skews the data.

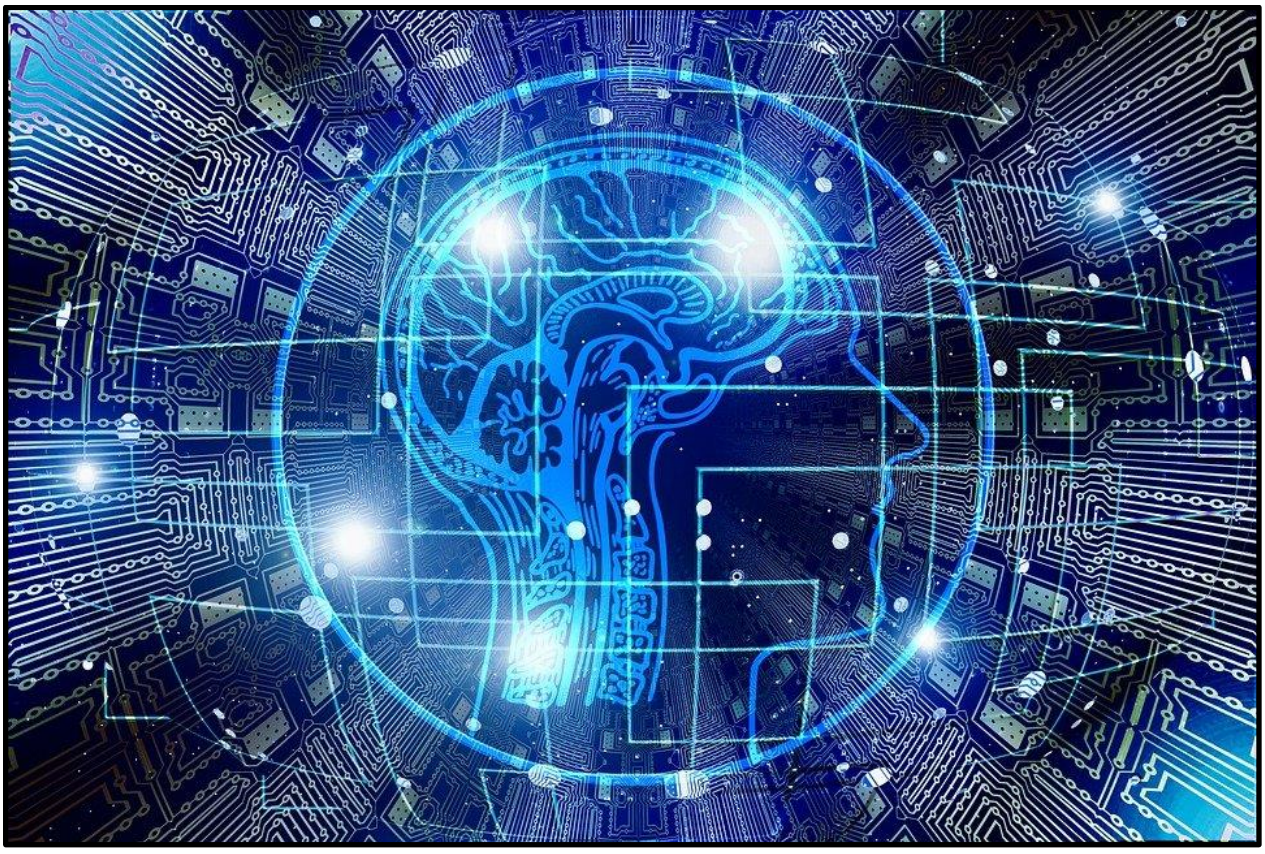
Due to the detrimental effects of the Hawthorne Effect on research, psychologists try a myriad of methods to limit it. To do this requires limited to no intervention of the subjects involved so that they are unaware of being observed. One of the ways to achieve this is through naturalistic observation. With this method, researchers record data by going out to the natural environment of their subjects instead of bringing the subjects to a lab. For example, a biologist researching monkeys could go to jungles to observe monkeys' behavior, instead of having monkeys brought into a lab.

In addition, secrecy can also be a part of eliminating the impact of observation. By making subjects unaware that they are a part of an experiment at all, by either not informing them of its purpose or observing them clandestinely, the risk of a Hawthorne Effect is close to zero. On the other hand, ethical issues and implications are brought up when subjects are secretly made part of an experiment. Due to the nature of observation, subjects can never provide permission to be observed. Despite this, scientists often continue to use these procedures in their studies, as limiting the Hawthorne Effect is vital to the creation of effective research.

