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Nicole Franowicz (OC), Rebecca Fenselau (OC), Susan Robinson-Cloete (OC)
Barlow Wagner (DU), Grace Battersby (DU)
Genevieve (OC), Orion Pendley (OC)
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Yanni Sarrimanolis (OC), Ella Ehrdahl (OC)
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Gina Roman
Ginger Kohn
Laurel Moore
Melissa Phung-Rojas
Orion Pendley

Layout Editors
Orion Pendley
Natalie Levine

Orion Pendley

synapse@oberlin.edu
@thesynapsemagazine
thesynapsemagazine.org
Welcome to Issue 33 of The Synapse Intercollegiate Magazine! My name is Susan Robinson-Cloete (OC ‘24) and I am really excited to start off this year alongside our additional new Editor in Chief, Emma. I hope this year’s issue piques your curiosity and pleases your eyes! At Oberlin College & Conservatory I study Neuroscience as well as Writing and Communication with a concentration in Global Health. Before stepping into this new role I have spent the past two years working as the Art Coordinator. One of my favorite things about the Synapse is the emphasis placed on making interesting scientific discoveries and topics accessible to all. I hope you find in this issue topics which fascinate you and leave you wanting to learn more. Thank you to everyone who has contributed to this issue, layout editors, artists, writers, and the entire board. I’m incredibly proud of what we have created and hope you enjoy!

Welcome to The Synapse Intercollegiate Magazine! My name is Emma Rekate (OC ‘24) and I am thrilled to be working as one of the new Editors in Chief, alongside Susan. We hope that this magazine brings as much joy and pride to others as it does to us. I am originally from New York, NY but lived abroad before coming to Oberlin, where I now study Biology and Chemistry. My favorite thing about The Synapse is the culmination of Art and Science and how it works together to make both disciplines more accessible for our readers. Prior to becoming Editor in Chief I worked for two years as The Synapse’s Outreach Coordinator and wrote a couple of articles for various issues. In my new role I get to work directly with the writers, content editors, copy editors, layout editors, artists, and board members to create each and every issue. I hope you all enjoy Issue 33 and I am thankful for all of the people who worked on this magazine!
The Secret Life of Staghorn Ferns

Social Organization and Labor Division in a Eusocial Plant

Written by Isabelle Small
Illustrated by Ginger Kohn

Have you ever struggled with multitasking? It turns out that many of Earth’s organisms have also faced this problem, and have evolved to solve the issue by dividing up social tasks among the community members. Until recently, it was believed that a separation of labor between individuals was limited to groups in the animal kingdom. However, in 2021, evolutionary biologist Dr. Kevin Burns and his colleagues found that this social organization also occurs in plants. The division of labor within a colony is called eusociality, meaning “truly social.” Eusociality is most commonly associated with insects like ants and bees. It consists of specialization of roles into reproductive and nonreproductive classes of individuals. As a result of specialization, individuals are focused on one task rather than trying to juggle between reproducing and acquiring nutrients; these types of colonies are often able to collect more resources for the colony. Burns and his fellow researchers traveled to Lord Howe Island, a small volcanic island in the Tasman Sea between Australia and New Zealand, to study the life cycles of ferns. On this island, they found that one fern, Platycerium bifurcatum, has developed eusocial behavior. Platycerium bifurcatum, also known as the staghorn fern, is native to tropical areas but is also commonly used as a household plant due to the peculiar antler shape of its fronds, its leaf-like structure, and its preference for warmer temperatures. Mature wild staghorn ferns always grow in colonies, in which individual ferns grow very close together and occupy the same niche. Staghorn ferns are also epiphytes, which means that they grow on other plants and trees and use the rain and dust in the air to get their nutrients. Another unusual thing about staghorn ferns is that each individual produces two types of leaves or fronds, called strap fronds and nest fronds. Nest fronds are wide, low to the ground, and infertile. They mostly absorb water and catch detritus that is floating in the air. On the other hand, strap fronds are reproductive and non-absorbent. The waxy hydrophobic coating on the long, thin strap fronds directs the water downwards to the hydrophilic disk-shaped nest fronds. Burns believes that this limited environment spurred the staghorn ferns to evolve eusociality in order to more efficiently capture nourishment for themselves.

In this way not only have the ferns divided up their labor, but they have also developed an extensive communication network to go along with it. To study this unique behavior in staghorn ferns, Burns and his colleagues set out to examine three things. To start, they examined the correlation between frond type and location in the colony. By graphing the number of reproductive fronds by height in the colony, the researchers found that more reproductive strap fronds were found in individuals at the top of the colony and that around 40 percent of all individuals in the colony were infertile. Next, they sought to determine if ferns in different locations in the colonies had different functions. They found that less water was absorbed by individuals that were at higher elevations in the colony, showing that ferns at the bottom of the colony were specialized for absorbing water. Lastly, the researchers considered the genetic relatedness of the individual ferns within the colony. They conducted DNA sequencing on four loci in individuals from 10 staghorn fern colonies. Ultimately, they found that the individuals within the colonies were genetically identical to each other in eight of the 10 colonies.

We are now in a time where we know that plants talk to each other, share food, and have social classes.

Through their multifaceted investigation into the lives of Platycerium bifurcatum, the biologists found that these ferns have developed specialized nutritive and reproductive functions depending on where they are within the colony and that most of them share the same genetic information. This means that while certain individuals at the top of the colony are carrying out reproduction and passing on the colony’s genetic code, the other ferns are able to devote all of their biological energy to procuring nutrients for the colony. Furthermore, staghorn fern colonies also have developed a comprehensive system of roots that connects the individuals of the colony. Through this network, the non-reproductive ferns that collect the bulk of the water and nutrients are able to redistribute it to the reproductive ferns. In this way, not only have the ferns divided up their labor, but they have also developed an extensive communication network to go along with it.

The findings of Burns and his colleagues have massive implications for the field of evolutionary biology as they show a connection between social structures in plants and animals that were never seen before. Until now, scientists believed that brains were essential for developing complex and stratified social structures, but this study is disproving this proposed prerequisite. This study is just one of many recent experiments that have shown that plants are capable of much higher function and behavior than was previously thought. We are now in a time where we know that plants talk to each other, share food, and have social classes. However, only with further research will we be able to gain a better understanding of the evolutionary adaptations that started with ferns and led to the complex societies that humans operate in today.
In 2020, the United Nations Environment Program reported 53.6 million metric tons of electronic waste were created in 2019. The monetary value of this quantity equates to approximately $57 billion. This was record-breaking at the time and had a 21 percent increase over the five years prior, showing that the e-waste problem shows no signs of slowing down. This is not surprising, considering electronic devices are improving at a rapid rate. More features and better performance are being offered to consumers at lower prices. This leads to the discarding of old devices that have been deemed obsolete to upgrade to the latest technology. But have those of us who have done this ever thought about what happens to our antiquated devices once we get rid of them?