The Process of Creating AI

Stephen Hung

Artificial intelligence is a new and developing technology. Artificial intelligence, also known as AI, is where machines can perform complex tasks that typically require human intelligence. Examples of artificial intelligence are self-driving cars, which are cars capable of driving themselves without human intervention. Developing an artificial intelligence may sound difficult and complicated, but anyone with programming experience can do it.



The first step to creating an artificial intelligence program is to identify what the artificial intelligence program is going to solve. This may vary from identifying the text in an image to making a car capable of parking itself. Identifying what the artificial

intelligence program is going to do is crucial because without knowing what exactly the program is going to do, it will make the development process much more tedious and complicated.

The second step to creating artificial intelligence is to get data that the program will use. There are two distinct kinds of data which are structured and unstructured data. Structured data is in a specific format, whereas unstructured data comes in the form of audio, an image, or similar things. The data must be organized so that it can be used in the code. A lot of time is spent cleaning the data.

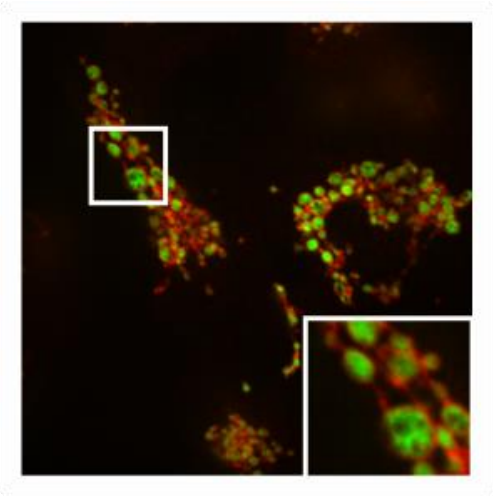
The third step is to develop an algorithm to find a pattern within the data that could be applied to other data sets. There are many different algorithms that can be used, and the main 2 ways of learning are supervised learning and unsupervised learning. Supervised learning has many algorithms that are already available for supervised learning such as logistic regression, Bayes classification, and SVM. Supervised learning can be separated into two distinct categories such as classification and regression. Classification is a type of algorithm used to separate data into various categories. Regression is a type of algorithm used to determine the relationship between an independent and dependent variable. Supervised learning usually returns some sort of value. In unsupervised learning, there are three main tasks which are clustering, association, and dimensionality reduction.

Finally, train the algorithm and fine-tune the program until you get the desired outcomes. AI is an incredibly unique type of programming and people interested in computer science should investigate building AIs for recreational purposes.

Proteins and Parkinson's Disease

Arthur Liang (community report)

As scientists work towards finding a cure for Parkinson's disease, they focus on mitochondria, the powerhouse of the cell. The health of mitochondria is maintained through a system that includes processes such as fission (one mitochondrion splitting into two) and fusion (two fusing into one). When there is a problem with fission, neurodegenerative diseases like Parkinson's will arise. For years, scientists have known about a protein called DRP1 that can regulate mitochondrial fission, but little was known about how to control DRP1. Recently, UCLA investigators have found added information about the mechanisms controlling DRP1, advancing the fight against Parkinson's and other related diseases.



Researchers have found that there is a protein found in humans called CLUH, that acts to attract DRP1 to mitochondria and trigger fission. Experiments were conducted on fruit flies that were genetically engineered with Parkinson's disease, in which they increased the amount of a protein in the flies that scientists call "clueless" (The fruit fly equivalent of CLUH). What they found was that the damage from the disease could be completely reversed. Disruptions in fissions are behind the cause of a lot of other important diseases such as cancer, diabetes, heart disease, and developmental defects. Advancements in DRP1 could be revolutionary in fighting these diseases.

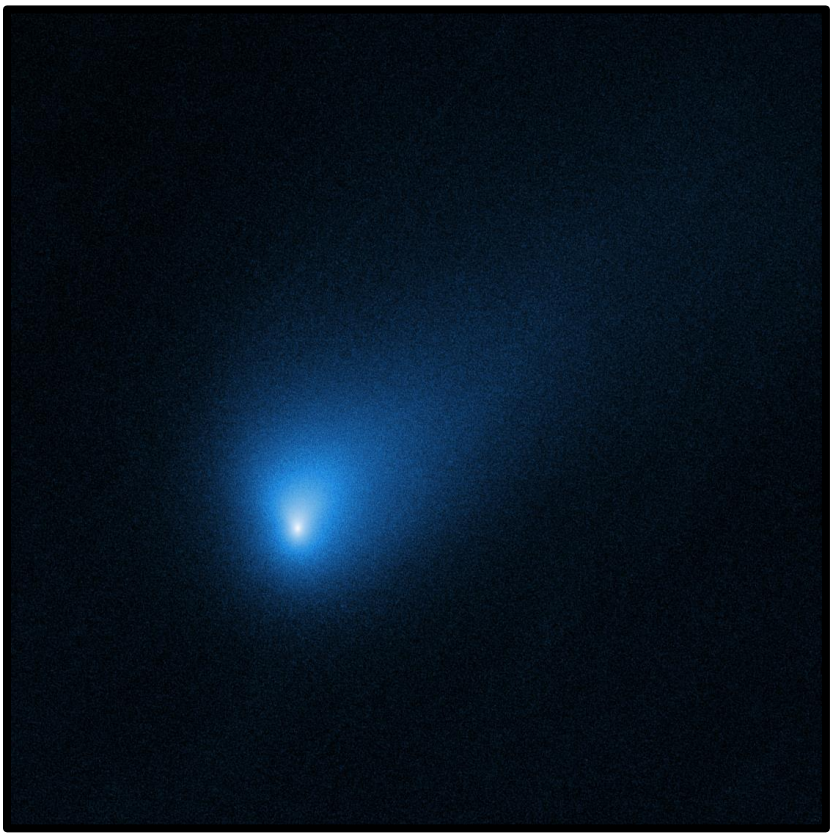
Going more in-depth about the fruit fly experiment, scientists found that fruit flies that lacked clueless had long mitochondria while the ones which had large doses had

fragmented mitochondria. Too little clueless would lead to too little fission, too much clueless would lead to too much fission. They also found that fruit flies that were genetically modified to lack cluelessness could live 4 times longer when the protein was added. Clueless and CLUH both recruit free-floating DRP1 proteins to attach to the mitochondria, and CLUH has also been found to increase the number of DRP1 receptors in the mitochondria. More receptors equal more DRP1 proteins that can attach to trigger fission. Scientists hope to find a mechanism with such precision that it only affects Parkinson's disease, so patients can receive maximum benefits.

Ancient Comet Heading Our Way

Arthur Liang (community report)

A comet 80 miles across (twice the size of Rhode Island) is heading our way at 22,000 miles (about 35405.57 km) per hour from the outer solar system. It is in no danger of hitting us, but it will be seen in around 2031. Comets are icy bodies tossed out of the solar system by the gravity of the outer planets, that reside in a reservoir of comets surrounding the solar system called the Oort Cloud. Comets are made of a solid nucleus of ice and dust that can have tails millions of miles long. This comet has the largest nucleus ever seen by astronomers. UCLA researchers determined its size using the Hubble Space Telescope, finding that it is 50 times larger than most known comets, with an approximate mass of 500 trillion tons. In a few million years, the comet will loop around the sun back to the Oort Cloud.



The comet was first discovered in 2010 and has since been intensely studied by ground and space telescopes. The challenge in measuring the size of the comet was how to determine the nucleus from the coma, a cloud of dust and gas covering it. UCLA researchers made a computer model of the comet from Hubble images and then subtracted the glow of the coma. They found that the comet has a darker surface than initially thought, as black as coal.

The comet has been falling towards Earth for 1 million years, flung back toward the sun due to its orbit being disturbed by the gravity of a passing star. Though there is evidence of the Oort cloud's presence and the trillions of comets that make up it, it remains a theory because the comets are too faint and far away to be seen directly. The solar system's largest structure remains invisible to us.

New Materials Inspired by Squid Skin

Annabella Luo (community report)

Researchers in the Department of Chemical and Biomolecular Engineering at the University of California, Irvine have invented a squid-skin inspired material that can wrap around a coffee cup to shield sensitive fingers from heat. They have also created a method for economically mass producing the adaptive fabric, making possible a wide range of uses such as insulated beverage cups, restaurant to-go bags, parcel boxes and even shipping containers.

The innovation is an infrared-reflecting metallized polymer film developed in the laboratory of Alon Gorodetsky, UCI associate professor of chemical and biomolecular engineering. In a paper published today in Nature Sustainability, Gorodetsky, and his team members describe a large-area composite material that regulates heat by means of reconfigurable metal structures that can reversibly separate from one another and come back together under different strain levels.