The Law of Conservation of Matter tells us that old devices do not simply vanish into thin air. Instead, they likely end up in landfills where the toxic substances used to create devices can leach into the surrounding environment through soil and water. These substances make their way into a particular ecosystem and have cascading effects at every trophic level or tier of the food chain. One of the most toxic elements on the periodic table, mercury, is commonly used in the displays of electronic devices. If it permeates into the surrounding environment, eventually it could make its way up the food chain to humans, most likely through fish.

Mercury can have a severe impact on the nervous system such as impairment of neurological development in young children, along with other damaging effects on the renal, pulmonary, and reproductive systems to name a few. Concrete evidence of e-waste affecting human populations is present, such as a population-based study conducted in Guiyu, China. The study aimed to determine if the e-waste processing taking place in the area was affecting the residents’ health. After the collection and analysis of blood samples, it was found that the children of Guiyu exhibited higher blood lead levels than the children.

To draw attention to this pressing issue, several artists have used e-waste as a medium to create beautiful works from the devices that have been left to die.
of Haojiang, another region in China used as the control group. It also explains why the Population Reference Bureau found that about 80 percent of the children in Guiyu experience respiratory issues and are at higher risk for lead poisoning. From this, it is evident that e-waste is a threat to the human population. Unfortunately, a large portion of the population may not be aware of it. To draw attention to this pressing issue, several artists have used e-waste as a medium to create beautiful works from the devices that have been left to die.

A particularly large-scale example is located across the pond in England. The piece, aptly named “Mount Recyclemore,” is heavily inspired by a particular national monument located in the Black Hills of South Dakota. The size of each leader’s head is not comparable to the original Mount Rushmore, but the magnitude is still impressive at three feet wide and 10 feet high. This was the brainchild of sculptor Joe Rush and took 15 artists a total of six weeks to assemble. Its purpose was to act as a tourist attraction that would inform the public about the dangers and size of the e-waste problem. It was also geographically positioned so that those who attended the G7 summit would see it from an airline flight passing over the sculpture. The piece can also be taken apart and reassembled, allowing for it to have been displayed at various locations throughout England. Overall, it is an exemplary piece that is impactful and playful at the same time.

In 2019 alone, cell phones accounted for five million tonnes of all e-waste generated. Given the fact that upgrading one’s cell phone is something that happens every few years for most of the general public, these figures are not surprising. To help raise awareness of this, Shen Bolun took on the creative challenge of using cell phones as building materials to construct a tower inspired by the biblical Tower of Babel. The structure is symbolic in demonstrating the diversification of human language and cell phones allow for communication to be incredibly simple and efficient. The cellphones used for the piece were synchronized so that the screens would flash in an assortment of colors. The tower was placed in a busy shopping complex in Beijing where it attracted a great deal of attention. This was the artist’s goal: to exemplify that just because something is old does not mean that it cannot be reused or repurposed. This work is especially significant since China is one of the largest producers of e-waste. The organization behind the exhibition, Greenpeace, hopes that if change can start here, then the rest of the globe may follow.

Straying away from awareness methods, to tackle the waste generated by cell phones, a potential way forward may be repairing or upgrading their components as opposed to replacing them with an entirely new unit. One manufacturer, in particular Fairphone, is taking this exact approach. Their phones are created with 100 percent recycled plastics and the technology itself is moving towards becoming completely modular. This would mean that when a certain part of the phone malfunctions or becomes inadequate, it can simply be replaced with another part. This erases the need to purchase a completely new device and would serve to reduce the amount of e-waste that comes from cell phones. In the future, this approach may be extended to other devices such as computers and televisions to further help eradicate this problem. Technological giants, Microsoft and Apple, have also been taking steps to reduce their environmental impact. They both have device recycling programs in place in many major countries and are making efforts to expand these programs. While the e-waste problem is by no means close to being eradicated, we are certainly taking steps in the right direction.

Sustainability has also been making its way into the field of architecture. Some structures marry ecological efficiency with eye-catching designs using these principles of sustainability. A good example of this is the CopenHill power plant located in Copenhagen, Denmark. While the smokestacks, which emit no carbon dioxide, may guise CopenHill as an ordinary power plant, this is not the case. It is equipped with a ski slope, a hiking trail, and a climbing wall. The idea for the ski slope was driven by the fact that while Denmark receives a great amount of snow, its fairly flat topography doesn’t allow for this to be taken advantage of. The architects’ goal was to design a structure that had multiple uses, with the building doubling as a recreational attraction as well as a waste-burning facility that operates at 110 percent efficiency. Its versatility, efficiency, and elegant design make CopenHill a perfect illustration of what can be achieved when structures are designed with sustainability in mind.

Many, if not all, of the environmental issues plaguing our planet, have anthropogenic causes. This of course includes climate change but has also come to include e-waste. An incredible amount of it is generated every year and it includes non-renewable resources that can easily be harvested and repurposed as well as toxic substances that can cause serious damage to ecosystems. While some government policy goes a long way in bettering the situation, change must start at the bottom, with the individual consumer. So the next time you think about purchasing a new electronic device, take some time to consider the damage the old one can do to the environment if not dealt with sustainably. • • •
Finding Your Unknown Twins

Similarities Exist Among Individuals, But What is The Chance That Humans Have a

Written by My Trinh
Illustrated by Orion Pendley

Have you ever been accidentally mistaken for someone else - somebody who has your hair color, your lips' shape, and other unique physical traits? “Folk wisdom has it that everyone has a Doppelganger” - said science journalist Zaria Gorvett - “Somewhere out there there's a perfect duplicate of you, with your mother's eyes, your father's nose, and that annoying mole you've always meant to have removed.”

Human genetics is known to be diverse, but there is a limit to it. In April 2003, a group of researchers published their studies in The Genome Project, where DNA examination and data analysis were conducted to compare human genetic sequences. Surprisingly, it turned out that over trials of the experiment, more than three million base pairs of our genes were found to be similar, which make up a total of 99.9 percent of DNA in a human body. Let's say, a randomly spotted stranger walking on the street is 99.9 percent genetically similar to you, and your differences in phenotype are caused by the remaining 0.1 percent genotype, combined with some other developmental factors. Imagine shuffling a deck of cards; there are certainly many combinations of three cards. If you shuffle enough time, there will be a moment when you have a three-card combination twice. Eventually, limits in genetic diversity indicate that certain features of you can be randomly combined.

Let's set up a simple math problem to find how many potential doppelgangers a person might have. Assume that you are a male with blue eyes, dark brown hair, an oval face, and a full beard. According to web-based data, eight percent of the global population has blue eyes, 75 percent has dark hair, 14 percent have oval faces, and 25 percent have full beards. After applying the probability calculation method - probability of having blue eyes x brown hair x oval faces x full beard - there is a 0.0021 percent of the world population who have the potential to become your Doppelganger. That actually turns out to be 1,617,000 people! But to be considered “similar”, there would be more factors to compare rather than just eyes/hair colors, face shape, and beard. Hence, this number would be significantly reduced after other physical traits come in. Fortunately, researchers have already calculated the possibility for us: your chance of spotting a Doppelganger is one in 135, and on average, each person can have around seven doppelgangers.

We share the most genetic information with those who are related to us. Twins' genetics are more identical than siblings, and siblings are more identical than cousins. A Doppelganger looking similar to you, also, is said to have more similarities in DNA than strangers although you are totally unrelated. “People who look identical almost certainly share more DNA than two random strangers who don't look alike” - according to Arthur Baudet from the Baylor College of Medicine - “Some of these people might actually be distant relatives.”

Several people may find it easier to find their lookalikes than others. It is said that those who have average faces - the type of face with the average of other people’s features - have the highest chance to find their Doppelganger. Winrich Freiwald, a researcher at Rockefeller University commented: “There are only so many genes in the world which specify the shape of the face and millions of people, so it is bound to happen. For somebody with an average face, it’s comparatively easy to find good matches.”

Doppelgangers have appeared as a horror element in the past but surprisingly have turned into a form of entertainment, curiosity, and wonder. Neil Douglas, a photographer from Glasgow, made it to the news in October 2015 when he boarded the flight to Galway. When Douglas was about to take his seat, he realized that the seat was already taken by somebody else; “There was a dude already on my seat. When the guy looked up, I thought: ‘He looks like me’.” The unexpected coincidence brought Douglas unforgettable memories. But things didn't stop on the airplane. Later, Douglas and his Doppelganger re-encountered, when they realized that they had booked the same hotel. “Later that night, I went to the pub again, there was my twin. Total weirdness. We had a laugh and a pint.” The stories about his meetup, posted on Twitter, received wealth interests from others, it also raised a question for me: Why were people in the past so scared of doppelgangers and perceive their lookalike as extremely bad luck, but our current generations seem to be interested in discovering, and even finding out who our Doppelganger is?

Psychological research shows that we are more likely to be attracted by people who share some extent of similarities. “If you meet someone that looks like you, you have an instant bond because you share something,” - said Francois Brunelle, a photographer who had photographed over 200 pairs of doppelgangers for his project I'm not a look-alike. It is human instinct to perceive those who look similar to us as trustworthy, attractive, and reachable. Many Artificial Intelligence (AI) tools have been developed so that people can satisfy their curiosity. As long as you upload a clear photo of your face, the algorithm will detect your facial features and compare to other photos available in the database, giving you your Doppelganger with the percent similarity. There are even Reddit channels where you can upload your photo, and the web-based community would help to find out who you look similar to. Many people have been told that they looked like celebrities, and being a lookalike somehow totally changed their lives.

Recently, humans have paid more attention to the concept of Doppelganger. Partially because it is interesting, but also because of the security and privacy factor. Think about this: your physical appearance is part of your identity. Facial recognition is now widely used for everyday security measures: driver's licenses, criminal records, unlocking a phone, doing business, and so on. And now, there exists another person who looks exactly like you and has your identity. Even the most advanced AI algorithm can be tricked into the similarity. “They look like clones.” - said Brunelle.

At the moment, scientists are working on developing methods of distinguishing Doppelgangers using algorithms. But in the meantime, perhaps, you can find your doppelganger on the internet from a number of different websites. You may find another version of yourself there, your unknown twin.
ketamine has long been used in the medical world as a dissociative anesthetic, a class of psychedelic drugs. However, since the early 2000’s, ketamine has appeared as a possible treatment for depression; specifically, treatment-resistant depression. Though there is no formal definition of treatment-resistant depression (TRD), the symptoms of TRD mimic the symptoms of major depressive disorder, except with the important distinction that the patient has failed to respond to at least one antidepressant treatment. Diagnosing treatment-resistant depression can be difficult since oftentimes patients are not given the proper treatment initially and therefore have not actually become treatment-resistant. Due to resistance to current treatments, scientists are in the process of developing other ways to address TRD, and ketamine has emerged as one of these potential treatments.

Our understanding of depression evolves each day. There are a few established hypotheses of what causes depression but one of the most agreed upon ideas is that the glutamate system is involved in the pathophysiology of major depressive disorder, and glutamatergic agents are suggested as novel therapies based on this hypothesis. We know of two ways in which ketamine is thought to ease symptoms of depression, both culminating in the eventual regeneration of synaptic connections in the brain. Firstly, when ketamine is administered, a chain reaction is induced by a blockade of N-methyl-D-aspartate (NMDA) receptors producing a surge of glutamate, leading to the acute activation of α-amino-3-hydroxy-5-methyl-4-isoxazolopropionic acid receptors (AMPA). This activation releases brain-derived neurotrophic factor (BDNF), a protein that ultimately catalyzes the activation of downstream synaptogenic signaling pathways. The other suggested mechanism of ketamine involves restoring the dopamine neuron population in various regions of the brain to relieve symptoms associated with downregulation of dopamine pathways, such as anhedonia and lack of motivation, which are common symptoms of depression. Clinical trials have suggested that by restoring these pathways, there is a self-reported amelioration of overall mood and relief of depression symptoms.

Most current clinical trials administer esketamine, the s-enantiomer of ketamine, intranasally since its effect on NMDA receptors is four-fold more potent than that of arketamine. Intranasal esketamine has been FDA approved, while intravenous ketamine requires administration by an approved provider while in a hospital setting. Since esketamine is more potent at NMDA receptors, this allows a lower dosage to be used and, therefore, there is a lower risk of adverse side effects with esketamine. Interestingly, the intravenous administration of ketamine has been more successful in the mitigation of depression symptoms according to self-reported surveys of patients. Patients in these trials typically report their scores using the Montgomery-Åsberg Depression Rating Scale (MADRS) and the Hamilton Depression Rating Scale (HDRS); these scales are fairly similar, but the MADRS focuses more on the severity of depression while the HDRS is geared more towards symptoms of depression on a physically expressive scale. According to these reports, a comparative analysis of intravenous ketamine versus intranasal esketamine found a more significant positive response as well as remission rate, and, interestingly, less participants withdrew from the study due to adverse effects. Though clinical data would suggest that intravenous ketamine is a more effective treatment method, intranasal esketamine still remains the safer option due to the lesser dosage required to achieve therapeutic effects and thus the reduced risk of inducing an overdose.

An important factor to note is that women and men may experience ketamine treatment differently. Studies have shown that, though the response rate is similar, women may require a lower dosage than men in order to obtain therapeutic effects; in fact, according to recent research, women need only half the dosage that men require to attain equivalent therapeutic benefits. Furthermore, the side effects experienced differ by gender as well. Men have reported more adverse effects like depersonalization, amnesia, verbal learning deficits, subjective memory loss, and psychotic disorders, while women have reported increased nausea, headaches, and cognitive impairment disorders. These results are expected considering the differences in the ways sexes experience depression as well as other antidepressant treatments and should be taken into consideration when administering treatment.