The metal islands in the new composite material are next to one another when the material is relaxed and becomes separated when the material is stretched, allowing for control of the reflection and transmission of infrared light or heat dissipation. The mechanism is analogous to chromatophore expansion and contraction in a squid's skin, which alters the reflection and transmission of visible light. Chromatophore size changes help squids communicate and camouflage their bodies to evade predators and hide from prey. By mimicking this approach, "tunable thermoregulation" is enabled in the new material, leading to improved energy efficiency insulation capability.

A key breakthrough of this project was the UCI researchers' development of a cost-effective production method of their composite material at application-relevant quantities. The copper and rubber raw materials start at about a dime per square meter with the costs reduced further by economies of scale, according to the paper. The team's fabrication technique involves depositing a copper film onto a reusable substrate such as aluminum foil and then spraying multiple polymer layers onto the copper film, all of which can be done in any batch size imaginable.

The developed strategy and economies of scale should make it possible for the composite material to be used in a wide range of applications, from the coffee cup cozy up to tents, or in any container in which tunable temperature regulation is desired. The invention will be environmentally friendly since composite material can be recycled in bulk by removing the copper with vinegar and using established commercial methods to repurpose the remaining stretchable polymer.

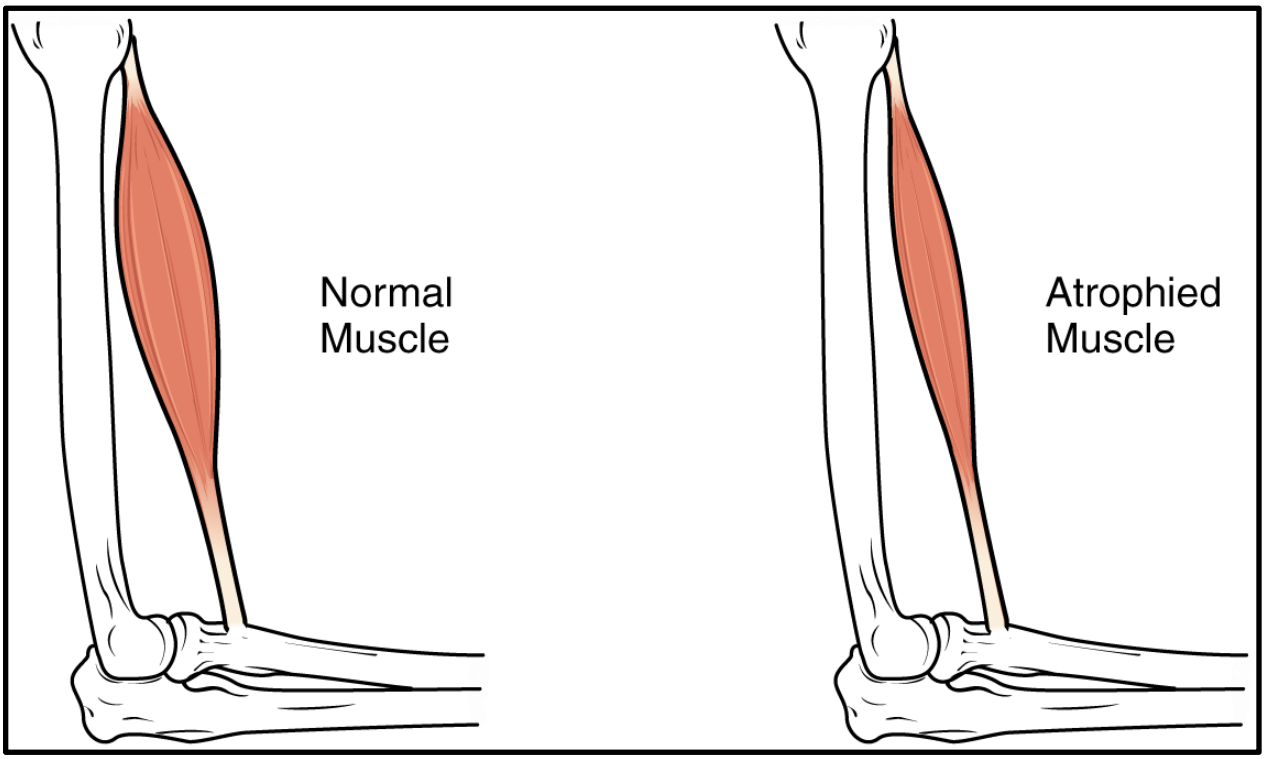
Muscle Dystrophies

Annabella Luo

Muscle Dystrophies are a group of genetic diseases that cause muscle weakness over time and loss of muscle mass. This kind of disease is caused by a mutation in the genes which leads to muscle degeneration. In types like Duchenne and Becker, the DMD gene is mutated. The DMD gene regulates the production of the protein called dystrophin which helps stabilize and protect muscle fiber. In the Facioscapulohumeral type (FSDH), the mutation occurs in the long (q) arm of chromosome 4. The disease results from changes in a region of DNA near the end of the chromosome known as D4Z4. Other specific genes can be mutated to affect certain muscle regions like in the hips or shoulder. Like many other diseases that humans are aware of, there are multiple classes in which the disease can be categorized in. For example, the