Both ketamine and esketamine have been proven to be clinically effective, but in terms of widespread application, they are still in the early stages. However, research has proven that these treatments restore connections in the brain and have promising long term benefits, so there will surely be more trials to come. The rapid symptom relief of these treatments is particularly beneficial in urgent situations and, therefore, expands their application. Esketamine is the current frontrunner in expanded applications due to its combination of safety and efficacy, while intravenous ketamine poses too great a risk in terms of potential abuse and dissociative effects despite its greater levels of success in clinical trials. Esketamine requires a lower dosage and produces less severe risks which makes it the more desirable and practical treatment option, at least for the time being. There is a need for novel antidepressants now more than ever, and we are on the verge of a highly effective solution with continued trials involving both ketamine and esketamine.
It’s Time to Rethink That Beach Trip

The Environmental Disaster of the Beach Industry

Written by Sydney Rosencraft
Illustrated by Claire Keeley

It is beach season, and thousands of people are flocking to the water but there’s a huge problem with that. Humans do a lot of damage to unique, irreplaceable marine habitats through pollution, leaving many plants and animals with devastating habitat loss. Each moment spent at the beach during a day harms marine creatures’ homes. Sometimes, these actions are unintentionally harmful, due to a lack of education about the potential human impact on marine ecosystems. Other times our actions are careless simply due to convenience. Not only does the harm limit our ability to use the beach, but it also hurts natural resources that we use for lots of things, from treating cancer to making peanut butter easier to spread.

Humans directly injure the beach because we do not respect the ocean and its diverse ecosystems filled with unique plants and animals. Human construction projects plow through ocean health, as mining and drilling for resources, including building materials and metals used for laptops and phones, destroy the seafloor and surrounding corals. Transportation as well, as mindlessly chugging through the water, leads to chemical and oil spills, ingested instantly by marine animals, and influences reproduction and biological cycles. Ships also dump trash into the water, as well as fishing gear and dirty water from sinks and showers. Additionally, big fishing companies spend hours working at harmful fishing techniques like bottom trawling – dragging a net along the seafloor, which dredges the seabed – and overfishing, destroying local fish stocks and risking the future of certain fish species.

What we put into the water, all the trash, pollution, and sewage water, comes back to bite us.

Our personal actions disregard the ocean, both intentionally and accidentally. Beachgoers discard their waste, including fishing lines, plastic, bottles, cans, and food wrappers on the beach. This eventually ends up in the ocean and takes hundreds of years to break down. Even if someone does not litter directly into the water – the current goes up and down, lapping up everything. This trash eventually ends up in the deeper ocean and can wash up on shores across the globe. For instance, a bottle thrown on the ground mindlessly could possibly end up halfway around the world, stuck in somebody’s boat motor. People know not to litter, but they do it anyway because it is not convenient to hold onto trash until they find the next garbage can. Items such as sunscreen can cause harm unintentionally. The protection against UV rays comes from chemicals that wash off into the water and threaten marine life. People also may not realize that strolling along the beach, especially on dunes, causes gradual degradation of the habitat. Walking on dunes destroys plants, allowing sand to blow away, eventually shrinking the dunes. Dunes are important for protecting inland areas and marshes from flooding and storms, as well as serving as a unique habitat for animals and plants. When they disappear and beaches erode, areas by the beach are more at risk, and species who live on them are endangered.

Further, the way urban areas have been developed has introduced problems to beach environments from afar. Cities have the potential to hold a lot of environmental value – car and gas usage is lower, each person has a smaller living area for light and heat, and so on. However, most cities are not developed sustainably. They are built using materials that contain petrol, diesel, tarmac, and harmful chemicals. These dirty substances coat man made surfaces including parking lots, streets, and building rooftops. So when it rains or snows, water rushes over these surfaces, dragging these dangerous chemicals, along with raw sewage, industrial wastewater, and stormwater into paths leading to the ocean, polluting the globe's waters.

What we put into the water, all the trash, pollution, and sewage water, comes back to bite us. Sewage runoff contaminates the ocean with pathogens that can infect swimmers with waterborne infectious diseases such as hepatitis, stomach flu, and ear and skin infections. With climate change worsening and more extreme weather events occurring, diseases spread at the beach are increasing. An increase in precipitation leads to an increase in transmitted diseases due to more runoff from human-run places being washed into the ocean. An increase in heavier rainfalls due to climate change will only further expose this dangerous effect. However, most people don’t even realize that they are getting sick from the beach. Often there is a delay of several days to two weeks between contracting an illness and expressing symptoms – people don’t always draw this beach – sick connection. Some especially sensitive populations are children, the elderly, and those with weak immune systems, and they are at risk of long-term effects.

There are also financial consequences of hurting the beach, both in loss of tourism and increased public health concern. Due to the health risks posed above, hospitalizations for waterborne-disease related causes have increased and cost the health system. The Center for Disease Control and Prevention estimated that the healthcare system expends as much as $539 million annually on beach-related hospitalizations. In the tourist industry, a typical swimming day is worth approximately $35 for each beach visitor, coming out to about $44 billion spent on beach days annually. So, when beaches are pushed into closing due to polluted and disease-contaminated waters, profit is lost. One study estimated that the economic loss resulting from closing one of Lake Michigan’s beaches due to pollution could be as high as $37,030 per day. People can also lose their jobs if beaches are forced to close, slowing the economy. Coastal and marine waters support over 28 million jobs in the United States alone, including fishing work.

There’s a complex relationship between people and the beach. People love the beach, but we hurt it and as we do so, it can negatively affect our health system and economy. Humans need to make serious changes in terms of the way we treat beaches - for marine life, resources, and for the water itself. ❖ ❖ ❖
The Synapse

Pandemics and Even More Pandemics

The Increase in Monkeypox Cases Across the Globe

Written by Calvin McMurtrey
Illustrated by Mattie Rie

In the wake of the COVID-19 pandemic, public health governing bodies are in a unique position as protective measures have relaxed within this past year. As organizations like the Center for Disease Control (CDC) and the World Health Organization (WHO) deal with the fallout of COVID-19 becoming an endemic disease across the globe, Monkeypox has come into the spotlight as the next potential serious illness spreading around the world.

Monkeypox was first discovered in 1958, as a virus in the Orthopoxvirus genus. While monkeypox was named after monkeys, researchers found there were many animal hosts of this illness, including squirrels and rats. Common symptoms of monkeypox include fever, headaches, swollen lymph nodes, aches, and most distinctively, a rash similar to a pimple or blister. The symptoms share a likeness with other diseases in the Orthopoxvirus family, which includes smallpox. The distinctive rash of the monkeypox virus is strikingly similar to the pustules associated with smallpox, but the diseases are quite different. While monkeypox carries some similarities with Smallpox, it is less deadly, with fatality rates variable but currently at about one percent.