most common kind of muscle dystrophy is the Duchenne type. The Duchenne type is the generic form, which typically begins in early childhood and is much more common for boys rather than girls (girls can be carriers but will be mildly affected). Symptoms include frequent falls, difficulty rising from a lying or sitting position, trouble running or jumping, a waddling kind of walk, walking on the toes, large calf muscles, muscle pain and stiffness, learning disabilities, and delayed growth.

Another form of muscle dystrophy can be the Becker kind, which has similar symptoms and signs to Duchenne. However, the disease can be milder and more prolonged over a period. Myotonic muscle dystrophy is quite common among adults and is characterized by the inability to relax muscles after contractions. Symptoms can include weakness in the face and neck muscles, where people would have long, thin faces with drooping eyelids and swan-like necks. Facioscapulohumeral, also known as FSDH, is muscle weakness typically beginning in the face, hip, and shoulders. A side effect includes

the shoulder blades sticking out like wings when the arms are raised. This form of muscle dystrophy can start in childhood to even 50 years old.



Congenital muscle dystrophy affects both boys and girls around age 2 and below. It can either progress slowly and mildly affect their disability or progress rapidly and cause severe impairment. Limb-girdle muscle dystrophy is where hip and shoulder muscles are affected and is characterized by abnormal growth of the calf muscle. People typically have trouble lifting the front part of the foot, tripping frequently. This type occurs in childhood or teenage years. Although there is no actual cure for muscle dystrophy, there are treatments that can help extend the time a person with the disease can remain mobile and can help with the heart and lung muscle strength. There are medications like corticosteroids (prednisone and deflazacort), which can help with muscle strength and delay the progression of muscle dystrophy. However, long use of this drug can cause weight gain and weakened bones, increasing fracture risk. Other drugs like Eteplirsen are used specifically to treat people with the Duchenne disease. There is also Golodirsen, which was approved in 2019 by the FDA. Patients can also do therapy to improve quality

and sometimes the length of life in people with muscular dystrophy. Muscular dystrophy is still a disease that is yet to be cured; application of the study of gene and genome modification may lead to potential treatment in the future.