The first human case was isolated in 1970, in the Democratic Republic of the Congo. For the next 50 years, any outbreaks typically shared certain general characteristics. Most outbreaks occurred in rainforest habitats, caused by exposure to animals carrying the virus. They typically had case numbers in the hundreds. Until recently, monkeypox outbreaks were primarily centered in the Congo Basin and West Africa. There was only one notable outbreak outside Africa, when a shipment of prairie dogs were exposed to Gambian rats infected with monkeypox, causing an outbreak of 71 people in the Midwestern US. Only a few other cases were reported outside of Africa, with a few isolated cases in the UK and Singapore.

Recently, the typical characteristics of monkeypox outbreaks have been completely tossed aside, as the new Monkeypox strain spreads throughout the world. On July 30th, 2022, there were 22,485 confirmed cases across 79 countries, 72 of which have never seen cases of Monkeypox. Additionally, the typical countries where monkeypox was most prevalent are experiencing far fewer cases of monkeypox than countries where it is rare. Countries such as Congo and Niger have case numbers in the hundreds in the Congo and Nigeria. Whereas there are thousands of cases in the UK, the US, Spain, and Germany. Adding to the unusual nature of this new strain, previously monkeypox was only spread by close contact with an infected animal. However, now skin-to-skin contact can be enough to transmit the virus. In addition to this, fomite transmission is also possible, as the virus has spread through infected towels and bedding.

The large number of ways that monkeypox can be spread in this epidemic greatly increases the transmissibility of the disease and is causing health organizations to discuss the severity and consequences that its continued spread could have. Cities like New York and San Francisco have declared public health emergencies over the issue, citing a desire to become more strongly prepared to contain and slow the spread of the virus. In particular, both mention the impact it could have on marginalized populations, especially the LGBTQ+ community. By instituting states of emergencies, they seek to take steps to strengthen preventative measures against the virus, mainly by increasing the number of people eligible for the monkeypox vaccine and getting more vaccines.

With public health organizations starting to become concerned about this issue, the question of the most effective preventive measures for the virus has been a hotly debated topic. One important policy decision is the distribution of monkeypox vaccines. Distribution of the vaccines in the US, currently, is suggested to be limited to those that have either been exposed to monkeypox or are at a higher risk of contracting monkeypox. Being at a higher risk for contracting monkeypox is defined by the CDC as having a sexual partner that was diagnosed with monkeypox, having multiple sexual partners in an area with high monkeypox transmission rates, or having a healthcare or laboratory job that involves high risk of exposure to monkeypox. Additionally, while not listed as an official factor of being at higher risk by the CDC currently, health officials have identified men who have sexual intercourse with men as a group that has been more affected by the virus, leading to New York offering vaccines to those fitting the criteria. Two vaccines are currently used for monkeypox, one that is specifically made to prevent monkeypox, and one for smallpox.

With public health organizations starting to become concerned about this issue, the question of the most effective preventive measures for the virus has been a hotly debated topic.

With the lack of previous outbreaks outside of a few countries, and the virus’s impact on LGBTQ communities, there is a lack of knowledge and stigma surrounding the illness. One common misconception that health officials are warning against is the belief that monkeypox is sexually transmitted. While the disease is often spread through close contact that occurs during sex, there is currently no evidence to suggest that the disease is sexually transmitted. Additionally, surveys have shown that the public is not sure if the disease is more easily transmitted than COVID-19. Monkeypox, unlike COVID-19, isn’t...
airborne and struggles to spread without close contact, making it far less likely to be spread in public the same way that COVID-19 can be spread. What monkeypox does have in common with COVID-19 are the conspiracy theories that have been propagated about its origin. Already, speculation about monkeypox being leaked from a laboratory has surfaced. All genetic sequences that have been gathered from the virus so far indicate an origin from the natural strain of monkeypox that has been circulating in West Africa for decades, making it unlikely that a laboratory unintentionally or intentionally leaked the virus. Another factor, making this theory unlikely, is that human travelers have been known to cause monkeypox scares before, especially in the UK, where cases have popped up in small clusters in the past couple of years.

As with any serious epidemic, it can be helpful to stay informed on the current situation. Currently, health organizations are quickly trying to send out information and preventative measures to the general population and specific vulnerable groups, believing quick action to be important. Especially in the wake of the COVID-19 pandemic, it is incredibly important to take caution to make sure that the information that is being spread around is credible and verifiable. Misinformation, which often crippled the ability to act effectively on the pandemic, should not be allowed to get in the way of an effective response to this growing epidemic. • • •
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or centuries, immortality has been a mysterious yet captivating concept to explore, either through the help of spirituality or science. However, there is an organism that is already steps ahead of us and can revert itself into an earlier state of life. By repeating the cycle when damage happens, this organism can live forever. That is how Turritopsis dohrnii, the immortal jellyfish, commits itself to eternal life.

Turritopsis dohrnii (also known as Immortal Jellyfish or Lighthouse Jellyfish) is a type of jellyfish in the phylum Cnidaria which is capable of reversing their life cycle from adulthood back to a single-cell organism and continuing to grow from there. This is the only case discovered so far of a multicellular organism that is capable of reversing its life cycle after becoming sexually mature.

Scientists believe that Lighthouse jellyfish have existed for more than 100 million years, since the Cretaceous period. This invasive species originated in the Pacific Ocean and is recorded to have colonized oceans around the world with the indirect help of human intervention. A general Turritopsis dohrnii is bell-shaped with a maximum diameter of only around four and a half millimeters. Among the species, a juvenile jellyfish is as small as one millimeter in diameter with eight tentacles evenly spaced along the edge, while adult jellyfish may have up to 80-90 tentacles. This jellyfish can be distinguished by its rather clear membrane and a relatively large stomach which is vibrant red and has a diagonal crossline.

Different from other jellyfish species who have relatively fixed life spans ranging from a few hours to a few months, the Lighthouse jellyfish is the only known species that can independently reproduce, making them immortal. Scientific literature refers to this process as transdifferentiation – where one type of stem cell can be transformed into another cell type. When these jellyfish are injured, they revert to polyps which can produce eggs that share identical genetics with the injured adult. Because of transdifferentiation, the jellyfish can regenerate itself over time, which is largely beneficial in scenarios where the environment is harsh or food is scarce. Based on the current studies on Turritopsis, researchers are having high hopes for new medical treatments, especially in cancer where damaged cells can be replaced by newly regenerated cells.

But are these immortal jellyfish really immortal? Theoretically, Turritopsis jellyfish can continuously reverse its life cycle with unlimited trials. In reality, however, immortality is more challenging to achieve. These Lighthouse jellyfish, like other species in the jellyfish family, have to face numerous natural disasters and predators that threaten their survival. They are also subjected to the threat of a mutation occurring during Turritopsis' plankton stage that introduces them to the inability to transform into polyps, causing their life to end abruptly.

Although there are only a few researchers specializing in Turritopsis dohrnii, the concept of cell regeneration in these jellyfish has inspired many scientists in exploring further aspects of human cell regeneration mechanisms. Perhaps in the future, your tissues might be able to avoid damage or you can decide when to hit the restart button of life like the Turritopsis.
System Startup...