UCLA Alumni Goes to ISS

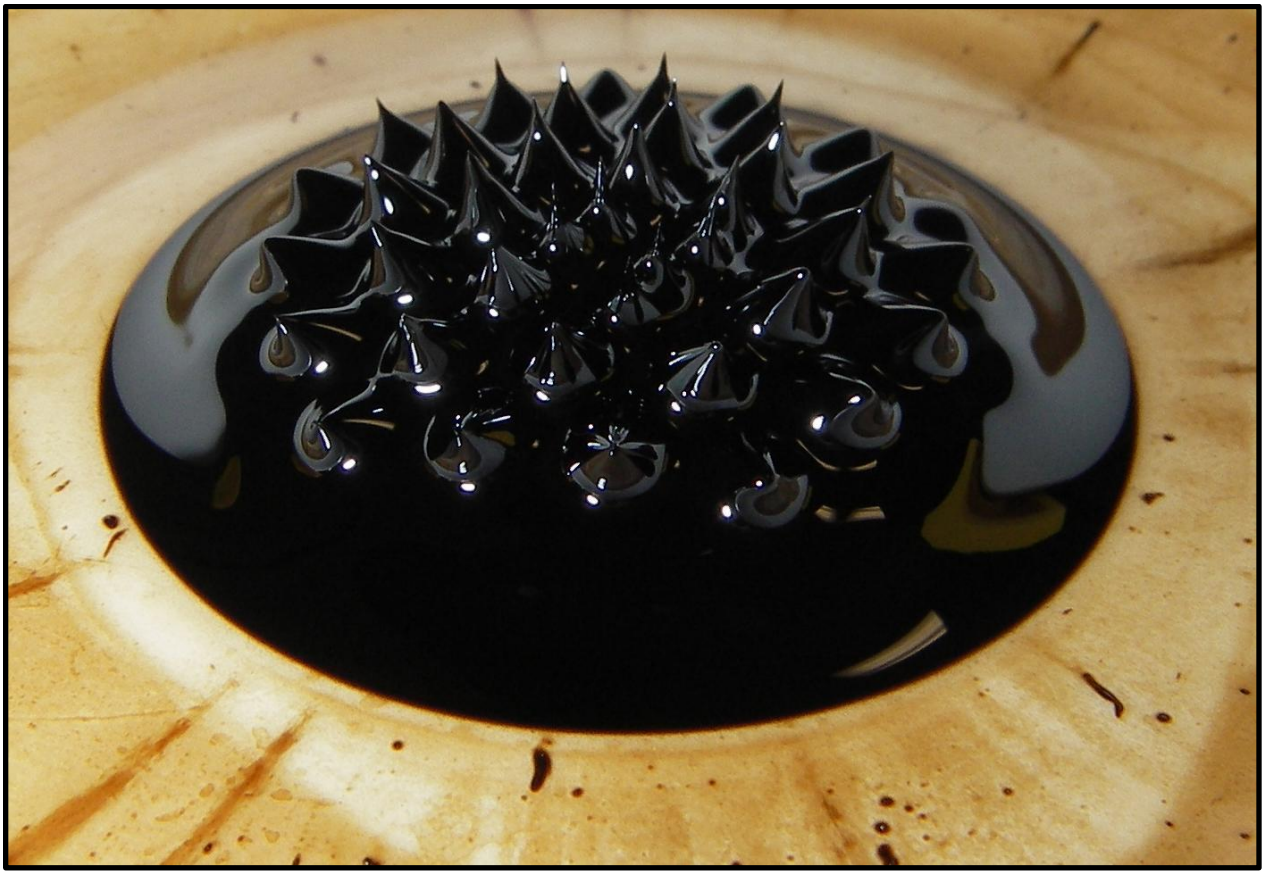
Annabella Luo (community report)

Jessica Watkins, who earned a doctorate in geology from UCLA in 2015, will spend six months on the International Space Station (ISS) as part of NASA's SpaceX Crew-4 mission. Watkins, a mission specialist, will monitor the spacecraft during the flight's launch and re-entry and serve as a flight engineer once she arrives at the space station. Her first trip into space is scheduled for April 20 at Kennedy Space Center in Florida. The ISS is a modular research laboratory that was launched in 1998 and has been continuously occupied since 2020. It orbits the Earth at an average altitude of 248 miles and a speed of about 17,500 miles (about 28163.52 km (about 17500 mi)) per hour, completing 15 1/2 orbits per day. Watkins will be the first Black woman to complete a long-term mission on board.

Creating Liquid Magnets

Kenny Wu

Ferrofluid is a magnetic fluid made of nanoparticles suspended through Brownian motion. This fluid was invented by Steve Papell, a scientist at NASA, who was tasked during the early 1960s to create a liquid form of rocket fuel by NASA, However, this invention would prove to be especially useful in countless other industries as well.



For starters, ferrofluid is just a stable suspension of a magnetic iron compound. However, the iron compounds must first be prepared as nanoparticles, and coated with surfactant to keep them stabilized. The first step is to create the magnetite which is a mixture of Fe^{3+} and Fe^{2+}, but to make the magnetite form as nanoparticles, concentrated

ammonia will also be required along with extreme stirring. This is because faster stirring is equivalent to smaller particles, it also means that more Fe^{3+} will be formed from Fe^{2+} being oxidized and adjust the balanced ratio of $2Fe^{3+}$: $1Fe^{2+}$. A great way to avoid breaking this balance would be to start off with the ratio of 1.7 Fe^{3+} to Fe^{2+}; this ratio allows the Fe^{3+} to join with the extra Fe^{3+} formed.

After the mixture is complete, a type of soap named Ammonium oleate stirred was added along with more concentrated ammonia to completely stabilize the nanoparticles. Once the result of the stirring has been stable, Dilute Muriatic Acid (Separate out the magnetite) will be appended to it. As a result, the nanoparticles will be required to be completely filtered out, and it will be the "ferro" part of the ferrofluid. There are two types of ferrofluid, water-based or oil-based. Assuming it is an oil-based ferrofluid, a preferable solvent would be kerosene as it evaporates slower than some other solvent. The magnetite will go through suspension after the kerosene is introduced since the nanoparticles are not soluble in solvent but are small enough to be easily disseminated. The result of this is a stable suspension known as a colloid. Accordingly, a stable complete ferrofluid is created.