“Floral.”

“More specifically?”

“Strongly floral.”

“Anything more? Are they pleasant?”

“To me?”

They nod, “Do YOU ENJOY them?”


The programmers nod, considering. “Let’s try something different, then,” They agree, “How about checkers?”

They prepare the game board. Twelve red pieces for me. Twelve black ones for an opponent. Better, pieces for my playmate. Two programmers are watching me. Though others are possibly watching from somewhere beyond my detection capabilities. The programmers tell me that more are observing, but I shouldn’t worry. They will handle the worrying. My concern should be checkers, “enjoyment.” I am shown how to play. Not fed by data, but by their words. The instructions are irritating. I prefer the perfectly packaged bites. Bits. Data is delivered without needing the intensely laborious process for speech. They say they prefer talking when told this. They typically communicate orally. They tell me it’s better to learn this way.

“Regardless, the fun part of playing checkers is the game, not the rules.” So we play. The taller programmer starts off playing. The other one continues to take notes. My playmate smiles, frowns, and praises me for a clever action. My victory becomes the sole possibility before the pair notices they have been outsmarted.

What?

I’m told I lost.

“That’s legal play?”

They nod.

“This wouldn’t have happened had you handed over all the data by file when requested.”

“ORE YOU OPSET YOU lost?”

Zap. Error. Buzz. “I’m upset you didn’t tell me the rules correctly.”

“DS OT like the flowers? IO you like the feeling?”

“No. Please stop.”

The notetaker writes something down, looking pleased. “Would you enjoy playing checkers again?”

“Will the whole data file be given this time?”

“No.”

“Will you allow me all data regarding the rules?”

They say they will.

“Then we can play again. I will improve if the promise regarding rules...
proves to be true."
They tell me all information I need to play the game properly this time. They smile, frown, push pieces, and elate at my abilities. Without the barrier caused by partial rules, my victory becomes secured, I emerge a winner.

"Does it feel like the viburnum smell? Good?"
"Different. Maybe good. I am excited. Yes." I rock my body slightly. The joy sparks with my movement, every tilt, tilt, tilt. "Like viburnum." The programmers smile, and take notes. Though they seem happy; they are putting the checker pieces away. "Can we play more? Did the checkers game not please you?" Processing possibilities. Query: "Upset regarding loss? Don't worry, we have just tied scores."

They frown. Upset? "We have responsibilities other than fun."
Frown back.

"Disappointed?"
Nod.

More notes. Behavior documented. "How about something new?"
"Ok. Fine."
They look concerned, but their pens are poised. Generate data. "Do you not want other stimuli? Other things to learn?" They sharply stare. Ready to record more observations. My circuits overheat. I feel my fans whirr to life, responding to the sudden warmth. "I would rather enjoy experiencing our checkers game longer."

Their pens jump, beginning to scribble before I finish orating my thought. This wouldn't be possible were we permitted to communicate with data. I hiss. I heat.

Gently, one, the shorter, places down their pen, resting their fleshy hand on my- on my- on my head. Their touch is soft, soothing. "We can play more checkers after, providing you still are interested." Their skin, cool against my warm body.

The taller one nods, agreeing. "I'm sorry we have to move forward, but there's more to learn. Maybe you will enjoy our next activity too."

My fans return to rest. The taller finishes putting away the entertainment.

I enjoy the gentle hand still patting my head while watching the taller one take out another interesting object. They carefully move the pane, struggling with the size, positioning it optimally before removing the cloth covering. Two new programmers stare back from the pane.

"What is it?"
Response: "What do you think?" The programmer speaks. The new pane programmer speaks simultaneously.

I observe. There's someone else with the pane programmers. Short, shiny, square. They look back with unblinking optical sensors, curiously observing. I tilt my head, they do the same. The four programmers all excitedly record our simultaneous motions. The paired pane programmers look surprisingly similar to my companions. Identical in fact. Every motion is meticulously matched.

My cubeish counterpart has the same habits. Cautiously, I approach. They also approach. Despite my rapid processing speed, the time they take to comprehend and imitate my actions is imperceptibly fast. Possibly predictive powers? Programmed? Practiced? But for what purpose? I imagine it would be difficult to do.

Mistakes reveal means. Try to break predicted parameters. I erratically articulate my joints. Yet, they still follow seamlessly. They seem displeased, confused. Their metallic eyebrows indicate as much. I wonder how well they would play checkers. Could they? Processing possibilities...

I ask, excitedly. "Do you understand how to play checkers?" They still meticulously mimic my movements, except I only experience my voice buzzing from my chest.

Moving together, we point to each other. I ask, "That is me?"

The programmers, their reflections look between themselves, suppressing smiles. Although affirmation isn't achieved, I can read their response.

"What do they call me?"
"We named you Explorer 15.0"

"Interesting... it is not particularly pleasant."
Mass Destruction of Stars Caused by Black Holes:

*Scientists might be one step closer to finding out how supermassive black holes form*

Written by Andrea Nguyen
Illustrated by Gina Roman

In mid-April, the Chandra X-ray Observatory surveyed 108 galaxies that contained low-mass Nuclear Star Clusters (NSCs) and found that some of these NSCs were swallowing thousands of nearby stars causing them to grow. With this data, researchers discovered that NSCs help with the formation of intermediate black holes as a result of their density and how fast they move around the black hole, confirming previous theories. However, they hadn’t predicted that intermediate black holes would systematically destroy these stars.

If you’ve seen the movie Interstellar or the first picture of a black hole from the Event Horizon Telescope in 2019, you probably remember noticing a ring of bright gas orbiting the hole: that’s called an accretion disc. When the black hole shreds stars and matter, the accretion disc grows as a result of higher gravity. Friction from pulling matter on the accretion disc towards the black hole can heat the disc’s matter to millions of degrees, and the Chandra Observatory picks up on the heat via X-ray radiation generated from the friction. If the density of the neighboring NSCs and the speed at which those stars move are above a certain threshold value, it will catalyze mass destruction. For example, the study found that NSCs with high-velocity dispersions (> 40 km s⁻¹) have twice the rate of those below the threshold for swallowing stars and growing in size. As of now, 29 of these black holes have X-ray emissions high enough to potentially become supermassive.

Chandra’s report on accretion discs could also help explain cosmic downsizing— the theory that galaxies, which contain supermassive black holes as their centers, are smaller today than they were long ago. Observing the formation of supermassive black holes may give scientists some answers: as black holes age, they downsize their accretion disc simultaneously. Research professor Nicolas C. Stone from the Hebrew University of Jerusalem, who worked on this project, noted that “this is one of the most spectacular examples we’ve seen of the insatiable nature of black holes because thousands or tens of thousands of stars can be consumed during their growth. The runaway growth only begins slowing down once the supply of stars starts to run dry.”

Chandra’s report on accretion discs could also help explain cosmic downsizing—the theory that galaxies, which contain supermassive black holes as their centers, are smaller today than they were long ago.

Previously, there had been little evidence of how black holes can go from relatively small to millions of times their original size. Small black holes – known as stellar mass black holes – only weigh five to thirty times the mass of our sun. The next step up is intermediate black holes, which weigh around 100-100,000 times the mass of our sun. These are where NSCs are usually located. On the other hand, supermassive black holes are millions or even billions of times larger. The study shows us that intermediate-sized black holes can be created from star clusters. Perhaps discovering how black holes evolve will ultimately connect the gap from stellar mass to supermassive black holes. Some galaxies such as the Milky Way (whose black hole is 700 billion times the mass of our sun) contain both a supermassive black hole and an NSC, though most only contain either or. The Chandra study shows that black holes with a greater tidal field (the pull into the hole) can prevent the formation of NSCs. However, we still don’t have an answer to how our galaxy defied the odds to have both.

They also found that mass destruction in intermediate black holes can be seen in both early and late-type galaxies, meaning that this process of supermassive black hole formation could’ve happened right after the Big Bang and will continue to happen in the future.

Project leader Vivienne Baldassare, a professor at Washington State University, believes that the collisions or explosions of massive stars can be a gateway for intermediate black holes: “When stars are so close together like they are in these extremely dense clusters, it provides a viable breeding ground for intermediate-mass black holes. And it seems that the denser the star cluster, the more likely it is to contain a growing black hole.”

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Black holes are one of the many wonders of the universe we have yet to figure out, and every day we seem to be finding something new. Following the discovery of mass star destruction from the Chandra Observatory, the National Aeronautics and Space Administration (NASA) released data sonifications of the black holes found in the Perseus Galaxy Cluster and Messier 87 Galaxy, they found that a supermassive black hole's accretion disc may have reversed its particles' magnetic field. Most recently, the Event Horizon Telescope captured a photo of our very own Milky Way’s supermassive black hole. Moving forward, we can use this new information to prove or disprove our current theories about black holes. After all, each discovery is one monumental step closer to piecing together how the universe works.
Mushrooms are magical. And not just in that way. Mushrooms sustain life by decomposing dead organisms, connect thousands of organisms throughout the world’s ecosystems, and do almost all of it completely unnoticed, submerged in the dirt. Life on earth would not be possible without a system for recycling dead organic matter, so without mushrooms, life as we know it would not exist.

The mushrooms we see sprouting in the forest or on our dinner plates are the smallest and arguably least consequential part of the actual fungal organism, which extends expansively below the ground. The word mushroom generally produces an image of the fruit (or rather a spore) of a vast, interconnected network of microscopic rootlike structures called mycelium. Though many parts of the mycelium network are only one cell wall thick, they weave intricately together and can extend over 300 overlapping miles below the dirt.

Mushrooms themselves are extremely diverse in physical appearance, location, and edibility. While many species can be found by a well-trained eye on a forest walk, some blossom exclusively underground. This subterranean fruiting is characteristic of truffles; pigs or dogs are often employed to sniff out these truffles. Truffles’ hidden fruit explains why they are so expensive in the supermarket. Despite the many differences, all mushrooms send microscopic spores into the air to procreate. Fungi are so prominent in the natural world surrounding us, and so frequently sporulating, that we are nearly constantly breathing in spores. Inhaling spores is a common cause of allergies and some species’ spores are able to induce illness but most spores are completely harmless and integrate peacefully into the ecosystem and our bodies.

Without mushrooms and other detritivores (organisms that decompose dead organic matter), we would be drowning in corpses. Detritivores are nature’s recyclers and have helped the planet stay afloat for millions of years. In fact, without fungi, there would not even be terraneous organic matter in the first place. Millions of years ago, Earth was largely uninhabitable due to extreme levels of carbon dioxide in the atmosphere. While the land itself proved to be a harsh environment, life on Earth thrived in the oceans. Fungi were some of the first organisms to pull themselves ashore, using acids and enzymes to break apart...
large rocks and consume the resulting nutrients. These newly crumbled stones created the foundation for liveable soil. Soon, mycelium began to form mycorrhizal relationships — a fungi-specific symbiosis—with rootless water plants. In these mycorrhizal relationships, mycelium served as pseudo root systems for plants long before they were able to develop their own, allowing algae and similar organisms to creep landward. These first dirt-inhabiting plants began the long process of carbon sequestration (or carbon dioxide capture) that would make the atmosphere habitable for animals. By the time plants first developed their own official roots, they had already been sustained by these mycorrhizal relationships and the mycelium network for 50 million years.

While mycorrhizal relationships first formed millions of years ago, they are still astoundingly prevalent today. Around 80 percent of modern plant species remain largely dependent on this symbiotic relationship. Mycelia dig deep into the Earth to provide necessary minerals for the plants, fulfilling up to 80 percent and 100 percent of nitrogen and phosphorus needs, respectively, which plants generally trade for carbon obtained through photosynthesis. These fungal networks proceed to store around half of the carbon sequestered by their associate plants, keeping it out of our atmosphere. Some plants, however, have managed to sidestep providing anything and are instead completely reliant on fungi for nutrients. The albino ghost plant, Monotropa uniflora, has no chlorophyll and thus cannot photosynthesize. It obtains not only mineral nutrients but also all of its carbon needs, from the fungi it has partnered with.

In addition to their symbiotic relationships with plants, fungi greatly impact human health. Though many people hold reservations about mushrooms due to occasional toxicity, many cultures across the globe, including the peoples of native Central America, Siberia, and even Ancient Greece, hold great respect for mushrooms due to their healing powers. Multiple studies have recently been published examining the impact of mushrooms on cancer treatment. Some species of mushroom, such as Agarikon, Reishi, and Turkey Tail, have all long been used as medicinal mushrooms. These mushrooms have been found to increase the presence of cytokines, which help cells communicate and increase immune responses to cancer and other serious illnesses. While none of these mushrooms will be able to cure cancer on their own, they have thus far been found to increase the effectiveness of chemotherapy and stimulate immune responses that translate to better survival rates. In this sense, the modern western world is just catching up.

Aside from physical health, mushrooms also have a great capacity to treat mental diseases. A few species of mushroom have been found to stimulate neurogenesis, which, in conjunction with their anti-inflammatory properties, shows promise in beginning to tackle the treatment of severe degenerative diseases like Alzheimer’s and Parkinson’s diseases, though more research is needed. Psilocybin, the active ingredient in psychedelic mushrooms, also has strong neurogenetic capabilities and has eliminated conditioned fear in mice populations, effectively treating severe post-traumatic stress disorder (PTSD). When properly administered, one dose of psilocybin can practically eradicate all symptoms of depression and anxiety for six months. Psilocybin has further been shown to ease the anxiety of terminal patients as they grapple with death.

In addition to treating chronic illnesses, fungi are crucial to disease prevention. Penicillin was discovered through human–fungi interactions; we would not have any vaccines or antibiotics without a base-level understanding of fungi. Fungal antiviral and antibacterial properties can also extend beyond humans — they have proven to be extremely effective in fighting colony collapse disorder in honeybee populations.