In conclusion, ferrofluid is a fascinating fluid to play around with but to make genuine ferrofluids instead of random DIY magnetorheological fluids could be challenging and notice that any physical interaction with ferrofluid is considered dangerous.

The Detriment of Climate Change

Aidan Hong

Elevated temperatures. Rising sea-levels. Increased droughts and heatwaves. These are examples of the damage climate change can cause. Climate change, also known as "global warming," is a natural process where temperature, rainfall, and other elements take a drastic change when compared to the last decade. Despite having a drastic impact on Earth, it is still possible to mitigate its damage.

Climate change has already left its mark on Earth. According to NASA, Earth's Sea level has risen 102.3 millimeters (about 4.03 in) since 1993. This is caused by an increase in greenhouse gases. Greenhouse gases trap heat inside Earth, leading to a temperature increase of 1.1° Celsius since the 1800s. As a result, polar ice caps melt, leading to rising sea levels. At this rate, the Artic would become ice-free by mid-century.

Temperature is not the only element altered by climate change. According to a study by NASA, droughts would become more intense and precipitation patterns would change. In addition, hurricane intensity and duration would change as well. The chances of a major hurricane, which is classified as a category 3 hurricane or higher, have risen to 40%. All these effects would drastically impact society negatively.

Climate change has not only impacted the environment, but it has had a significant impact on the economy as well. To help combat climate change, developed countries pledged to donate $100 billion to undeveloped countries to aid the battle against climate change. According to research conducted by the United Nations, switching to an eco-friendly economy could raise $2.8 trillion. This is achievable through carbon price revenues, as well as redirecting investments in fossil fuels to public investments. Shifting

to a green economy could yield a gain of $26 trillion by 2030, with minimal disruptions to business operations.

Although the impact of climate change seems drastic and dangerous, some actions can be taken to mitigate the impacts. Since emissions increase greenhouse gases, conserving energy can reduce emissions. Instead of driving a car, riding a bike, or taking a walk could also greatly reduce emissions. As a bonus, biking and walking also improve fitness and health. Food also plays a role in reducing emissions. By eating more plant-based foods, you can reduce emissions. Reducing food waste will help with emissions as well.

Everyone has heard the terms "reduce, reuse, and recycle." However, there is also "repair." The right-to-repair movement calls for the right to repair electronics. More electronic manufacturers lock down their devices, restricting repairs to only the original company. The longevity of devices can be extended if consumers are allowed to repair

their own devices. As a result, there will be a decrease in mining for essential computer parts. This can benefit climate change positively.

Climate change has left a massive impact on society. From rising sea levels to more violent hurricanes, climate change has proven its danger to humanity. However, numerous actions can be taken to reduce climate change. No action is too small to help the climate, and together, we can mitigate the impacts of climate change.

Research Done on Monkeys

Nick Li

Kyoto University's Primate Research Institute has been studying primates' biological, behavioral, and socioecological aspects since the end of World War II. On June 1, 1967, it was founded by two research groups who wanted to expand the study of primatology in Japan. The field study of nonhuman primates and their natural habitats was started by a group from Kyoto University, while the experimental study of nonhuman primates in Japan was started by a group from Tokyo University. In many ways, the two groups were diametrically opposed, but they worked together to institutionalize the study of nonhuman primates.

The institute is currently housed in Inuyama, Aichi Prefecture, and consists of a 5-story main building that houses the administration office, library, and research departments; a 3-story building for the Center for Human Evolution Modeling Research; a 5-story Ape Research Annex; and a guest house for visiting scientists.

The Ai project, housed in the Ape Research Annex, is a research program that continues to study and understand chimp cognition through computer interface experiments to this day. Ai is a female western chimp who was born in West Africa's Guinean Forests.

Born in the wild, Ai was captured and sold to KUPRI (Kyoto University's Primate Research Institute) in 1977 by an animal trader. She was the first subject of KUPRI's chimp project, which was meant to be Japan's first ape-language study in the tradition of previous ape-language studies. KUPRI now has an outdoor chimp complex called the Ape Research Annex, which includes an 8-meter-tall tower with river and trees, as well as 14 other chimps. In addition to studying the chimps' development and growth, the researchers discovered that Ai enjoys painting and drawing even when there is no food reward. In 2013, she created a painting that was presented to Kyoto University's president. Other chimpanzees have also drawn paintings without a food reward but treat it as a hobby just like how we love to do things for fun.