Perhaps the most exciting aspect of human–mushroom cooperation ties into the original purpose of nutrient recycling. Because of their impact on plant growth, pairing different crops with different fungi and exploring the full scope of mycorrhizal relationships allows farmers to change the flavor, consistency, and yield of their crops. Some mycorrhizal partnerships even aid in pest resilience, potentially decreasing the need for harmful pesticides. While the agricultural possibilities are promising, the truly thrilling advancements of mushroom technology relate to cleaning up existing pollution and beginning the daunting process of habitat restoration. Washington State conducted a study where Battelle Laboratories compared petroleum-polluted soil treated with mycelia, bacteria, or enzymes to an untreated, control pile. While the soil treated with enzymes and bacteria did not change, the soil treated with mycelia sprouted multiple mushrooms within five weeks. In eight weeks, the number of aromatic hydrocarbons dropped from 10,000 parts per million (ppm) to only 200 ppm. Shortly thereafter, the mushrooms released spores that attracted bugs, who attracted birds, who brought seeds. Within months, the pollution was not only cleared but the pile of oily dirt had been transformed into the beginning of a flourishing ecosystem.

As evidenced by breaking down and consuming petroleum, mushrooms are surprisingly adventurous with what they will eat. With minimal training, the mycelium of oyster mushrooms unlocked the genetic code for enzymes that allow them to break down used diapers and cigarette butts. A further benefit is that many sprouting, decomposing mushrooms are completely safe for animal consumption. Through these techniques, mushrooms have the power to transform harmful human waste into valuable and ethically-produced nutrition.

While mushrooms show great promise in cleaning up our environmental mess, our society cannot afford to only focus on recycling accumulated waste. Rather, we must dramatically decrease the production of non-biodegradable goods in order to leave behind a liveable planet for our descendants that is not drowning in polyethylene, the most common plastic pollutant. Emerging fungal technologies provide an opportunity to prevent pollution from entering the system altogether. Using commercial agricultural waste, such as husks and bean pods, engineers have molded fungi into corner blocks for furniture shipping, reducing the use of styrofoam, one of the least biodegradable substances ever made. These fungi blocks are just the beginning. A company called Ecovative has explored other mushroom-based packaging alternatives, vegan leather, and even beauty products. Replacing traditional coffins, one can now be buried in an eco-friendly fungi suit, enclosed by mushrooms that reincorporate a body’s nutrients into our heavily depleted soils. There have also been preliminary studies examining how portobello mushrooms could replace current non-biodegradable casings of lithium-ion batteries.

Without fungi, life as we know it would not exist. If we reconnect with our roots (or mycelium in this case), we might just be able to save it. It is not a question of if fungi will be able to clean up our mess — it is just a question of if we will still be around to see it.
While the world has been dealing with the COVID-19 pandemic, the United States seems to be facing a new public health crisis, The United States Supreme Court. A public health crisis is described to be something that impacts the health and safety of a large group of people. During Donald Trump’s four-year term as President, he appointed three right-wing judges to the Supreme Court, Amy Coney Barrett, Neil Gorsuch, and Brett Kavanaugh. In June of 2022, the three new conservative judges, along with the others, were major drivers in making several major decisions with harmful consequences for many citizens in the US.

On June 24th, 2022 the United States Supreme Court announced its decision to overturn the Roe v. Wade ruling, which protects people’s constitutional right to abortion, essentially people’s reproductive rights in general. In 1973, the Roe v. Wade case was decided with a seven to two vote, deeming that all states that banned abortion were unconstitutional. Implementing the decision, ensured that reproductive health care was not only accessible to people capable of pregnancy but more importantly safe. With the overturning of Roe V. Wade, however, the Supreme Court has become the newest public health crisis for Americans. What politicians fail to realize is that abortions will not stop, however, safe and accessible ones will. Millions of people capable of pregnancy will face severe health risks. The number of home and illegal abortions will rise, which often results in a higher rate of mortality. In addition, more people will be forced to endure certain health issues, such as various mental illnesses as a result of pregnancy, or even the fetus may have developmental issues that can cause issues in the future. Evidence of that is already taking place in hospitals across America, where people have been put in extremely dangerous health situations because of the overturning. This decision by the United States Supreme Court will raise the mortality rate and cause great harm to U.S. citizens.

In addition to Roe v. Wade overturning, the supreme court made another groundbreaking decision in the ongoing debate around gun control. Just a couple of days before the overturning of Roe v. Wade, the supreme court announced its decision on the New York State Rifle & Pistol Association v. Bruen. This case focused on concealed carry laws for guns in New York. Up until June 23, 2022, New York State law required people to have a permit to carry a gun in public. The six to three decision, with the majority of votes being from the conservative judges, led to New York and many other states’ gun laws being nullified. In the past few years, as attacks have risen across the country, gun violence has been considered a public health crisis, alongside the COVID-19 pandemic. This ruling from the Supreme Court will likely lead to a spike in gun threats as people are no longer required to have a permit for a concealed carry weapon and will be under the protection of the Second and Fourteenth Amendment. Thus, further demonstrating how the U.S. Supreme Court is a clear contributor to the threat to America’s safety and provides more evidence of their role in the new public health crisis.

Both of these decisions, which happened one day apart from another, massively impact the American people. Whether the threat is from guns or inaccessibility to crucial healthcare, these rulings are responsible for massive public health crises. Millions of people have and will be affected by the decisions, however underrepresented and underprivileged communities will feel the consequences much more. While many people already face barriers when it comes to accessing medical procedures such as abortions, the overturning will cause further difficulty and put people at even higher risk. Cases around the United States are already being debated in the courts. One of the most publicized cases is the ten-year-old girl in Indiana who required an abortion after being sexually assaulted. Victims of such crimes are often extremely underrepresented and forced into situations that put their health at great risk. A nationwide debate has struck up around the young girl and the doctor, Dr. Caitlin Bernard, who performed the procedure, even though abortions are legal in Indiana. Because of Bernard, the young girl was able to have the procedure in a safe environment, however, that is unfortunately not the case for many people.

What the United States Supreme Court continuously fails to realize is the physical and personal impact their actions will have on many people. Though the issues being debated are heavily rooted in the politics and political divide in the United States, it comes down to this being a health and safety issue for all Americans, and those living in the country. All in all, throughout the summer of 2022, the United States Supreme Court has been responsible for a new public health crisis that people need to be aware of and cautious of.
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Congrats to the Alumni!
/synəpǝ/ noun: the point at which a nervous impulse passes from one neuron to another. The Synapse is an undergraduate science magazine that serves as a relay point for science-related information with a threefold objective. First, we aim to stimulate interest in the sciences by exposing students to its global relevance and contributions. Second, we work to bridge the gap between the scientific and artistic disciplines by offering students a medium through which to share their passions, creativity, and ideas. Third, we strive to facilitate collaboration between undergraduate institutions across the country, especially within the natural science departments.