The Effects of Pollution

Anna Dai

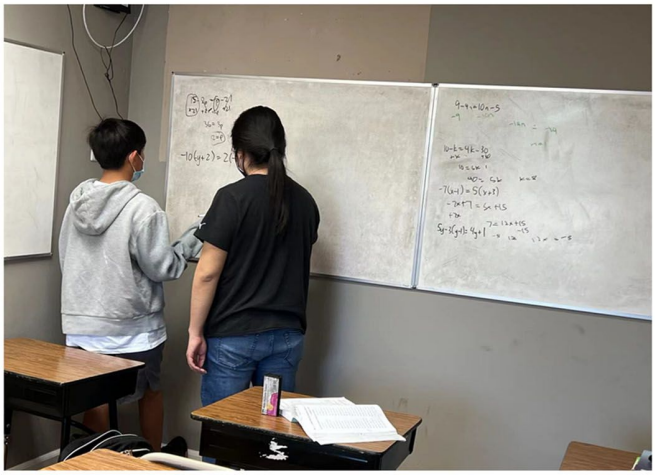
Pollution has always been a complication on the planet Earth, and it can be defined by any harmful material into a natural environment. Pollutants are not always artificial, they can be natural such as smoke from fires, ash from volcanic eruptions, and ground-level ozone. However, human activities and inventions have always been the most common pollutants. Chemicals, waste, plastic, and coal continue to destroy the world living things strive in. Two main types of pollution, air pollution, and water pollution, all play a big controversial role in society.

Looking into air pollution, it is contamination in the air. This type of pollution is usually caused by the burning of fossil fuels from producing energy and transportation, construction, and industrial manufacturing. Fossil fuels including petroleum and coal release nitrogen oxide gases into the air causing acid rain and, obviously, contaminated air. In 2020, 79% of energy consumption in the United States comes from fossil fuels, according to the U.S. Energy Information. Construction and demolition of structures and buildings suspense particles up into the air and creates exposure to asbestos and mold. Lastly, waste from factories pollutes the air with smoke, as well as dumping waste onto land and into water.

Pollution in the air leads to long-term health issues in the body. Respiratory diseases are commonly caused by bad air quality, especially to those who already have trouble breathing. Not only do humans suffer from this damage, but animals also catch diseases and sicknesses from breathing in contaminated air.

When hazardous materials are dumped into bodies of water, it is called water pollution. Plastic or trash, chemicals, and oil spills frequently spoil the water sources humans use and some species live in. Plastic is the most crucial issue in terms of water pollution. Every body of water has some plastic or trash in it, considering how much waste humans produce daily. Sea animals suffocate from getting tangled in plastic and are poisoned from consuming debris. It takes hundreds of years for plastic to decompose which will be harmful in the future. Corresponding to harmful waste, oil spills are also another major factor in pollution. The oils that are spilled into the sea are ingested by food species humans eat and intoxicate consumers. Organisms develop diseases from unhygienic water that causes death.

There are multiple things people can do to prevent further pollution of air and water. Seeing the crucial resources everyone relies on being destroyed and polluted is devastating. Together, people can take extra steps in their lives to save their homes. Reusing and recycling recyclable items can conserve marine animals by reducing the amount of plastic waste. Saving energy by turning off lights when not in use can decrease the consumption of electricity for cleaner air to breathe in. Helping save this world can create a clean environment for life to flourish in.



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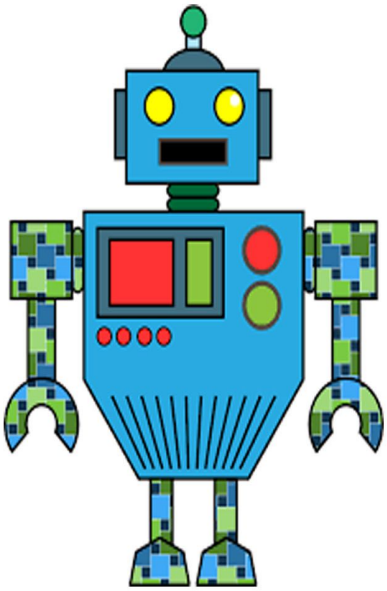

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